

# China DC/EP Research and Perspectives of CBDC in Japan

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# I. DC/EP Research

## 1. DC/EP Summary

Blockchain technology and digital currencies are among the most important breakthroughs that are driving an open, accessible, resilient, interoperable ecosystem in the financial industry. Many central banks are exploring the possibility of retail CBDC options. The People's Bank of China (PBOC), the Chinese central bank, is pioneering the development and testing of the Digital Currency Electronic Payment (DC/EP) platform.

DC/EP, a tokenized digital currency, is proposed to be built on a distributed ledger and wallet that will store and transact the asset “end to end”. The token, issued by the PBOC (one single node), will be backed by a 1:1 fiat reserve, which will replace the M0 supply through the digitization of cash. This function will also rely on the credibility of the central bank, emphasizing core features such as manageable anonymity and encryption. DC/EP will not necessarily require the use of a bank account but may require KYC compliance.

The anonymous deposit, withdrawal, and circulation of digital currency will be facilitated through commercial banks. Further, the PBOC will have enough transactional information to prevent money laundering, terrorist financing and tax evasion. DC/EP is designed with no intention to disrupt core central-banking functions or compete with other financial products.

The following research aims to summarize and contribute to the understanding of DC/EP's architectural design and its potential impact on monetary policy and the financial system.

## 2. DC/EP Design Insights

### 2.1. DC/EP Design Principles

DC/EP's technical architecture will be structured based on market competition between financial institutions and technology enterprises. The PBOC will manage financial risks, set up market standards, maintain reserve stability and supervise policymaking.

## 2.2. DC/EP Key Designs

Although there is no detailed plan or prototype for DC/EP, five core features can be identified from available information.

### 2.2.1. Cash-like Currency to Replace M0 Supply

DC/EP is a cash-like, interest-free digital currency to replace M0 supply. Digital currency is issued by the Central Bank and backed by a 1:1 fiat reserve from commercial banks. For currency issuance, the Central Bank will decrease fiat reserves from commercial banks and issue an equivalent amount of digital currency; when withdrawing digital currency from circulation, the Central Bank will increase fiat reserves to commercial banks by an equivalent amount so that the M0 supply remains the same.

### 2.2.2. Central Bank and Commercial Bank Two-Tier Model

DC/EP will be distributed through two distinct layers:

- Between the Central Bank and commercial banks
- Between commercial banks and individual businesses.

Merchant banks will offer digital currency deposit, withdrawal, and circulation services in collaboration with the Central Bank to ensure supply stability.

### 2.2.3. Loosely Coupled Account Management

In contrast to existing cash bank accounts and internet payment platforms, DC/EP has less autonomy over user accounts. This loose structure will allow DC/EP to remain anonymous while maintaining cash-like liquidity and circulation. Merchant banks and vendors will not be able to trace historical data without user consent. The PBOC's access to transaction data empowers regulators to prevent large scale AML and tax evasion and alleviate the systemic burden on commercial banks.

### 2.2.4. Centralized Ledger for Clearance/Settlement, DLT for Registration

As DC/EP is designed to handle high-frequency transactions among retail users, which will require high throughput over the trading system, a centralized ledger will be implemented for digital currency issuance, clearance, and settlement. Distributed ledger technology (DLT) will also be adopted for digital currency registration to ensure data accuracy and security.

### 2.2.5. Certification Center, Registration Center and Big Data Analysis Center.

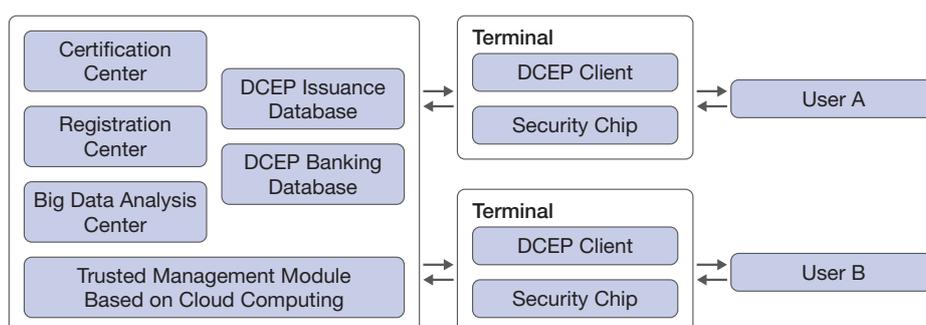
The *Certification Center* is the core component in managing anonymity. Plans

call for adoption of public key infrastructure (PKI) for financial institutions and VIP customers and use of identity-based cryptography (IBC) for lower-end users.

The *Registration Center* records token ownership and matches digital currency with respective digital identities. It also records the entire life cycle of digital currency from issuance through circulation, clearance and destruction.

The *Big Data Analysis Center* processes massive transaction data through big data and cloud computing. By leveraging payment behaviour and regulatory indicators, it will closely supervise currency circulation, ensuring secure transactions and preventing illegal activity.

**Figure 1. DC/EP flow chart, NIFR TSINGHUA PBCSF**



### 2.3. Key Technological Attributes

The following includes a summary of technical attributes that will enable deployment of digital retail currency on a massive scale.

#### 2.3.1. Double Offline Payment

The underlying principle of double offline payment of digital currency is that the payer constructs and signs the transaction message offline, submits the signed transaction message to the payee through near-field communication, and submits it to the Central Bank.

#### 2.3.2. UTXO Model

According to the People's Bank of China and other institutions, the Central Bank's digital currency is likely to adopt the UTXO (unspent transaction output) model rather than a balance model. In the UTXO model, the digital currency has many offline circulation processes. Currency holders sign their payment commitments and transfer them to the next owner together with previously signed payment

commitments. As long as the signatures can be traced back continuously and the first signature is consistent with the signature that the owner recorded in the Central Bank's digital currency registration system, the digital currency can be cashed out to the payee designated in the last signed payment commitment. Anyone who receives digital money offline can cash it in through the Internet without the need for cash.

**Table 1. Account model vs UTXO model, Xu Gang (2019), with modification**

|             | Account Model                                                                                                                                                                                                                                                                                                                                                                       | UTXO model (Cash-like exchange)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Features    | <p>Address keeps balance. There is no difference between the balance in addresses.</p> <p>Example:<br/>Alice's balance: 5 yuan.<br/>Bob's balance: 10 yuan.</p>                                                                                                                                                                                                                     | <p>UTXO keeps not only balances but also owners' information (e.g. address). The total balance held in the account is equal to the sum of all UTXO in hand.</p> <p>Example:<br/>Alice: one 10 yuan note, one 5 yuan note and five 1 yuan notes---20 yuan in total<br/>Bob: two 50 yuan notes and two 1 yuan notes---102 yuan in all.</p>                                                                                                                                                                                                                   |
| Bookkeeping | <p>Payment is made by reducing the balance of payer's address by a corresponding amount and increasing the balance of the payee's address by same amount in a central ledger (through internal bank transfer or Bulk Electronic Payment System led by PBOC)</p> <p>Example: Alice paid Bob 2 yuan.<br/>1. Alice's balance in BOC -2 yuan.<br/>2. Bob's balance in ICBC +2 yuan.</p> | <p>Payment changes the ownership of currency owned in centralized/ decentralized way. Payee may need to refund change to payer if UTXO denominations paid exceed the amount owed, like cash exchange.</p> <p>Example:<br/>Alice paid Bob 8 yuan. UTXO status is the same as above.<br/>Method one (denominations paid = amount owed, no refund)<br/>Alice gives Bob her 5 yuan UTXO and three of her 1 yuan UTXOs;<br/>Method two (non-match, payback)<br/>1. Alice gives Bob her 10 yuan UTXO.<br/>2. Bob gives two of his 1 yuan UTXOs back to Alice</p> |

### 2.3.3. Anti-Counterfeiting Identification

The most critical challenge of double offline payments is to prevent counterfeiting of signed transactions. This includes verifying the authenticity of the digital currency. The key technical measure to solve the anti-counterfeiting problem is to use smartphone TEE to protect the Central Bank's digital wallet and prevent malicious acts.

### 2.3.4. Single Transaction vs. Secondary Circulation

If dual offline payments require only a single offline transaction, digital currency received in an offline transaction must be recognized online before it can be transacted again. Further, use of variable-denomination digital currency is more convenient. If required to support secondary circulation of digital currency offline,

digital currency received in an offline transaction can be spent offline. As a result, fixed-denomination digital currency is more secure. The key technical features to achieve offline secondary circulation are also protected by TEE.

### 2.3.5. TEE-Protected Digital Wallet

The Central Bank digital wallet can be bound only to one smartphone that meets the security requirements to ensure that a controller (the owner of the digital currency) has a public-private key account that can only be used for payments on one smartphone. Conversely, the payee must verify whether the wallet of the payer is a legitimate wallet certified by the Central Bank, to prevent double offline payments. The key technology to bind wallet to mobile phone is remote attestation technology based on mobile phone root trust. The table below illustrates how the system will function and prevent malicious behaviour.

**Table 2. Malicious Conduct Prevention and TEE Application Scenarios, Xu Gang (2019), with modification**

|   | Malicious Party | Possible malicious conduct                                                                                                                                                                                                                                                                                             | Solutions                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Payer           | The payer knowingly enters the wrong amount in the transaction message.                                                                                                                                                                                                                                                | The payee's wallet displays the amount to the payee for confirmation when it receives the transaction message.                                                                                                                                                                                                                                                                                                               |
| 2 | Payer           | The payer knowingly enters the wrong destination address in the transaction document and conceals the address from the rightful payee.                                                                                                                                                                                 | The payee's wallet checks the payee address when receiving the transaction message.                                                                                                                                                                                                                                                                                                                                          |
| 3 | Payer           | The payer uses a malicious wallet that is not authenticated by the central bank to intentionally sign the correct transaction message with the wrong private key or fill in the data with a random signature to construct an invalid transaction message.                                                              | The payee wallet uses the root public key of the central bank wallet present in the TEE to authenticate the payee wallet, ensure that the other party's wallet is authenticated by the central bank, and verify the transaction signature.                                                                                                                                                                                   |
| 4 | Payer           | The payer uses malicious software to tamper with the UTXO account book information in the wallet, and constructs a transaction message with forged UTXOs (UTXOs not registered in the digital currency registration system of the central bank), and the message cannot be booked when it is entered into the account. | Payees' wallets use TEE protection to ensure that the cost of tampering with UTXO information exceeds the UTXO denomination. The payee's wallet uses the public key issued by the central bank's digital currency present in the TEE to verify the digital currency paid by the payer to ensure that it is genuine currency. Set the maximum wallet offline time and limit the number of UTXO flows for each offline period. |
| 5 | Payer           | Double spend. The payer inputs spent UTXOs in the transaction message for the next offline transaction. The message is not valid at the time of entry.                                                                                                                                                                 | Use TEE protection in authenticated wallet to ensure the updated UTXO owner status. UTXO account-smart phone one-to-one correspondence.                                                                                                                                                                                                                                                                                      |
| 6 | Payee           | The payee denies receipt of transaction message received from the payer.                                                                                                                                                                                                                                               | The wallet of the payer saves the transaction message and allows digital currency registration system to resolve dispute.                                                                                                                                                                                                                                                                                                    |

## 3. DC/EP and the Financial System

### 3.1. DC/EP and Mobile Payments

DC/EP is a payment gateway that unlocks solutions for many scenarios. Given the prevalence of mobile payments in China, what additional value-added benefits can DC/EP provide?

Here are several aspects:

#### 3.1.1. DC/EP is Legal Tender

DC/EP is another form of M0, which is issued and controlled by PBOC. It is different from the corporate deposit components of M1 and M2. Mobile payment platforms like WeChat Pay and Alipay are connected to commercial bank accounts, which are another component of M1 and M2. As required by the PBOC, M0 (cash or DC/EP) must be accepted by merchants.

While the most popular mobile payment systems like WeChat Pay or Alipay are well within the realm of the broad money supply (M2), funds in mobile payment accounts are resident deposits sitting on the balance sheets of commercial banks. If a user transfers money from a bank account to a mobile payment account, it will become M0. Whether M2 or M0, mobile payments can be rejected by a merchant because they are not legal tender.

#### 3.1.2. Offline Payments

DC/EP will utilize “dual offline payment” technology that allows counterparties to transfer money offline (without Internet access) if both parties’ payment devices are turned on.

With the increased popularity of electronic payments today, network malfunctions have become one of the main problems of mobile payments. In blind areas such as subways and underground supermarkets where mobile signals are weak, users will have difficulty staying connected to the Internet. With the emergence of dual offline payments, both receipt and payment can be completed offline. This emulates an offline cash transaction.

#### 3.1.3. Settlement Layer

Another significant difference between DC/EP and mobile payments is the settlement layer. DC/EP settles instantly while mobile payments settle through

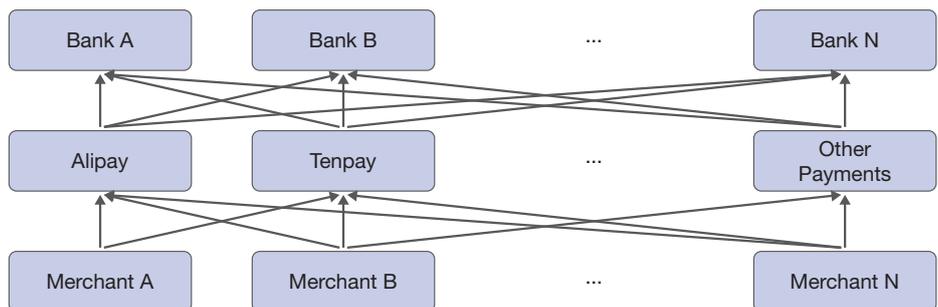
NetsUnion, a unified clearing platform set up by the Payment & Clearing Association of China.

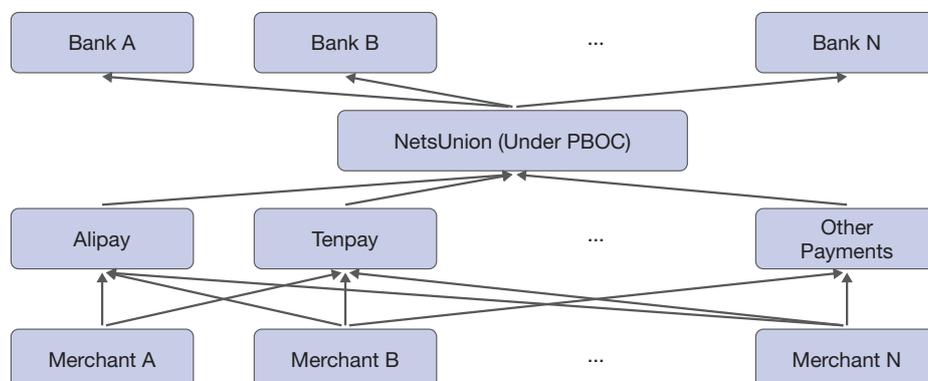
NetsUnion was established to intermediate between payment companies and banks (so-called Break Direct Connect or “断直连” in Chinese). Previously, third-party payment providers were direct intermediaries between banks and merchants. Payment platforms relied on their reserve accounts held at many banks to accomplish interbank clearing of funds. As a result, banks had the details of all transactions, meaning the cash flow information was unregulated. Such a situation can give rise to issues involving anti-money laundering, shadow banking and financial security.

The internationally accepted practice for payment systems is the “Quadripartite Model” which involve consumers, banks, merchants and payment companies. The transaction occurs through the bank account card and Internet merchants, which are accessed by third-party online payment institutions including Alipay and WeChat Pay. The transaction data will be transferred by the payment company to the clearing system of the card payment settlement organization, which executes the settlement process with card issuers. Under this process, card payment settlement organizations are intermediaries between merchants and banks, responsible for the settlement of each transaction.

As a result, the PBOC curbed direct contact between mobile payment companies and banks and pushed the mobile payment companies to join NetsUnion. This caused third-party payment platforms to sever their previous direct connections with banks. All data and information processed through third-party payment platforms will be monitored by NetsUnion and the PBOC.

**Figure 2. Directly connected mode of third-party payments, Qiudan Xing (2018)**



**Figure 3. Disconnected mode of third-party payments, Qiudan Xing (2018)**

After joining the NetsUnion platform, payment companies should not hold any customer reserve accounts at banks and they should deposit 100% of their reserves with the PBOC for aggregated management. Therefore payment companies cannot settle transactions directly with banks. In comparison, DC/EP is a new category of M0. Not only can it be used as a mode of payment, but it can also settle transactions. This highlights two advantages of DC/EP:

- Third-party payments are not anonymous as they are based on the account model. However, DC/EP is anonymous by virtue of being based on the loose-coupling model.
- Different third-party payment platforms cannot interface with each other. Payment transfers cannot be facilitated between WeChat Pay and Alipay, whereas DC/EP can be transferred between any two users.

### 3.2. DC/EP and Monetary Policy

The role of the Central Bank is to conduct monetary policy, which utilizes multiple tools to adjust interest rates and monetary and macroeconomic stability. Under monetary theory, the monetary supply is determined by the monetary base, “B”, and currency multiplier, “m”:

$$\text{Total money supply } M = B * m$$

$$B = M0 (\text{Cash}) + \text{bank deposit reserves}$$

$$+ \text{banks' excess reserves held at central bank}$$

As the goal of DC/EP is to partially replace M0, DC/EP will gradually grow to where it accounts for a majority of M0. Thus, the structure of the total money supply will differ from the traditional paradigm.

Money supply of M0, M1 and M2 are RMB7.72tn, 57.60tn and 198.65tn, respectively, at the end of 2019. DC/EP could potentially account for 25% of M0 in 5-7 years per optimistic estimates, as the total money supply is growing at a 5% CAGR. If so, DC/EP would be roughly RMB2.60tn, only 1.3% of M2, by 2027.

**Table 3. China's Money Supply, PBOC**

| tn RMB | 2019   | 2018   | 2017   | 2016   | 2015   | 2014   | 2013   | 2012  | 2011  | 2010  |
|--------|--------|--------|--------|--------|--------|--------|--------|-------|-------|-------|
| M2     | 198.65 | 182.67 | 169.02 | 155.01 | 139.23 | 122.84 | 110.65 | 97.41 | 85.16 | 72.59 |
| M1     | 57.60  | 55.17  | 54.38  | 48.66  | 40.10  | 34.81  | 33.73  | 30.87 | 28.98 | 26.66 |
| M0     | 7.72   | 7.32   | 7.06   | 6.83   | 6.32   | 6.03   | 5.86   | 5.47  | 5.07  | 4.46  |

Even if consumers prefer DC/EP as a retail payment method over current payment options, the exchange between of M2 and DC/EP will still be small in scale. After thorough analysis of DC/EP, issuing one unit of DC/EP will not change the total M2 supply. Instead, money would be reallocated between deposits and cash within M2. Issuance of DC/EP in small amounts thus does not pose additional risk. However, should a large amount M2 be transferred to DC/EP, base money would surge. In such an event, commercial bank balance sheets would be challenged and require other sources of funding (like re-loans from the PBOC) to support their funding structure. Such a scenario may cause volatility in funding costs. Digital money consequently seems unlikely to become more popular than account payments in the near term.

## 4. Conclusion

In this paper we discuss the possible features of China's forthcoming CBDC, DC/EP, from both a technical and financial standpoint. We find that DC/EP, by leveraging many new technologies, will differ from the prevailing third-party payments in China. However, the potential effects on payment methods and the financial system are still unknown as no official guidance on DC/EP has been released. Based on the prudent stance of the PBOC, DC/EP will likely be launched at a deliberate pace. We accordingly do not expect it to cause much change anytime soon.

## II. Perspectives on CBDC in Japan

In contrast to China's steady progress with DC/EP, currently in the testing phase, the Bank of Japan (BOJ) has not announced any plans to issue CBDC so far. However, the BOJ is actively studying the potential benefits and risks of CBDC.

The BOJ and ECB carried out joint research called Project Stella to explore DLT opportunities and challenges. The BOJ has also examined legal issues regarding CBDC issuance in Japan. In addition, the BOJ has occasionally raised some important issues about CBDC issuance in Japan, mainly through Deputy Governor Masayoshi Amamiya's speeches.

The following summary highlights the essence of the BOJ's view on CBDC and related cashless trends in Japan, along with some comparisons with the situation in China.

### 1. Project Stella: BOJ and ECB

#### NOTE

1) (Ph.1) [https://www.boj.or.jp/en/announcements/release\\_2017/rel170906a.htm/](https://www.boj.or.jp/en/announcements/release_2017/rel170906a.htm/)

(Ph.2) [https://www.boj.or.jp/en/announcements/release\\_2018/rel180327a.htm/](https://www.boj.or.jp/en/announcements/release_2018/rel180327a.htm/)

(Ph.3) [https://www.boj.or.jp/en/announcements/release\\_2019/rel190604a.htm/](https://www.boj.or.jp/en/announcements/release_2019/rel190604a.htm/)

(Ph.4) [https://www.boj.or.jp/en/announcements/release\\_2020/rel200212a.htm/](https://www.boj.or.jp/en/announcements/release_2020/rel200212a.htm/)

Project Stella<sup>1)</sup> is joint research conducted by the ECB and the BOJ. It explored DLT's opportunities and challenges for financial market infrastructure supporting payment and securities settlement.

#### 1.1. Phases 1-3

Stella Phase 1 analysed the processing of large-value payments using DLT, while Phase 2 investigated securities DVP in a DLT environment.

Phase 3 explored innovative solutions for cross-border payments. It assessed the security and efficiency implications of a variety of potential payment methods, namely:

- (1) **Trustline;**
- (2) **On-ledger holds/escrow using Hashed Timelock Contracts (HTLC);**
- (3) **Third-party escrow;**
- (4) **Simple payment channels; and**
- (5) **Conditional payment channels with HTLC.**

From a technical perspective, the Phase 3 report concludes that the security of

today's cross-border payments could be improved by using payment methods that synchronise payments and lock funds along the payment chain.

## 1.2. Phase 4

Stella Phase 4 analysed how confidentiality and auditability could be balanced in a DLT environment. Through conceptual studies and practical experimentation, it explored how privacy-enhancing technologies/techniques (PETs) would ensure confidentiality.

PETs can be divided into three categories based on their underlying concepts:

- (1) **Segregating PETs** ensure that each participant can only view a subset of all transactions conducted in the network.
- (2) **Hiding PETs** make use of cryptographic techniques to prevent third parties from interpreting transaction details.
- (3) **Unlinking PETs** make it difficult for third parties to determine transacting relationships from the sender/receiver information recorded on the ledger.

The Phase 4 report proposed three key perspectives for assessing the auditability of each PET setup.

- (1) **Accessibility** to the necessary information: whether the auditor can obtain with certainty the information it needs to conduct auditing activities
- (2) **Reliability** of the obtained information: whether the auditor can interpret confidential transaction information with certainty using the obtained information
- (3) **Efficiency** of the auditing process: whether the auditing process could be conducted in a manner efficient enough for it to be feasible

The Phase 4 report concluded that effective auditing can be achieved when the auditor receives necessary information from participants in such a way that the above three perspectives are accommodated. The existence of trustworthy central sources of information in auditing processes would be beneficial for effective auditing. One potential drawback, however, is that such sources could present single-point-of-failure risks.

## 2. BOJ: Report of Study Group on Legal Issues regarding CBDC

2) [https://www.boj.or.jp/en/research/wps\\_rev/lab/lab19e03.htm/](https://www.boj.or.jp/en/research/wps_rev/lab/lab19e03.htm/)

The Bank of Japan's Institute for Monetary and Economic Studies commissioned a Study Group on Legal Issues regarding Central Bank Digital Currency<sup>2)</sup> to examine issues surrounding CBDC issuance in Japan.

The Report examines CBDC issuance models and discusses crucial legal issues that may arise from implementation of CBDC within the Japanese legal framework.

### 2.1. Categorization and definition of CBDC

According to the report, CBDC is largely categorized into (1) wholesale CBDC aimed at interbank settlement and (2) general-use CBDC for larger users including individuals and corporates. The report focused on the latter and defined CBDC in Japan as digital currency that is:

- issued by the central bank of Japan (BOJ),
- an electronically recordable and transferrable store of value,
- denominated in Japanese yen, and
- usable to make payments of consideration to unspecified persons.

### 2.2. Legal issues on CBDC

The report notes that only BOJ banknotes and coins are permitted as legal tender under current law and indicates that electronically recorded CBDC is unlikely to legally qualify as BOJ banknotes. Therefore, CBDC issuance would be possible under current law only if it were regarded as an operation that fulfills the BOJ's purpose. Otherwise, the Bank of Japan Act and the Act on Currency Units and Issuance of Coins would have to be amended or new legislation would have to be passed to issue CBDC. The report also discusses civil and criminal legal issues, legislation on data collection, and administrative and competition law.

The report concludes that CBDC issuance involves diverse legal issues that may require new legislation to address. Furthermore, the specific design of CBDC regulation may differ significantly depending on the purpose of CBDC issuance.

### 3. BOJ's views on CBDC

<sup>3)</sup> [https://www.boj.or.jp/en/announcements/press/koen\\_2019/ko190712a.htm/](https://www.boj.or.jp/en/announcements/press/koen_2019/ko190712a.htm/)

#### 3.1. Deputy Governor Amamiya's July 2019 speech<sup>3)</sup>

##### 3.1.1. Zero lower bound

Firstly, Mr. Amamiya mentioned in his speech that some academics argue that CBDCs should bear interest or even incur negative interest to increase the effectiveness of monetary policy. This argument is based on the premise that the interest rate applied to CBDC could serve as the effective lower bound on interest rates for wide-ranging financial assets. However, he noted that physical cash would need to be completely eliminated to circumvent the zero lower bound (ZLB) on nominal interest rates. As long as cash yielding zero interest remains, if a central bank were to charge a negative interest rate on CBDC, economic agents would shift funds out of the CBDC into cash. Abolishing cash would make payment infrastructure less convenient since cash is still used by many people. Mr. Amamiya emphasized that no central bank wants to completely abolish cash.

**Figure 4. 10-Year JGB Yield, Ministry of Finance**



In comparison, the PBOC's benchmark interest rate is set at 3.85% and 10-Year Chinese government bonds are yielding roughly 2.7% as of May 31, 2020. Since Chinese rates are positive, the ZLB issue is not relevant to China at present.

##### 3.1.2. Resolving the surfeit of cashless payment instruments

Secondly, Mr. Amamiya mentioned that there are so many cashless payment instruments currently available in Japan that consumers are often at a loss as to which one to use. Such confusion could be cleared up if the central bank were to issue a CBDC that becomes widely used by consumers. The retail payments market

is now in a phase where FinTech firms and incumbent financial institutions are competing in payments innovation. For now, the BOJ sees importance in promoting innovation in the private sector, given the private sector's technological capabilities. Mr. Amamiya expects the current surfeit of cashless payment instruments to eventually be resolved through competition.

In China, by contrast, third-party mobile payments are dominated by Alipay and WeChat Pay, which together account for over 90% of the market. The Chinese mobile payments industry is supported by efficient mobile payment infrastructure such as NetsUnion.

4) [https://www.boj.or.jp/en/announcements/press/koen\\_2020/ko200306a.htm/](https://www.boj.or.jp/en/announcements/press/koen_2020/ko200306a.htm/)

### 3.2. Deputy Governor Amamiya's speech at March 2020 BOJ Conference<sup>4)</sup>

Mr. Amamiya asserted that three things about money and the payment and settlement systems should not and will not change.

#### (1) The basic architecture of money will remain unchanged.

There are two forms of money: token-based and account-based. Future payment services will likely develop based on either of these two forms.

#### (2) The two-tiered monetary system will remain unchanged.

The two tiers are the central bank and private banks. The former exclusively supplies base money consisting of cash and central bank deposits; the latter provide deposits through credit creation.

#### (3) The fundamental roles of the central bank will remain unchanged.

Even if use of physical cash were to decline and the Japanese economy becomes cashless, the BOJ would still conduct monetary policy under the two-tiered monetary system by controlling bank reserves on deposit at the BOJ and acting as the lender of last resort.

By contrast, he highlighted three things that will change as the payment and settlement systems evolve in the wake of IT innovations.

#### (1) Cashless payments will steadily expand in the retail payments market.

In Japan, people seem to be increasingly using cashless payments. At the same time, however, cash in circulation has been growing two percent annually and the preference for cash remains surprisingly strong. Nonetheless, evolution

into a cashless society is inevitable over the long run.

**(2) Diversification of payment service providers is likely to continue.**

Recent progress toward a cashless society seems to be led by non-bank payment services providers (NBPSPs). Diversification of payment service providers will likely have various impacts on financial regulation as well as payment and settlement system operations.

**(3) Money and data will become more closely linked.**

Many NBPSPs provide convenient cashless payment services but their proliferation has increased the importance of addressing issues concerning protection and effective use of personal data.

Mr. Amamiya argued that CBDC can help remove impediments to P2P payments and significantly improve interoperability between different brands of private digital money. However, he also cautioned that many issues need to be considered.

CBDC could also pose a risk of crowding out existing private services. Moreover, if transaction costs associated with CBDC are much lower than fees charged by private payment services, most merchants would prefer to be paid in CBDC instead of private digital money. CBDC could hurt private businesses and discourage innovation, depending on its core infrastructure's design and pricing. In addition, if firms and individuals prefer holding CBDC over bank deposits, CBDC could alter the two-tiered monetary system itself.

Mr. Amamiya emphasized that central banks need to deepen their understanding of the challenges and risks as well as the benefits of issuing CBDC.

## 4. Cashless trends in Japan

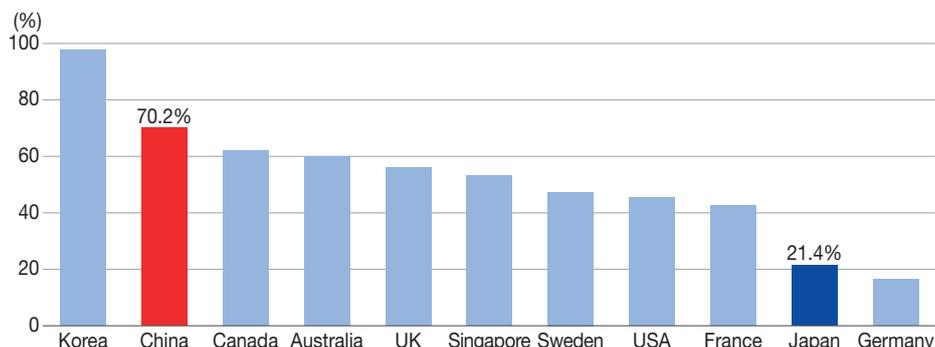
### 4.1. Cashless payments

Cashless payments are increasing in Japan but remain much less prevalent than in more digitally advanced nations. The Japanese government is targeting 40% cashless payments by 2025, which would be a twofold increase from 2016.

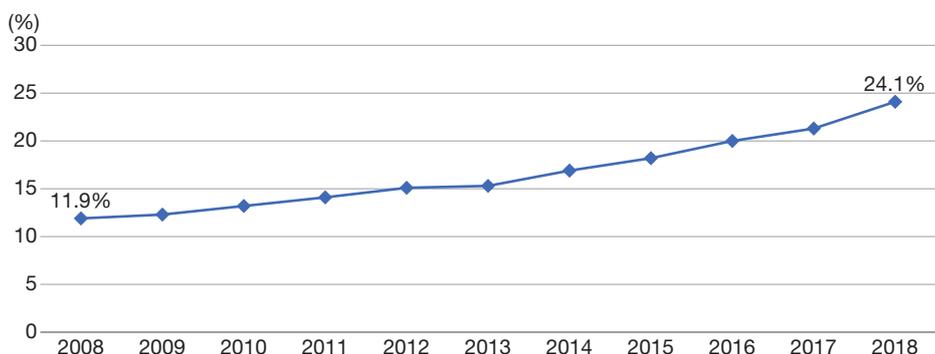
After Japan raised its consumption tax rate to 10% from 8% in October 2019, the government worked together with financial services companies to promote cashless

payments by temporarily issuing consumption tax rebates of up to 5% on cashless purchases. This promotion has likely boosted cashless payments.

**Figure 5. Cashless payment share by country (2017)**  
Payments Japan “Cashless Roadmap 2020”



**Figure 6. Cashless payment share in Japan**  
Payments Japan “Cashless Roadmap 2020”



**4.2. Cash in circulation**

In Japan, cash in circulation equates to 21.1% of GDP and approximately \$8,400 per capita as of 2018. With new banknote designs slated to be released in 2024, cash is unlikely to become extinct anytime soon. Kenneth Rogoff, author of “The Curse of Cash,” advises Japan to reduce circulation of 10,000 yen notes, which account for nearly 90% of cash in circulation. Given Japan’s large elderly population, completely abolishing cash in the near future is not realistic but reducing cash in circulation would be achievable.

According to NRI’s previous analysis, the societal cost of cash handling is 1.6 trillion yen annually, while the potential economic benefits of cashless payments

5) [https://www.meti.go.jp/medi\\_lib/report/H29FY/000187.pdf](https://www.meti.go.jp/medi_lib/report/H29FY/000187.pdf)

are estimated at 6 trillion yen annually<sup>5)</sup>. In addition, concerns about the risk of COVID-19 infection from paper bills might accelerate migration to cashless payments.

Figure 7. Currency in circulation (as % of GDP), BIS

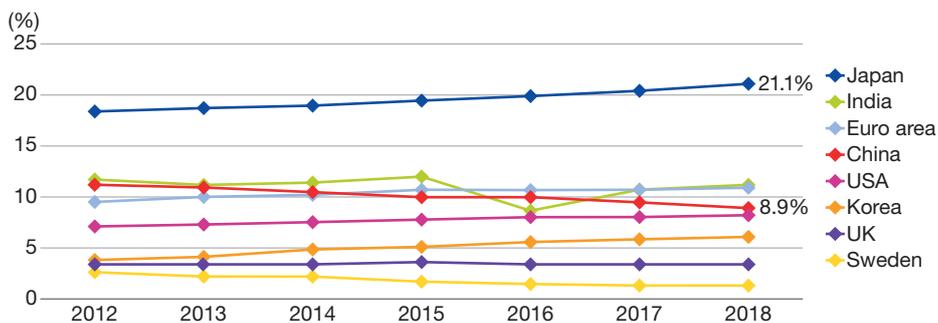


Table 4. Banknotes and coins issued (as of year-end 2019), BOJ

|                                         | JPY trillion | percentage    |
|-----------------------------------------|--------------|---------------|
| Banknotes issued of which JPY 10,000    | 104.4        | 88.7%         |
| JPY 5,000                               | 3.5          | 3.0%          |
| JPY 2,000                               | 0.2          | 0.2%          |
| JPY 1,000                               | 4.5          | 3.8%          |
| Other banknotes and coins               | 5.1          | 4.3%          |
| <b>Total banknotes and coins issued</b> | <b>117.7</b> | <b>100.0%</b> |

## 5. Conclusion

Although the BOJ does not have any specific plans to issue CBDC at this moment, it is continuously studying the opportunities and risks surrounding CBDC and expressing its views.

With the BOJ likely to keep pace with other major central banks, including the ECB and Fed, its stance towards the actual issuance of CBDC appears relatively conservative when compared with the steady development of DC/EP in China. The design concept and technologies behind the PBOC's pioneering project are worth studying.

Meanwhile, thorough analysis is needed to deepen discussions on country-specific

CBDC issuance objectives and other relevant factors, such as the influence of Japan's protracted negative interest rate environment.

In March 2020, Nomura Research Institute floated Japan's first bond issue using blockchain technology. It used the blockchain platform "ibet" provided by BOOSTRY, a joint venture between Nomura Holdings and Nomura Research Institute. Regulations surrounding security token offerings in Japan have been clarified by an amendment to the Financial Instruments and Exchange Act (FIEA) that took effect on May 1. CBDC has a potential to provide efficient settlement functions such as delivery versus payment (DvP) for these digital securities as well.



*Founded in 2018, HashKey Capital is a blockchain investor and digital asset manager. It provides accredited and professional investors with secure access to a diversified range of digital assets. HashKey Capital has a core investment focus on blockchain technology, digital assets, and crypto-financial infrastructures backed by research driven strategies and deep industry experience. It has made over 35 investments across 13 different sub-categories, located in 9 countries.*

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