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Payment and Settlement Systems Report

Bank of Japan

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Introduction

The payment and settlement systems are a vital foundation for a nation's economic activities. Economic activities such as commercial and financial transactions are based on trust that payment and settlement are executed without failure. Furthermore, the efficiency and convenience of payment and settlement can influence the productivity of firms, as well as consumers' behavioral patterns. These indicate that payment and settlement systems are expected to constantly improve their safety, efficiency, and convenience, in line with the changing economic environment and advancing technologies.

In recent years, the environment surrounding Japan's payment and settlement systems has gone through various changes. On the demand side, globalized entities make more cross-border transactions involving time differences than ever before. The demand for payment and settlement services that realize efficient cash management is increasing against this backdrop. Because of diversified lifestyles and the spread of e-commerce businesses, consumers also seek more convenient payment and settlement services, such as means of payment available during the nighttime and on holidays or low-cost international remittance services. On the supply side, technologies applicable to payment and settlement services have advanced, and new devices enabling the public to access those services have continued to expand amid further progress in information technology. In particular, in the area of retail payment, various parties have become involved in the provision of services, such as traditional financial institutions and non-bank firms with strong capabilities in information technologies, or so-called FinTech firms.

Given these changes in the environment, this report focuses on providing an overview of the latest initiatives in the payment and settlement systems and identifying issues to be addressed in future. The nation's payment and settlement systems consist of mutually complementary infrastructures operated by the central bank and the private sector. The Bank of Japan not only operates the Bank of Japan Financial Network System (BOJ-NET), the core payment and settlement system in Japan, but also encourages actions to improve safety and efficiency of the overall financial market infrastructures operated by the private sector. Internationally, together with central banks and financial authorities of other jurisdictions, the Bank makes efforts to establish a common framework for the design and risk management and form common understanding on operations of financial market

infrastructures. In addition, it also participates in international cooperative oversight arrangements of international financial market infrastructures.

This report is based on these initiatives taken by the Bank to address domestic and overseas issues related to payment and settlement. The report mainly covers the period starting from fiscal 2016 onward, the time after the release of the previous report.

Contents

I. Executive Summary

In Japan, a huge value of transactions is settled every day via financial market infrastructures (FMIs). In the Bank of Japan Financial Network System (BOJ-NET), which is operated by the Bank of Japan, about 150 trillion yen worth of funds and about 80 trillion yen worth of Japanese government bonds (JGBs) on average are smoothly settled every business day. In the private-sector FMIs, the value of transactions handled by the Zengin Data Telecommunication System (Zengin System) and the Foreign Exchange Yen Clearing System is gradually increasing, and the use of central counterparties (CCPs) is expanding for securities and over-the-counter (OTC) derivatives transactions. Looking at netting efficiency, the settlement value of JGB OTC transactions is compressed to the range of 20-25 percent, attesting sufficiently high netting efficiency.

Improving the Safety and Efficiency of Payment and Settlement Systems

FMIs have been making various efforts to improve payment and settlement, in terms of safety, efficiency, and user convenience.

For payments, the Japanese Banks' Payment Clearing Network (Zengin-Net) has initiated the 24 hours a day and 365 days a year operation of the Zengin system (Zengin More Time System) since October 2018. In December 2018, the Zengin EDI System started its operation, enabling firms to attach commercial information such as transaction details to inter-firm remittance messages. These new efforts were made against the backdrop of changing consumer and corporate needs -- that is, the need to transfer funds during the nighttime or on holidays, as e-commerce services spread, and the need to raise efficiency of business-to-business administrations.

For securities settlements, the JGB settlement cycle was further shortened (from T+2 to T+1) in May 2018, resulting in mitigation of settlement risks of the JGB. In April 2018, the Bank, in cooperation with the Hong Kong Monetary Authority, started the development of a cross-border delivery-versus-payment (DVP) link, which links the BOJ-NET JGB Services with the Hong Kong Dollar Real-Time Gross Settlement, with the aim to support stable foreign currency funding by Japanese financial institutions against JGB collateral. These efforts were initiated in response to the following changes in economic environment: (1) the global financial crisis in 2008 reinforced the importance of mitigating settlement risk, and

(2) the globalization of financial and economic activities increased the need for an infrastructure that supports safe and efficient cross-border transactions among financial institutions.

Oversight of FMIs by the Bank

As a central bank, the Bank is strongly committed to improving the safety and efficiency of Japan's payment and settlement systems. From this viewpoint, it conducts oversight of main FMIs based on the *Principles for Financial Market Infrastructures* (PFMIs) -- the international standard formulated by the Committee on Payments and Market Infrastructures (CPMI) and the International Organization of Securities Commissions (IOSCO) that FMIs are required to meet. In addition, given the rising international attention in the importance of CCPs and cyber security, CPMI and IOSCO developed guidance that provides more clarity and granularity to PFMIs.

The main FMIs in Japan are proactively engaging in efforts to enhance risk management and improve safety and reliability of their operations. The Bank considers that overall, the main FMIs are in conformity with the PFMIs and that safety and efficiency are ensured. FMIs are expected to continue efforts to improve the risk management framework, business continuity arrangements, and recovery planning to prepare for an extreme shock.

New Development of FinTech and Payment

The retail payment market is experiencing change in its structure in recent years, as the number of new FinTech firms entering the market increases with the rapid progress of information technologies. Coupled with both collaborative and competitive aspects, the relationships between financial institutions offering traditional settlement services via bank accounts and FinTech firms providing new settlement services are becoming more diversified and complicated. Under the new market structure, it largely depends on the profitability of financial institutions and FinTech firms respectively whether efficient and convenient payment services are sustainably provided in the long term. The Bank will take these points into consideration and pay close attention to implications that changes in the retail payment market would have on the financial and payment and settlement systems as a whole.

Future Issues of the Payment and Settlement Systems

To maintain safety of payment and settlement systems and further improve their efficiency, it is important to address the following issues. The first challenge is to make the best use of recently introduced functions and services of payment and settlement infrastructures, and fully realize their benefits, such as further sophistication of financial and settlement services, reduction of transaction costs of various economic activities, and utilization of data. The second is to pave the way to a retail payment market in which consumers and retailers can fully benefit from the convenience and efficiency of cashless payment methods when the market is crowded with a number of those services. The third is to secure safety of payment and settlement as a precondition for promoting further improvement in convenience and efficiency, by ensuring resiliency against cyber attacks and improving business continuity arrangements.

The Bank will, through its oversight activities, encourage stakeholders to take actions to address these issues. At the same time, it will also play a role as a catalyst and promote cooperation and collaboration among stakeholders, with a view to enhancing the safety and efficiency of payment and settlement systems as a whole.

II. Overall Picture of the Payment and Settlement Systems and Their Trends

In Japan, a huge value of transactions is settled every day through the main financial market infrastructures (FMIs). For example, in 2018, via the Bank of Japan Financial Network System (BOJ-NET), which is operated by the Bank of Japan, about 150 trillion yen worth of funds and about 80 trillion yen worth of Japanese government bonds (JGBs) on average were settled every business day. As for private-sector FMIs, the value handled by the Zengin Data Telecommunication System (Zengin System) and the Foreign Exchange Yen Clearing System (FXYCS) is gradually increasing, and central counterparties (CCPs) are increasingly used for securities transactions and over-the-counter (OTC) derivatives transactions. As payment and settlement systems are one of the important social infrastructures that form the basis of the economic society, it is of utmost importance to secure their safety and efficiency. Specific initiatives for enhancing the safety and efficiency of payment and settlement systems are described in Chapter III, and the Bank's oversight activities of main FMIs are outlined in Chapter IV. This chapter, as an introduction to those chapters, presents an overall picture of and recent trends in the payment and settlement systems in Japan.

A. Overall Picture of the Payment and Settlement Systems

FMI, which constitutes the payment and settlement systems, is defined as a multilateral infrastructure among participating institutions, including the operator of the infrastructure, used for the purposes of clearing, settling, and recording payments, securities, derivatives, or other financial transactions. FMIs typically establish a set of common rules and procedures for all participants, technical infrastructure, and a risk-management framework to cope with the risks FMIs and their participants might incur.

FMIs are in general divided into four types of infrastructures: payment systems, securities settlement systems, CCPs, and trade repositories (TRs). A payment system is an arrangement for processing the transfer of funds, while a securities settlement system is for custody and delivery of securities. A CCP is an arrangement for processing the clearing and settlement of obligations resulting from financial transactions, such as securities and derivatives transactions. A CCP replaces an obligation between two clearing members with

a pair of obligations between the CCP and a clearing member. A TR is an arrangement for processing the collection, storage, and dissemination of transaction data, such as those for OTC derivatives transactions.

In Japan, the Bank operates a payment system (the BOJ-NET Funds Transfer System [BOJ-NET FTS]) and a JGB settlement system (the BOJ-NET JGB Services). Private-sector FMIs operate payment systems, securities settlement systems such as for corporate bonds or equities, CCPs, and TRs (Chart II-1). The main private-sector FMIs (or their operational entities) are as follows:

- The Domestic Funds Transfer System, which is operated by the Japanese Banks' Payment Clearing Network (Zengin-Net), is an interbank clearing system for funds transfers requested by individuals and firms. Exchange of transaction data among financial institutions is conducted via the Zengin System.

- FXYCS, which is operated by the Japanese Bankers Association, is an interbank yen clearing system for remittance from overseas individuals and firms or foreign exchange trades between financial institutions. Settlement and related operations are conducted via the BOJ-NET.

- Japan Securities Depository Center (JASDEC) is a central securities depository that operates a securities settlement system for safekeeping and transferring of equities, commercial papers (CPs), corporate bonds, investment trusts, and other securities. It also provides electronic matching services for trading data and settlement instructions (pre-settlement matching services) associated with JGBs and other securities transactions executed between institutional investors and securities firms.

- JASDEC DVP Clearing Corporation (JDCC) is a financial instruments clearing organization that provides clearing services for equities and other securities that are traded off-exchange between financial institutions (a wholly owned subsidiary of JASDEC).[1]

- Japan Securities Clearing Corporation (JSCC) is a financial instruments clearing organization that provides clearing services for equities transactions on securities

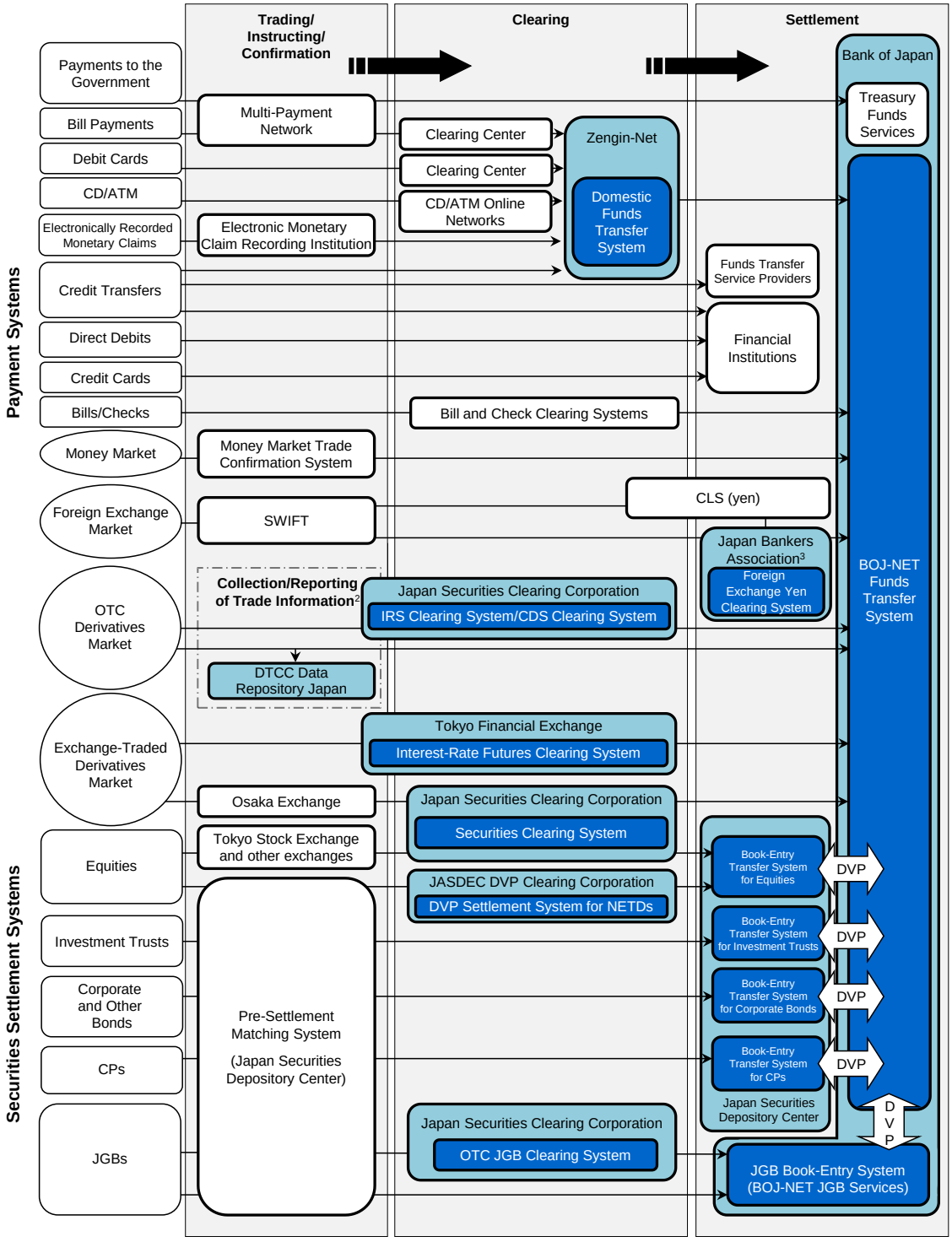
[1] Those securities settlements conducted at JASDEC that are not resulting from the clearing of exchange trades are called non-exchange transaction deliveries (NETDs).

exchanges, listed derivatives transactions, JGB OTC transactions, and OTC derivatives transactions (interest rate swaps [IRSs] and credit default swaps [CDSs]).

- Tokyo Financial Exchange (TFX) is a financial instruments exchange that provides exchange markets for interest rate futures, foreign exchange (FX) futures, and equity index futures. It also serves as a financial instruments clearing organization that provides clearing services for these listed derivatives transactions.

- DTCC Data Repository Japan (DDRJ) is a TR whose main business is to report trading data of OTC derivatives transactions conducted between financial institutions to the Financial Services Agency.

Chart II-1 Main FMIs in Japan and their Operational Entities



Notes: 1. Dark-shaded frames denote FMIs mentioned in this report and light-shaded frames denote their operational entities.

2. JSCC is required to report data to relevant authorities for OTC derivatives transactions it has cleared. Transactions not cleared by JSCC are required to be reported to authorities either via DDRJ or directly by financial institutions.

3. Japan Bankers Association, which operates FXYCS, entrusts operations related to funds transfers to the Bank of Japan, and the Bank processes such operations via the BOJ-NET FTS.

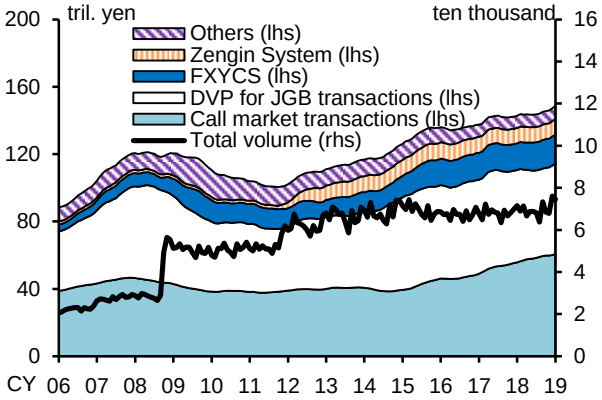
Source: Bank of Japan.

B. Trends in Payment and Settlement via the BOJ-NET

The BOJ-NET, which is operated by the Bank, has the BOJ-NET FTS, a payment system, and the BOJ-NET JGB Services, a JGB settlement system, which are the core FMIs in Japan. A link between the BOJ-NET FTS and the BOJ-NET JGB Services has enabled delivery-versus-payment (DVP) settlement of JGBs, where delivery of securities occurs if, and only if, corresponding payment occurs.

The BOJ-NET FTS processes (1) transactions in money markets, (2) payments related to transactions of securities such as JGBs and corporate bonds, (3) payments related to private-sector FMIs such as the Domestic Funds Transfer System and FXYCS, and (4) settlements related to the Bank's market operations and receipts and payments of banknotes, by transferring funds between financial institutions' current accounts at the Bank or other means. With increasing money supply from the Bank, the value of settlements has been on the rise in recent years, led mainly by "call market transactions" (Chart II-2-1). The value and volume of settlements via the BOJ-NET FTS were about 150 trillion yen and about 70,000, respectively, per business day in 2018.

Chart II-2-1 Value and Volume of Payments Settled via the BOJ-NET FTS

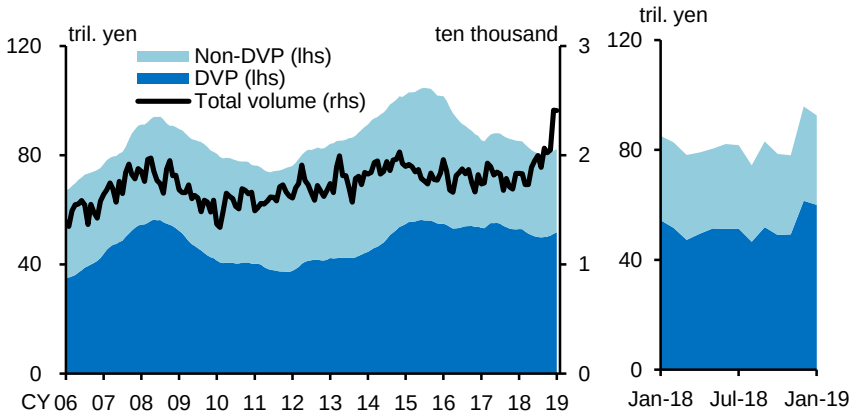


Note: Average daily amount in a month. The latest data is as of January 2019. The value is 12-month backward moving average. "Call market transactions" include funds transfers related to market transactions other than call market (e.g., DVP for non-JGBs).
Source: Bank of Japan, *Payment and Settlement Statistics*.

The BOJ-NET JGB Services provide real-time gross settlements (RTGS) for transfers under the JGB Book-Entry System (delivery of JGBs between participants of the book-entry system such as banks and securities firms and those between participants and the Bank). The value of settlements via the BOJ-NET JGB Services remains low in recent years compared to its peak in the first half of 2015, as the transaction volume of JGBs between dealers and with customers remains lower than before, while the Bank purchases a large

amount of JGBs (Chart II-2-2). The value and volume of settlements via the BOJ-NET JGB Services were about 80 trillion yen and about 20,000, respectively, per business day in 2018. The sharp increase in the value and volume of settlements at the end of 2018 is mainly attributable to the fact that trust banks dedicated to asset management, which are key players in the JGB market, increased DVP settlements via CCPs.

Chart II-2-2 Value and Volume of Transactions Settled via the BOJ-NET JGB Services



Note: Average daily amount in a month. The latest data is as of January 2019. The value of the left chart is 12-month backward moving average (face value).
Source: Bank of Japan, *Payment and Settlement Statistics*.

C. Trends in Payment and Settlement via Private-Sector FMIs

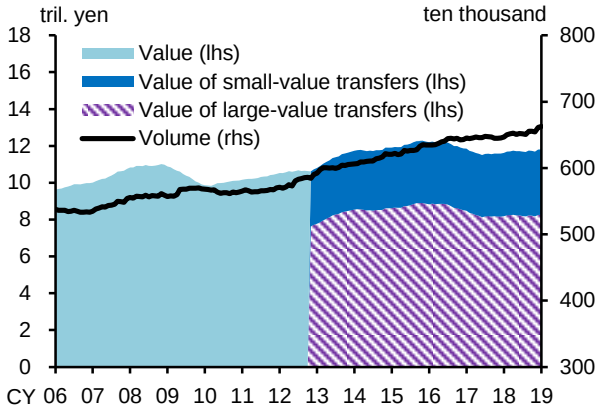
This section describes trends in payment and settlement via private-sector FMIs in recent years.

Private-Sector Payment and Settlement Systems

Funds transfers between financial institutions are settled via the Zengin System operated by Zengin-Net under the Domestic Funds Transfer System. Among these transfers, large-value transfers of 100 million yen or more per transaction are transmitted to the BOJ-NET FTS and processed on an RTGS basis via the Bank's current accounts. As for small-value transfers of less than 100 million yen per transaction, the Zengin System aggregates individual payment instructions, and calculates net receipt or payment position for each financial institution. The net positions are settled between financial institutions and Zengin-Net on a deferred net settlement basis via the Bank's current accounts. The value and volume handled by the Zengin System is moderately increasing in tandem with the

economic activities of Japan (Chart II-3-1). In 2018, the Zengin System processed, on average, about 12 trillion yen per business day. The volume of small-value transfers is overwhelmingly larger than that of large-value transfers; the former is about 6.5 million per business day while the latter is about 10,000. On a recent volume basis, large-value transfer is flat or slightly declining, while small-value transfer is gradually increasing.

Chart II-3-1 Value and Volume of Transactions Processed by the Zengin System

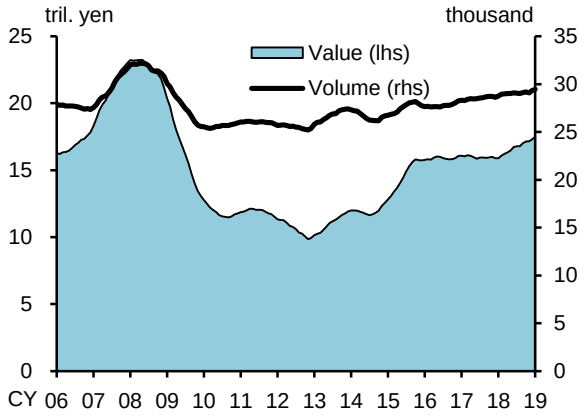


Notes: 1. Average daily amount in a month. The latest data is as of January 2019. The value and volume are 12-month backward moving average.
2. Data that are divided into those on large-value transfers and those on small-value transfers are available from those of December 2011, as the RTGS of large-value transfers was introduced in November 2011. However, only the data of November 2012 and after are presented, because backward moving average is adopted.
Source: Bank of Japan, *Payment and Settlement Statistics*.

The Foreign Exchange Yen Clearing System (FXYCS) is operated by the Japanese Bankers Association. Operations related to exchange and settlement of payment instructions are entrusted to the Bank, and the Bank handles this processing via the BOJ-NET. There has been a complete transition of the FXYCS settlement to RTGS since October 2008, abolishing deferred net settlement.[2] The total value exchanged by FXYCS decreased dramatically after the global financial crisis in 2008 due to the effects of diminished financial and economic activities and the yen's appreciation, but has gradually recovered thereafter (Chart II-3-2). In 2018, FXYCS exchanged about 17 trillion yen per business day.

[2] Chart II-2-1 shows that the volume of settlements via the BOJ-NET FTS increased sharply in October 2008 due to the complete transition of the FXYCS settlement to RTGS.

Chart II-3-2 Value and Volume of Transactions Processed by FXYCS



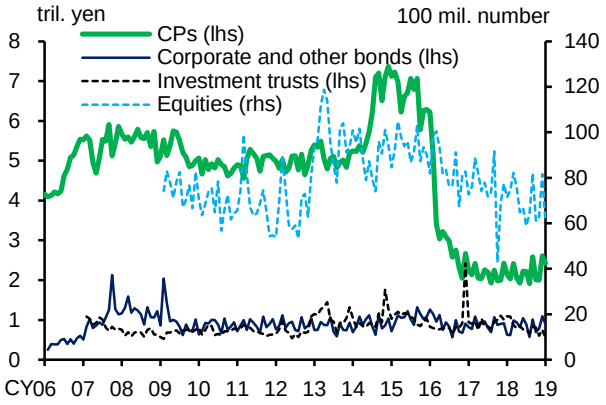
Note: Average daily amount in a month. The latest data is as of January 2019. The value and volume are 12-month backward moving average.
Source: Bank of Japan, *Payment and Settlement Statistics*.

Private-Sector Securities Settlement Systems

Of those securities, the Bank provides settlement for JGBs via the BOJ-NET JGB Services, as the operator of the JGB Book-Entry Transfer System. For other securities (equities, corporate bonds, CPs, and investment trusts), JASDEC provides settlement, as the operator of settlement systems for each type of securities (Chart II-1). A link between the JASDEC systems and the BOJ-NET FTS has enabled DVP settlement of these types of securities.

Looking at the value of settlements in JASDEC, since the Bank introduced Quantitative and Qualitative Monetary Easing (QQE) with negative interest rates in January 2016, it has become difficult to manage funds with positive interest rates in the money market. As a result, market participants raise fewer funds with repo transactions using CPs, and the value of CP settlements declined sharply (Chart II-3-3). Recently, the value of CP settlements has been around 2 trillion yen per business day. Settlement of corporate bonds and investment trusts has been around 1 trillion yen each per business day in 2018. The amount of equities settlement fluctuates according to its trading volume. In 2018, it was around 7 billion per business day.

Chart II-3-3 Amount of Settlements Processed by JASDEC



Notes: 1. Average daily amount in a month. The latest data is as of January 2019. Data include both DVP settlement and non-DVP settlement. Value for "CP," "Corporate and other bonds," and "Investment trusts," and number of shares for "Equities" are presented.
2. The data for the month that each transfer system launched are excluded.
3. Figures for "CPs" and "Corporate and other bonds" show the total amounts of underwriting, redemption, retirement by purchase, and book-entry transfer. Figures for "Equities" and "Investment trusts" show the total amounts of new record, deletion, and book-entry transfer.

Source: Japan Securities Depository Center.

CCPs

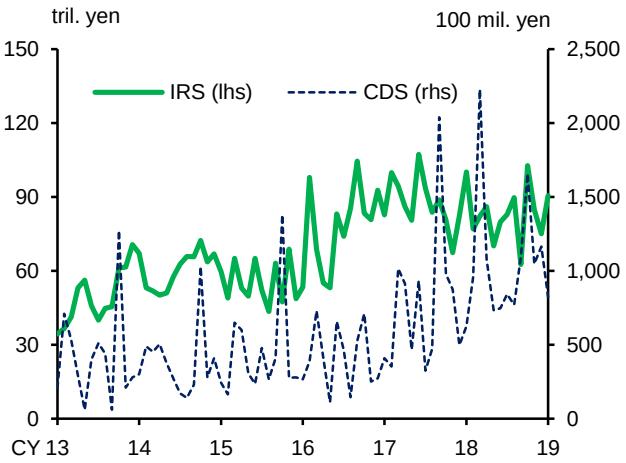
The global financial crisis in 2008 provoked criticism that the fragile structure of the OTC derivatives market partly amplified the crisis. In other words, credit concern and deterioration of market liquidity were exacerbated, in part, by difficulty in recognition of accumulated risks in complicated transactions. Meanwhile, financial transactions cleared via CCPs were stably processed in general even during the crisis. Based on this recognition, it was internationally agreed at the G20 Pittsburgh Summit in 2009 that settlements via CCPs be promoted by mandating the use of CCP for standardized OTC derivative transactions.

The amount of obligations assumed by JSCC shows that the use of CCP in the OTC derivatives transactions in Japan is steadily expanding (Chart II-3-4). The amount of obligations assumed by JSCC for equities transactions on exchanges and listed derivatives transactions also turned to an increase in 2013 (Chart II-3-5). In addition, the value of obligations assumed by JDCC for transfers of securities traded off-exchange is also increasing (Chart II-3-6).[3] Meanwhile, the use of CCP in JGB OTC transactions is also expanding since around 2014 (Chart II-3-7). The share of all transactions of JGBs involving DVP settlement that have been cleared by JSCC reached around 80 percent at the end of

[3] Specifically, JDCC assumes obligations related to deliveries between trust banks and securities firms and between custody banks and securities firms regarding outright transactions and securities lending transactions by institutional investors.

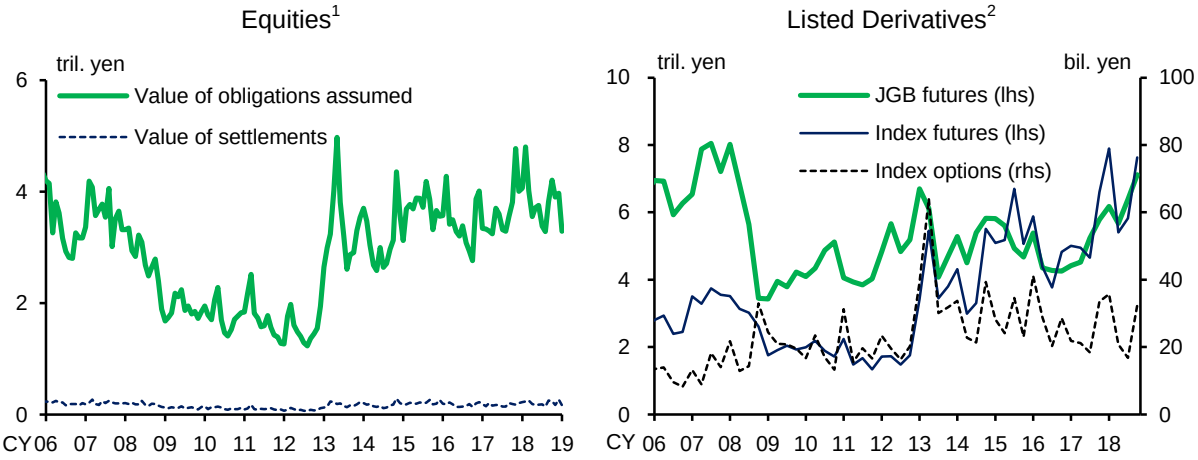
2018, as trust banks dedicated to asset management, which are key players in the JGB market, increased the use of CCPs for repo trust (investment securities trust).

Chart II-3-4 Value of OTC Derivatives Obligations Assumed by JSCC



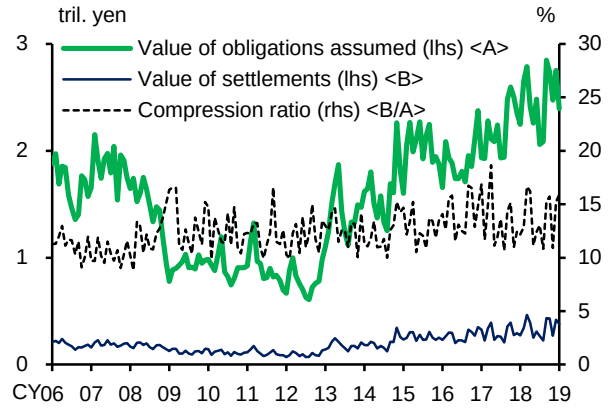
Note: Monthly total notional value assumed. Each transaction is counted once. The latest data is as of January 2019.
Source: Japan Securities Clearing Corporation.

Chart II-3-5 Value of Equities and Listed Derivatives Transactions Processed by JSCC



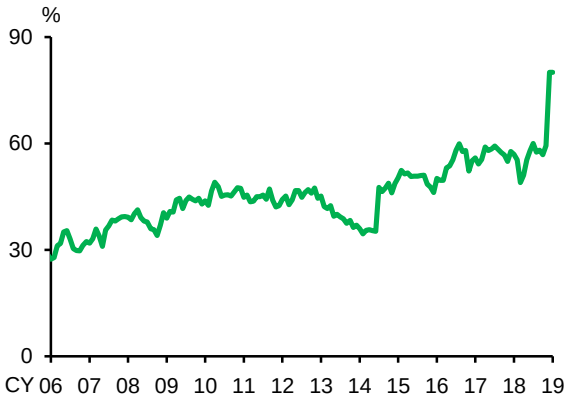
Notes: 1. Average daily value in a month. Each transaction is counted once. The latest data is as of January 2019.
2. Average daily notional value assumed in a quarter. The latest data is as of fourth quarter 2018. Figures for "JGB futures" show the amount for 10-year JGB futures. Figures for "Index futures" show the total amount for Nikkei 225 futures, as well as Nikkei 225 mini and TOPIX futures. Figures for "Index options" show the amount for Nikkei 225 options. Transactions processed by the Osaka Securities Exchange, whose clearing functionality for exchange-traded derivatives was integrated into JSCC, are counted.
Sources: Japan Securities Clearing Corporation; Japan Exchange Group.

Chart II-3-6 Value of Transactions Processed by JDCC



Note: Average daily amount in a month. Each transaction is counted once. The latest data is as of January 2019. See Chart II-3-8 for the definition of the compression ratio.
Source: Japan Securities Depository Center.

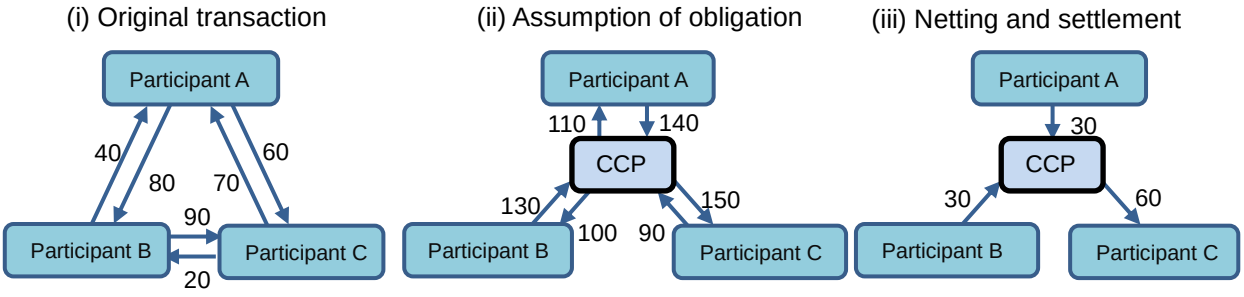
Chart II-3-7 Share of JSCC in DVP Settlements of JGBs



Note: Calculated by dividing the total value of DVP settlement in which JSCC delivers or receives JGBs by the total value of JGB DVP settlement via the BOJ-NET. The latest data is as of January 2019.
Sources: Japan Securities Clearing Corporation; Bank of Japan, *Payment and Settlement Statistics*.

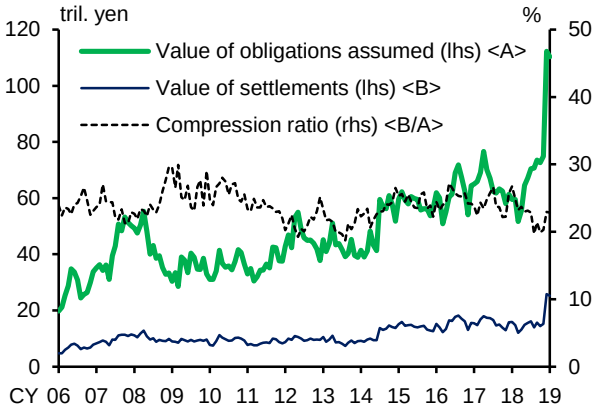
In general, cash obligations arising from transactions cleared by these CCPs (JSCC and JDCC) are settled with finality via the BOJ-NET. The value of settlements is compressed significantly compared to the value of the obligations assumed (Chart II-3-8). For example, the value of JGB settlement for the JGB OTC transactions by JSCC (about 16 trillion yen per business day in 2018) is about 20-25 percent of the value of obligations assumed (the total value of obligations assumed is about 70 trillion yen per business day in 2018) (Chart II-3-9). The compression ratio of the value of settlements for NETDs is even lower at 10-15 percent, attesting sufficient netting effect (Chart II-3-6).

Chart II-3-8 Compression of the Value of Settlements at CCP



Sample calculation: Compression ratio = $\frac{\text{Value of settlements}}{\text{Value of obligations assumed}} = \frac{60\text{(iii)}}{110+100+150\text{(ii)}} = \frac{30+30\text{(iii)}}{140+130+90\text{(ii)}}$

Chart II-3-9 Value of JGB OTC Transactions Processed by JSCC

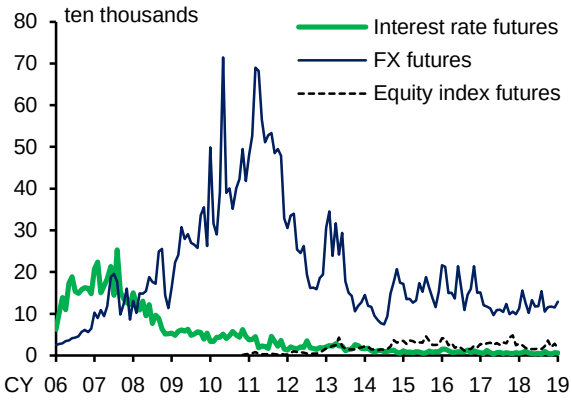


Note: Average daily amount in a month. Each transaction is counted once. The latest data is as of January 2019. For term repo transactions with subsequent collateral allocations, transactions with unwinding and rewinding of obligations within the term are included. See Chart II-3-8 for the definition of the compression ratio.
Source: Japan Securities Clearing Corporation.

Meanwhile, the trading volume of interest rate futures on the TFX has been sluggish amid prolonged low interest environments. Recently, it has been around 6,000 per business day. The trading volume of FX futures is volatile, averaging around 120,000 per business day in recent years (Chart II-3-10).[4]

[4] The trading volume of FX futures decreased in 2012 mainly due to the effects of separate self-assessment taxation applied not only to the exchange transactions but also to OTC FX transactions, which came into effect in January 2012.

Chart II-3-10 Trading Volume on TFX



Note: Average daily amount in a month. Each transaction is counted once. The latest data is as of January 2019.
Source: Tokyo Financial Exchange.

III. Efforts to Improve the Safety and Efficiency of Payment and Settlement Systems

The previous chapter outlines the trends of payments and settlements in the main financial market infrastructures (FMIs). FMIs are making various efforts to improve payments and settlements, for the sake of safety and efficiency or user convenience. These moves toward sophisticated payment and settlement systems are against the background of the following three changes in the environment. First, since the global financial crises in 2008, the significance of mitigating settlement risk has been fully recognized by stakeholders. Shortening of settlement cycles for securities and the further reduction of foreign exchange settlement risk are cases in point. Second, with the globalization of financial economy, needs have been increasing for infrastructures that provide the foundation for safe and efficient interbank transactions of funds and securities across borders (cross-border transactions). Third, given changes in customer needs and competition with FinTech firms, financial institutions have faced challenges in providing more sophisticated payment and settlement services, which necessitate upgrading of settlement infrastructures.

This chapter discusses various moves toward sophisticated settlement services, which have been made in both payment and securities settlement systems for the period after the previous report was published (from fiscal 2016 onwards).

A. Moves toward Sophistication of Payment Systems

With regard to the sophistication of payment systems, recent developments in the following three areas are presented in this section: (1) the Japanese Banks' Payment Clearing Network (Zengin-Net); (2) the installation of the Bank of Japan Financial Network System (BOJ-NET) terminals abroad; and (3) moves toward mitigating foreign exchange risk.[5]

(1) Zengin-Net

For small-value payment services, widespread e-commerce has increased the need for

[5] The installation of the BOJ-NET terminals abroad involves both the BOJ-NET Funds Transfer System (BOJ-NET FTS) and the BOJ-NET JGB Services and hence is related to both payment systems and securities settlement systems. Here it is presented as an example of sophistication of payment systems.

remittances during the nighttime and on holidays; there is also a growing need for efficient inter-firm payment administration. As FinTech firms have started to provide new payment services to meet such customer and corporate needs, financial institutions are now faced with intense competition. To respond to changes in the customer needs and provide advanced payment services, it would be necessary that financial institutions improve the functions of their infrastructure, the Zengin Data Telecommunication System (Zengin System). Given this, Zengin-Net, which runs the Zengin System, launched (1) the Zengin More Time System, which enables real-time payment 24 hours a day and 365 days a year, and (2) the Zengin EDI System (ZEDI), which enables firms to attach commercial information such as transaction details to inter-firm remittance messages in October and December 2018, respectively.[6]

Launch of Zengin More Time System

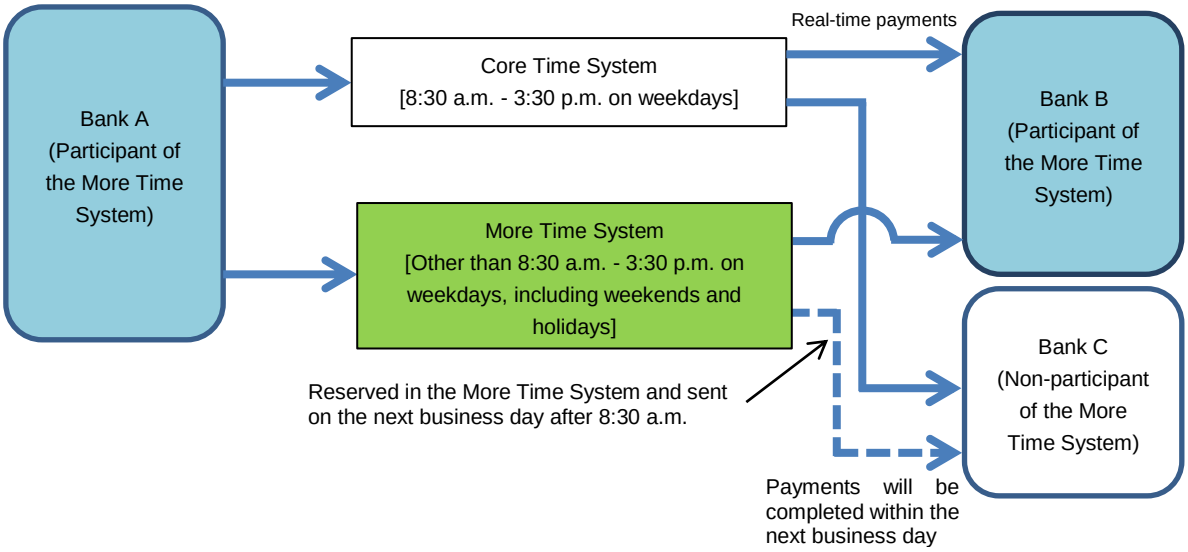
The Zengin System, which supports interbank funds transfers in Japan, had enabled real-time payment since the 1970s, ahead of the world. It had, however, operated only during daytime on weekdays for a long time. Given that other jurisdictions in recent years have increasingly implemented real-time payment on a 24/7 basis, enabling interbank transfers 24 hours a day, 365 days a year, not to mention nighttime and on holidays, it has also become keenly aware of the need to extend the Zengin System's operating hours in Japan.

Zengin-Net has begun to run the Zengin System 24 hours a day, 365 days a year since October 2018. In addition to the main Core Time System that regularly operates from 8:30 a.m. to 3:30 p.m. on weekdays (from 7:30 a.m. to 4:30 p.m. on the last business day of the month), a new platform called More Time System has been separately implemented (Chart III-1-1). This has enabled banks to immediately receive funds transferred from other banks 24 hours a day, 365 days a year, supported by the Core Time System and the More Time System, each of which operates in different hours to complement each other. The interbank

[6] In light of the *Japan Revitalization Strategy* (revised in 2014) published by the government in June 2014, Japanese Bankers Association and Zengin-Net published a report entitled *On the Results of Examining the Future Shape of the Zengin System* (available only in Japanese) in December 2014, indicating that they would expand the Zengin System's operating hours and promote financial EDI.

funds transfers processed by the More Time System is settled on a deferred net settlement basis via the Bank's current accounts in the evening (at 4:15 p.m.) on the next business day as small-value domestic transfers.

Chart III-1-1 Extension of the Operating Hours of the Zengin System by Launching the More Time System



Sources: Japanese Bankers Association; Japanese Banks' Payment Clearing Network.

While financial institutions voluntarily participate in the More Time System, a total of 504 financial institutions have taken part in the system since its launch: 105 banks or about 75 percent of the domestic banks that connect to the Core Time System, as well as 399 Shinkin banks and credit unions.[7] Likewise, financial institutions can choose connecting time to the More Time System.[8] 62 percent of the initial participants (66 financial institutions among 107, in which each Shinkin bank and credit union connecting is counted as one) connect to the system 24 hours a day on both weekdays and weekends, and 97 percent (104 financial institutions) connect to the system at least from 9:00 a.m. to 9:00 p.m. on both weekdays and weekends.

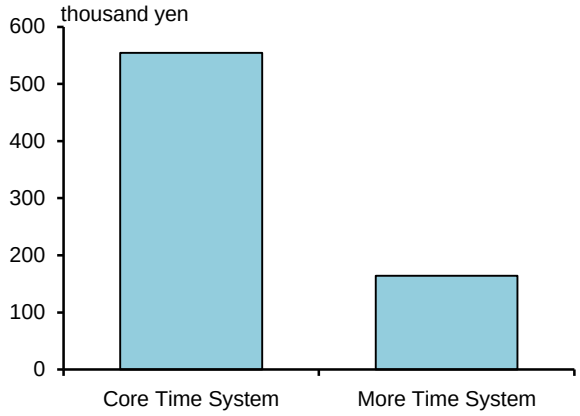
The More Time System-based funds transfers accounted for about 4 percent of the Zengin

[7] 4 city banks, 60 regional banks, 29 member banks of the Second Association of Regional Banks, 3 trust banks, 9 other banks, 260 Shinkin banks, and 139 credit unions.

[8] However, the participants in the More Time System are requested to connect to the system during the period between 3:30 p.m. and 6:00 p.m. on weekdays (common More Time).

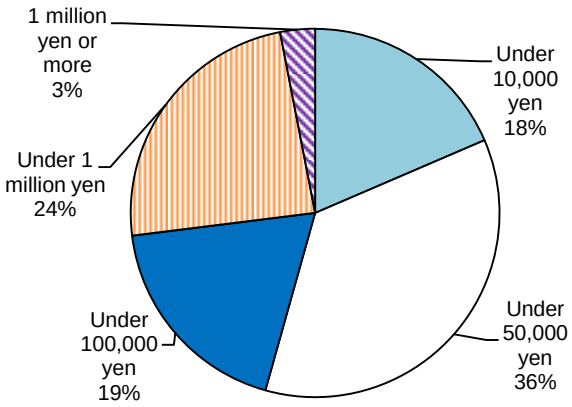
System's total transactions as of December 2018. The main transaction hours were from around 7:00 a.m. to around 9:00 p.m. on weekdays and from around 10:00 a.m. to around 6:00 p.m. on holidays. The average value per transaction on the More Time System was about 160,000 yen, which was smaller than that on the Core Time System (about 550,000 yen). Transactions under 50,000 yen accounted for over 50 percent of all transactions on the More Time System (Charts III-1-2 and III-1-3).

Chart III-1-2 Value per Transaction Processed by the Zengin System



Note: Calculated for small-value transactions from October 2018 to January 2019. For the Core Time System, instructions transmitted to the Zengin System are counted. For the More Time System, instructions settled in the Zengin System are counted.
Source: Bank of Japan, *Payment and Settlement Statistics*.

Chart III-1-3 Usage of the More Time System by Value per Transaction



Note: Share of transaction volume processed on November 30, 2018.
Sources: Japanese Bankers Association; Japanese Banks' Payment Clearing Network.

As the launch of the More Time System has provided the environment that enables real-time payment on a 24/7 basis, financial institutions are expected to use such infrastructures so as to provide reliable, safe, and convenient services for users. In other jurisdictions, initiatives have been taken to provide new services (e.g., person-to-person fund transfer services based on simple methods such as using mobile phone numbers) in conjunction with the implementation of 24/7 real-time payment infrastructures (Box 1). In Japan, stakeholders are expected to continue to make efforts in this regard.

Launch of the ZEDI

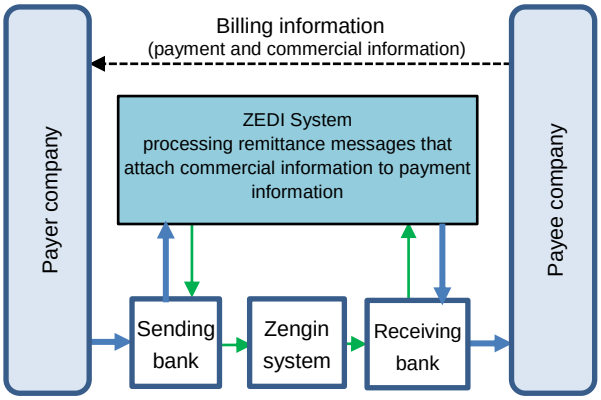
The ZEDI has enabled firms to attach commercial information such as transaction details to inter-firm remittance messages. It is an infrastructure to (1) achieve business efficiency in payment administration with the use of automated reconciliation application of accounts receivables and (2) support offering of new payment services by financial institutions. Zengin-Net decided to build the ZEDI at the end of 2016 and launched the system in December 2018.

Before the ZEDI was launched, there was an upper limit of 20 digits in fixed-length data format on EDI information (a message from the payer to the payee) that could be sent in conducting inter-firm payments through bank transfer. This required the payee to compare accounts receivables with details of cash received, and the payer to deal with inquiries by the payee about the breakdown of cash received. It was inefficient for both sides.

In contrast, the ZEDI's bank transfer data format has changed from fixed-length data format to eXtensible Markup Language (XML), which enables firms to attach information on commercial transactions to the EDI information box (Chart III-1-4).[9] Such information on commercial transactions allows the payee to perform automated accounts receivable reconciliation application, improving the efficiency of payment administration (for the payer as well).

[9] The XML format is an electronic message written in a language that describes data with a label called "tag" that shows its attributes. It enables flexible design and transformation of length and information amount.

Chart III-1-4 Overview of the ZEDI System



Notes: 1. The bold solid arrows refer to an XML message with commercial information; the thin solid arrows indicate a fixed-length message (payment information).
2. The chart shows the case where companies connect to the system via Internet banking.
Sources: Japanese Bankers Association; Japanese Banks' Payment Clearing Network.

A total of as many as 321 banks have participated in the ZEDI from its launch: 91 domestic banks or 60 percent of the domestic banks that connect to the Zengin System (Core Time System), as well as 230 Shinkin banks.[10] While the system is expected to be prevalent and widely used by firms going forward, financial institutions are expected to find new profit opportunities through the use of financial EDI information to be stored in the ZEDI, such as small loans, consulting, and making projections of industry trends by aggregating information on orders placed and received.

(2) Installation of the BOJ-NET Terminals Abroad

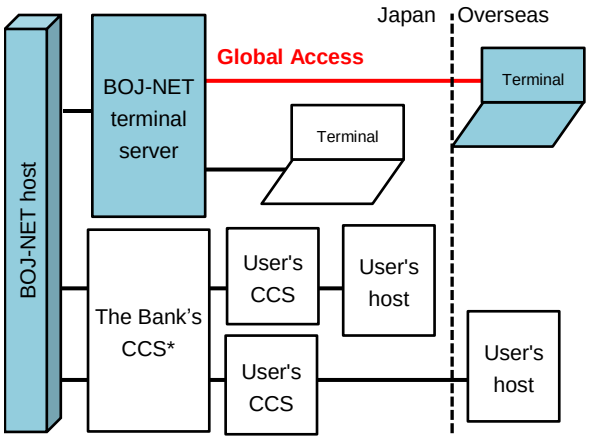
The Bank of Japan extended the operating hour of the BOJ-NET FTS and the BOJ-NET Japanese government bond (JGB) Services from 7:00 p.m. to 9:00 p.m. in February 2016 to secure the overlapping of settlement hours with overseas markets and support smooth cross-border settlement of yen and JGBs. Since fiscal 2016 (after the previous report was published), the Bank has approved the installation of the BOJ-NET terminals abroad (Global Access) to help its users to build global operational structure in light of the globalization of the financial economy (Chart III-1-5). The Bank began to accept applications in December 2017.

[10] 5 city banks, 58 regional banks, 25 member banks of the Second Association of Regional Banks, 3 other banks, and 230 Shinkin banks.

The Global Access can be used for (1) regular business operations at overseas sites and (2) strengthening business continuity arrangements in preparation for disasters that could strike domestic sites.[11] As the service incurs lower cost than computer-to-computer connection to the BOJ-NET from abroad, it can be an effective means for building operational structure at a global level, and in fact, has already been utilized in such a way.

Chart III-1-5 Overview of Global Access

Scheme



Note: Computer-to-computer Connections System (CCS) is a computer system that interconnects user's host computer and the Bank's host computer.
Source: Bank of Japan.

User Requirements

User (domestic)	The BOJ-NET participants who have accounts with the Bank's Head Office
Country/Region	Countries and regions that do not have particular restrictions on system environment, regulations etc.
Overseas site where Global Access is approved	Overseas branches of the BOJ-NET participants or local legal entities (usage is based on the instructions given by the BOJ-NET participants' business offices in Japan)
Operations in scope	All transactions except for auction transactions
Environment and support system	Japanese (input screen, reporting, user manual)
Network	IP-VPN service provided by carriers specified by the Bank
Cost	Initial installation cost and monthly fee

(3) Promoting Initiatives to Mitigate Foreign Exchange Settlement Risk

The payment systems that handle foreign exchange yen payments, such as those related to transactions in the foreign exchange (FX) market, include the Foreign Exchange Yen Clearing System (FXYCS) and the Continuous Linked Settlement (CLS) (Chart II-1). In the past, FXYCS allowed its users to choose either deferred net settlement or real-time gross settlement (RTGS), of which the former prevailed. To mitigate settlement risk, however, deferred net settlement has been discontinued and all payments in FXYCS shifted to the RTGS in October 2008 when the liquidity-saving features were added to the BOJ-NET RTGS system. Meanwhile, the CLS is a cross-border multi-currency settlement system,

[11] It covers all transactions except for auction transactions related to the Bank's market operations/lending facilities and government bond issuances.

which was set up to mitigate foreign currency settlement risk arising from a time difference between payment and receipt when two currencies are traded (risk that one party to a FX transaction has paid out the selling currency but fails to receive the buying currency, which is known as Herstatt risk). Specifically, it adopts a payment-versus-payment (PVP) settlement scheme, which simultaneously settles a combination of two currencies within a common time slot across the world.[12]

As recommended by the Basel Committee on Banking Supervision's *Supervisory Guidance for Managing Risks Associated with the Settlement of Foreign Exchange Transactions*, as well as by the *FX Global Code* developed by a partnership between central banks and private-sector market participants, PVP settlement has been encouraged, and PVP service is widely used in interbank settlements. In Japan, however, foreign exchange transactions by trust accounts of trust banks entrusted by investment trusts or pension funds had not been settled through PVP arrangements.

Under these circumstances, the Financial Services Agency established the Roundtable on Risks Associated with the Settlement of Foreign Exchange Transactions composed of Japanese foreign exchange market participants and the Bank in December 2016, in order to discuss challenges and their solutions in implementing PVP settlement of foreign exchange transactions by funds.[13] As a result, the Roundtable agreed on a phased approach to implement PVP settlement of foreign exchange transactions by funds; (1) the initial phase (the second half of fiscal 2018) in which priority is given to foreign exchange transactions by funds with higher risks (e.g., high-value foreign currency transfers) without making changes to existing market practices; and (2) full-fledged phase (in the second half of fiscal 2019 or the first half of fiscal 2020), in which PVP settlement will be implemented to the extent practically possible based on new market practices. As for the new market practices from the full-fledged phase onward, the Tokyo Foreign Exchange Market Committee published the *Market Practices of Foreign Exchange Transactions by Funds in the Tokyo*

[12] PVP settlement refers to a settlement mechanism for avoiding "default risk" by mutually conditioning multi-currency payments, so that if one party does not make payment in one currency, its counterparty does not deliver the other currencies.

[13] The results of the discussions were compiled in the report entitled *Final Report: Roundtable on Risks Associated with the Settlement of Foreign Exchange Transactions* published in August 2018.

Market in March 2018.[14] In addition, in summer 2018, the first PVP settlement of a Japanese fund occurred ahead of the initial phase. Going forward, stakeholders are expected to make progress toward the full-fledged phase.

B. Moves toward Sophisticated Securities Settlement Systems

For securities settlement systems, the following two points are discussed: (1) the shortening of settlement cycle and (2) cross-border delivery-versus-payment (DVP) link.

(1) Shortening of Settlement Cycles for Securities Transactions

After the global financial crisis in 2008, the importance of mitigating settlement risk was reinforced around the world. Against this backdrop, the use of central counterparty (CCP) has expanded in Japan, and the efforts to shorten the settlement cycles (the period between trade execution to settlement) for securities transactions, including JGBs and equities, have made significant progress. In May 2018, further shortening of the settlement cycle for JGB transactions (T+1) was realized. As for listed equities, a decision was made that the settlement cycle would be shortened to T+2, from the transactions executed on July 16, 2019 onward. These moves would make the Japanese settlement cycles for securities transactions, comparable with those of the United States and European countries (Chart III-2-1).

Chart III-2-1 International Comparison of Settlement Cycles for Securities

	United States	United Kingdom	France	Germany	Japan
Equities	T+2	T+2	T+2	T+2	T+3 (T+2 from July 2019 onwards)
Government bonds	T+1	T+1	T+2	T+2	T+1

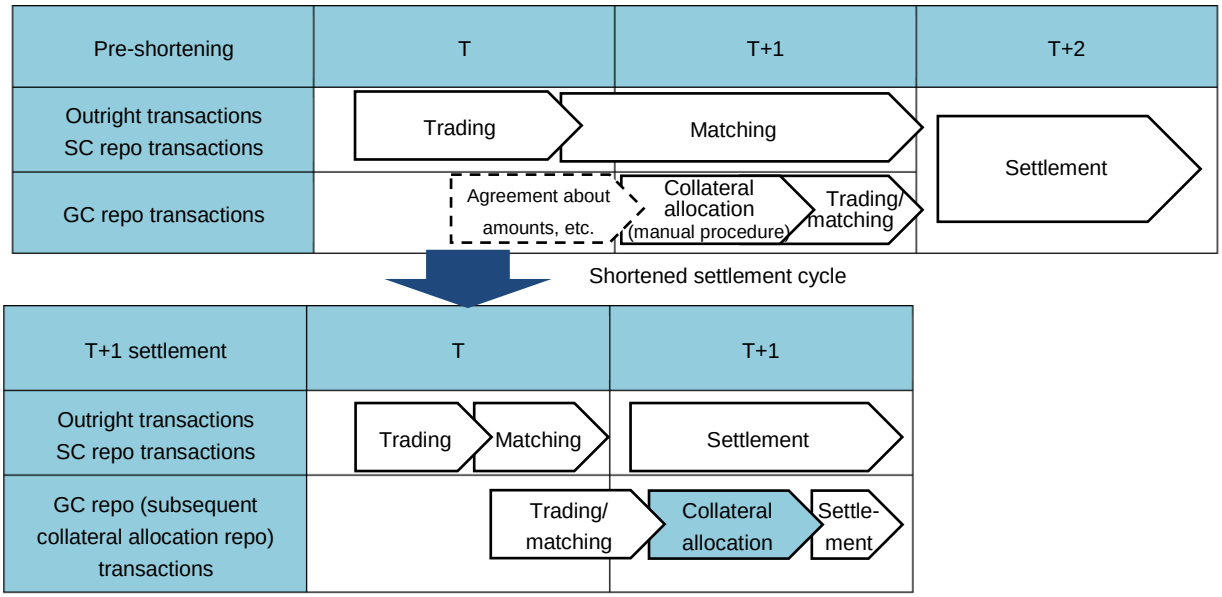
Note: Outright transactions.
Sources: Japan Securities Dealers Association; European Central Securities Depositories Association; Industry Steering Committee.

[14] The Tokyo Foreign Exchange Market Committee is composed of members who have broad expertise on the foreign exchange market and other international financial markets. One of its objectives is to produce and publish recommendations on a code of conduct for foreign exchange transactions as appropriate.

Implementation of Shortening of the JGB Settlement Cycle

With regard to shortening of the settlement cycle for JGB transactions (excluding retail transactions), the Working Group on Shortening of the JGB Settlement Cycle was established in September 2009 by the Japan Securities Dealers Association (JSDA), who served as the secretariat. The group led a discussion for shortening the settlement cycle of outright and special collateral (SC) repo transactions from T+2 to T+1, and realized it in May 2018 (Chart III-2-2).[15] As a result, about 90 percent of outright and SC repo transactions cleared via the Japan Securities Clearing Corporation (JSCC) have moved to a T+1 settlement (Chart III-2-3).[16]

Chart III-2-2 Changes in JGB settlement Flow after Shortening of Settlement

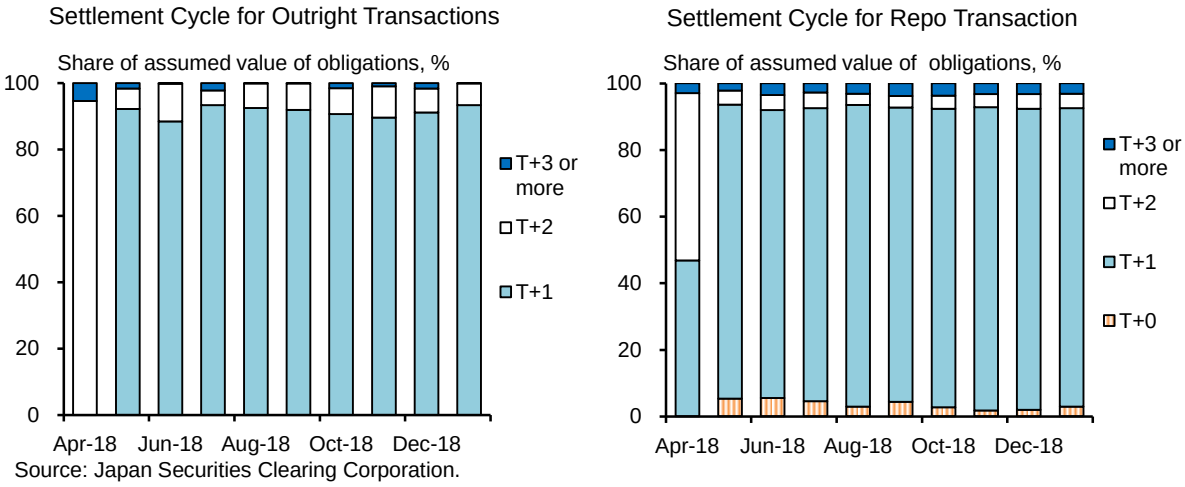


Source: Japan Securities Dealers Association.

[15] In June 2018, the Bank started to use the Pre-settlement Matching System of the Japan Securities Depository Center (JASDEC) for JGB transactions, of which one party is a foreign central bank or an international agency (these non-resident transactions are outside of the scope of T+1 settlement). In addition, it made changes to its operational flows in light of market practices, and enabled T+2 settlement for these non-resident transactions.

[16] Even after the settlement cycle of standard outright transactions and SC repo transactions has become T+1, not all transactions have moved to T+1, as non-resident transactions are exempted from T+1.

Chart III-2-3 JGB Transactions after Shortened Settlement Cycle



Source: Japan Securities Clearing Corporation.

General collateral (GC) repo is used for adjustment of excess and deficiency of funds resulting from outright transactions. With the move to T+1 settlement for JGB transactions, the new type of GC repo, which can be settled on a T+0 basis (i.e., same-day settlement), was implemented. This type of GC repo is called "Subsequent Collateral Allocation Repo."

These efforts have resulted in the greater mitigation of settlement risk for JGB transactions. It is estimated that the JSCC's outstanding exposure of JGB transactions has decreased by about 30 percent after the settlement cycle was shortened (Box 2).

Efforts toward Shortening of Settlement Cycle for Equities

With regard to shortening of the settlement cycle for equities (T+2), the JSDA, the Tokyo Stock Exchange, and the JSCC, jointly serving as the secretariat, set up the Working Group on Shortening Stock Settlement Cycle in July 2015. The results of discussion were presented in its final report, which was published in June 2016. The group continued its study on remaining operational issues, and produced documents entitled, *Guidelines on Borrowing and Lending Transactions of Share Certificates, etc.* and the *Points to Note concerning Settlement Failure for Stocks*, both of which were published by JSDA in September 2017.

On the basis of these efforts, the JSDA, the Tokyo Stock Exchange, and the JSCC announced in May 2018 that they would implement the shortening of the settlement cycle for listed equities (from T+3 to T+2) from the transactions to be executed on July 16, 2019

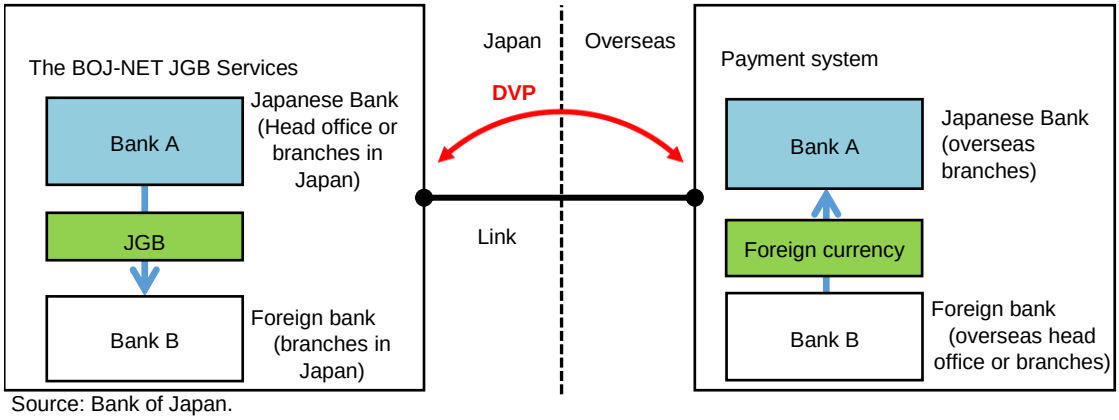
onward.[17] Since December 2018, market participants have been conducting various system tests (operational check test or running test) to be ready for this scheduled date.

Meanwhile, the JSDA announced the scheduled date for shortening of the settlement cycle for JGB retail trading and corporate and other bonds transactions[18] (from T+3 to T+2) in March 2019 (shorter settlement cycle would be implemented from the transactions to be executed on July 13, 2020).

(2) Preparation for the implementation of a Cross-Border DVP Link with Hong Kong

A cross-border DVP link is an initiative to link a securities settlement system with a payment system and achieve DVP -- a mechanism to ensure that a security is delivered if, and only if, corresponding cash is paid -- for a cross-currency transaction (i.e., exchange of a security against cash in different currency) (Chart III-2-4).

Chart III-2-4 Model Case of a Cross-Border DVP Link



Source: Bank of Japan.

Discussion was initiated by a public-private forum, composed of the central banks and securities settlement system operators in the ASEAN Plus Three (Japan, China, and South Korea) region, as part of the Asian Bond Markets Initiative. Japanese financial institutions have also expressed views that a cross-border DVP link with Hong Kong would meet their business needs, as Hong Kong is an important lending market in Asia.

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[17] The shortening of settlement cycle for foreign securities is scheduled to take effect simultaneously with domestic listed securities.

[18] Refers to securities registered in JASDEC's Book-Entry Transfer System, such as corporate bonds and municipal bonds.

On the basis of these, the Bank announced in April 2018 that it would begin to prepare for the implementation of a cross-border DVP link by linking the BOJ-NET JGB Services with the Hong Kong Dollar RTGS system, in cooperation with the Hong Kong Monetary Authority (HKMA). The Bank considers the implementation of a cross-border DVP link significant for the following three reasons:

First, a cross-border DVP link mitigates settlement risk. While it is possible to settle repo denominated in the domestic currency on a DVP basis via a credit risk-free central bank's current accounts, such a settlement option is not available for repo denominated in foreign currencies (cross-currency repos), because settlement systems of the central banks are currently not connected. With the use of a cross-border DVP link, foreign currency repo can be settled via the central bank's current accounts, in a way similar to domestic currency repo, thereby leading to mitigation of settlement risk.

Second, it contributes to the stable funding of foreign currencies by Japanese financial institutions. This link increases safety of settlement for cross-currency repo used for direct funding of foreign currencies against yen-denominated securities (JGBs). It would therefore facilitate, from a settlement perspective, the stable funding of foreign currencies in times of market stress. At the moment, FX swap is a dominant tool for funding Asian local currencies. If the implementation of a cross-border DVP link results in an increase in liquidity of cross-currency repo markets, it would also contribute to the diversification of foreign currency funding tools.

Third, it improves the value and usability of JGBs as collateral assets. This link, which realizes DVP settlement between JGBs and foreign currencies via credit risk-free central banks' current accounts, helps increase the value and usability of JGBs as collateral assets, and therefore contributes to the globalization of JGBs. At the same time, from the standpoint of those who lend foreign currency against JGB collateral, it is expected to bring benefits such as smooth money market functioning and provision of an additional money market instrument.

The Bank and the HKMA are proceeding with preparations for a cross-border DVP link, which is planned to go live around spring 2021. Meanwhile, the Bank is disclosing to the BOJ-NET users information needed for development of internal systems and preparations for operational arrangements. It also plans to run various tests at the final phase of the

development work. Further, the Bank plans to hold in-depth discussion with stakeholders regarding (1) operational arrangements for carrying out smooth cross-border settlement, and (2) system development by the BOJ-NET users, as well as good practices related to pre-settlement matching, cut-off time, and settlement cycles, on the occasion of the Forum toward Making Effective Use of the BOJ-NET.[19]

[19] For more information on the Forum toward Making Effective Use of the BOJ-NET, visit the Bank's website.

IV. Oversight of Financial Market Infrastructures by the Bank of Japan

As described in the previous chapter, the main financial market infrastructures (FMIs) in Japan are making efforts to enhance safety and efficiency, and the Bank of Japan oversees these efforts by respective FMIs. Oversight is the central bank's activities to monitor the design, risk management, and operations of FMIs; to assess them against established safety and efficiency objectives; and to induce changes where necessary. Through these activities, central banks seek to form a common view with FMI stakeholders and support their efforts for improvements, thereby ensuring safety and efficiency not only in individual FMIs, but also in the overall payment and settlement systems in their respective economies.

The Bank oversees FMIs pursuant to *The Bank of Japan Policy on Oversight of Financial Market Infrastructures*, and uses the *Principles for Financial Market Infrastructures* (PFMIs) established by the Bank for International Settlements' Committee on Payments and Market Infrastructure (CPMI) and the International Organization of Securities Commissions (IOSCO) as the standard for oversight of systemically important FMIs.[20] The Bank also applies the PFMIs to the Bank of Japan Financial Network System (BOJ-NET) Funds Transfer System and the BOJ-NET JGB Services operated by the Bank itself.

The following starts with introducing recent international trends in oversight of FMIs, and proceeds to review current status of FMIs in Japan (private-sector FMIs and the BOJ-NET).

A. International Trends in Oversight

The PFMIs provide guidelines for FMIs to address risk and ensure efficiency, and is used as the standard for oversight by member authorities (Chart IV-1-1). CPMI and IOSCO monitor implementation of the PFMIs in member jurisdictions. In addition, given rising international awareness of the importance of central counterparties (CCPs) and cyber security, they are working on additional guidance that provides more clarity and granularity to the PFMIs regarding financial risk management of CCPs, as well as safety and reliability of operations,

[20] CPMI-IOSCO published the PFMIs in April 2012 and requested central banks and other regulators to adopt them. In response, the Bank published *The Bank of Japan Policy on Oversight of Financial Market Infrastructures* in March 2013. The Committee on Payment and Settlement Systems (CPSS) was renamed as the CPMI in September 2014, so the PFMIs were published under the Committee's old name.

including cyber resilience. The Bank actively participates in international initiatives for the oversight of FMIs as follows:

Chart IV-1-1 Overview of PFMI

General organization	1	Legal basis	An FMI should have a well-founded, clear, transparent, and enforceable legal basis for each material aspect of its activities.
	2	Governance	An FMI should have governance arrangements that promote the safety and efficiency of the FMI, and support public interest and the objectives of relevant stakeholders.
	3	Framework for the comprehensive management of risks	An FMI should have a risk-management framework for comprehensively managing legal, credit, liquidity, operational, and other risks.
Credit and liquidity risk management	4	Credit risk	An FMI should measure, monitor, and manage its credit exposures and maintain sufficient financial resources to cover them.
	5	Collateral	An FMI that requires collateral to manage credit exposure should accept collateral with low credit, liquidity, and market risks and set appropriate haircuts, etc.
	6	Margin	A CCP should cover its credit exposures to its participants through an effective margin system.
	7	Liquidity risk	An FMI should measure, monitor, and manage its liquidity risk, as well as maintain sufficient liquid resources to continue settlement.
Settlement	8	Settlement finality	An FMI should provide final settlement, at a minimum by the end of the value date. Where preferable, an FMI should provide final settlement intraday or in real time.
	9	Money settlements	An FMI should conduct its money settlements in central bank money where practical and available.
	10	Physical deliveries	An FMI should identify, monitor, and adequately manage the risks associated with physical deliveries of financial instruments, etc.
CSD, DVP	11	Central securities depositories	A CSD should manage the risks associated with the safekeeping and transfer of securities, as well as maintain securities in an immobilized or dematerialized form.
	12	Exchange-of-value settlement systems	If an FMI settles transactions that involve the settlement of two linked obligations (for example, securities or foreign exchange transactions), it should eliminate principal risk by conditioning the settlement of one obligation upon the settlement of the other.
Default management	13	Participant-default rules and procedures	An FMI should have effective and clearly defined rules and procedures to manage a participant default, as well as maintain processing frameworks to contain losses and liquidity pressures and continue to meet its obligations.
	14	Segregation and portability	A CCP should have rules and procedures that enable the segregation and portability of positions of a participant's customers.
Business and operational risk management	15	General business risk	An FMI should identify, monitor, and manage its business risk (the risk of suffering potential asset losses arising from an FMI's administration and operation that are not related to a participant default), as well as hold sufficient liquid assets to cover such risk.
	16	Custody and investment risks	An FMI should properly manage risks associated with safeguarding of its own and its participants' assets and its investments.
	17	Operational risk	An FMI should establish an operational risk-management framework to identify and manage operational risks. Systems should be designed to ensure a high degree of security, operational reliability, and adequate capacity. An FMI should have business continuity management that enables timely recovery of operations.

Access	18	Access and participation requirements	An FMI should have objective, risk-based, and publicly disclosed criteria for participation and continuously monitor compliance with such criteria.
	19	Tiered participation arrangements	An FMI should appropriately identify, monitor, and manage the material risks to the FMI arising from tiered participation arrangements.
	20	FMI links	An FMI that establishes a link with one or more FMIs should adequately manage link-related risks.
Efficiency	21	Efficiency and effectiveness	An FMI should be efficient and effective in meeting the requirements of its participants and the markets it serves.
	22	Communication procedures and standards	An FMI should use internationally accepted communication procedures and standards in order to facilitate efficient settlement.
Transparency	23	Disclosure of rules, key procedures, and market data	An FMI should provide sufficient information to enable participants to have an accurate understanding of the risks and costs they incur by participating in the FMI. All key rules, procedures, and data should be publicly disclosed.
	24	Disclosure of data by trade repositories	A TR should provide timely and accurate market data to relevant authorities and the public in line with their respective needs.

Sources: BIS Committee on Payments and Market Infrastructures; International Organization of Securities Commissions.

(1) Monitoring of PFMIs Implementation

CPMI and IOSCO monitor implementation of the PFMIs in member jurisdictions. The monitoring is being carried out on three levels: level 1 is to assess whether jurisdictions have completed the process of adopting the legislation and regulations that will enable them to implement the PFMIs; level 2 is to assess whether the content of the legislation and regulations is consistent with the PFMIs; and level 3 is to assess the consistency in the outcome of implementation of the PFMIs by FMIs in specific fields.

Level 1 assessment was conducted for 28 jurisdictions, and the year 2014 and on, assessment reports have been updated annually. Level 2 assessment for member jurisdictions has been conducted seriatim. The first set of assessment reports was published in February 2015 for the United States, the European Union (EU), and Japan, followed by a series of reports for other jurisdictions. Level 3 assessment, which focused on financial risk management and recovery practices in times of crisis, was conducted for the first time for 10 major global derivatives CCPs, including the Japan Securities Clearing Corporation (JSCC). Its assessment report was published in August 2016 (2016 report).[21] Subsequently, a follow-up work to the 2016 report, which focused on recovery planning in time of crisis,

[21] CPMI-IOSCO, *Implementation Monitoring of PFMI: Level 3 Assessment -- Report on the Financial Risk Management and Recovery Practices of 10 Derivatives CCPs* (August 2016).

adequacy of financial resources, and liquidity stress testing, was conducted with the expanded coverage of 19 CCPs, and the follow-up report was published in May 2018.[22]

(2) Strengthening of Financial Risk Management of Systemically Important CCPs

After an agreement was reached at the G20 Pittsburgh Summit in 2009 on central clearing of standardized over-the-counter (OTC) derivatives, it was internationally recognized that CCPs, same as banks, should strengthen financial risk management, by improving their resilience and developing effective plans for recovery and resolution. Under these circumstances, in April 2015 CPMI-IOSCO, the Financial Stability Board (FSB), and the Basel Committee on Banking Supervision (BCBS) put together the following priorities as a CCP Workplan.[23]

i. CCP resilience: to maintain sufficient financial resources to cope with the materialization of risk, to develop the framework for stress testing, etc.

ii. FMI recovery planning: to develop more granular guidance for FMI recovery planning, so that FMIs can absorb loss and continue critical businesses in extreme scenarios.

iii. CCP resolvability: to set up crisis management groups and develop resolution rules, to prepare for cases in which CCPs suffer extreme shocks and cannot recover their operation on their own.

iv. Analysis of global interdependencies among CCPs, their members, and other service providers: the potential for any mutual spillovers of negative shocks.

Based on this workplan and implementation status of the PFMIs, these standard setting bodies developed, for each of issues listed above, guidance and frameworks that supplement the PFMIs, and conducted analysis of interdependencies. They published the results one

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[22] CPMI-IOSCO, *Implementation Monitoring of PFMI: Follow-Up Level 3 Assessment of CCPs' Recovery Planning, Coverage of Financial Resources and Liquidity Stress Testing* (May 2018).

[23] See the following material for the details of international discussions on CCPs:
Bank of Japan, "Global Response to Central Counterparties (CCP)," *Payment and Settlement Systems Report Annex Series* (August 2017) (available only in Japanese).

after another through 2017. Furthermore, in addition to the above four priorities,

v. Impact of other regulatory initiatives, including Basel III, on incentives to centrally clear

was also chosen as priority. This was added, as there were concerns that the treatment of capital requirements for customer transactions under the leverage ratio regulations and other regulations might impair incentives to centrally clear customers' derivatives transactions.[24] Based on these five priorities, CPMI-IOSCO, FSB, and BCBS published their priorities and action plans for 2017-2018 (Chart IV-1-2).[25] Among these priorities, further considerations would be required for the adequacy of financial resources to support CCP resolution and the treatment of CCP equity in resolution as a potential source of loss absorption. FSB is planning to develop further guidance on these issues.

[24] Under the current regulations on the leverage ratio, financial institutions are not allowed to deduct initial margins deposited by customers when they calculate exposures of transactions with customers.

[25] FSB, BCBS, CPMI, and IOSCO, *Chairs' Report on the Implementation of the Joint Workplan for Strengthening the Resilience, Recovery, and Resolvability of Central Counterparties* (July 2017).

Chart IV-1-2 CCP Workplan and Guidance, Framework, etc.

Area	Action Plan for 2017-18	Guidance, Framework, etc.
Resilience	・Continue monitoring implementation of the PFMIs regarding resilience. ・Finalize the framework on supervisory stress testing.	・CPMI-IOSCO, *Resilience of Central Counterparties (CCPs): Further Guidance on the PFMI* (July 2017). ・CPMI-IOSCO, *Framework for Supervisory Stress Testing of Central Counterparties (CCPs)* (April 2018).
Recovery	・Continue monitoring implementation of the PFMIs regarding recovery. ・Follow-up work in the area of good practices for auctions.	・CPMI-IOSCO, *Recovery of Financial Market Infrastructures* (2017) (2014 guidance was revised in July 2017.)
Resolution	・Implement the Key Attributes that effective resolution regimes must satisfy, consistent with the guidance regarding CCP resolution. ・Assess the adequacy of financial resources to support resolution and the need for additional financial resources. ・Consider the need for, and develop as appropriate, further guidance on the treatment of CCP equity in resolution.	・FSB, *Guidance on Central Counterparty Resolution and Resolution Planning* (July 2017). ・FSB, *Financial Resources to Support CCP Resolution and the Treatment of CCP Equity in Resolution* (Discussion paper) (November 2018).
Analysis of interdependencies	・Assess and determine the value of additional CCP data collection and analysis.	・FSB et al., *Analysis of Central Clearing Interdependencies* (July 2017). ・FSB et al., *Analysis of Central Clearing Interdependencies* (August 2018).
Impact of other regulatory reforms on incentives to centrally clear	・Assess the impact of the interaction of post-crisis regulatory reforms on incentives to centrally clear.	・FSB et al., *Incentives to Centrally Clear Over-the-counter (OTC) Derivatives* (November 2018).

Sources: Financial Stability Board; BIS Committee on Payments and Market Infrastructures; International Organization of Securities Commissions; Bank of Japan.

Meanwhile, there are moves afoot in the EU and the United States to review the framework for regulations and supervision of global CCPs, triggered by the United Kingdom's exit from the EU (Brexit) and other developments (Box 3).

(3) Initiatives to Enhance Cyber Security

As can be seen from payment fraud incidents at overseas central banks, cyber attacks in the financial industry have been increasing and becoming more sophisticated in recent years.[26] Under these circumstances, central banks and financial supervisory authorities are making

[26] For example, Bangladesh Bank, the central bank of Bangladesh, made public an illegal remittance due to cyber attacks that occurred in February 2016 (Bangladesh Financial Intelligence Unit Bangladesh Bank, *Annual Report 2015-2016*). In this incident, the Bangladesh Bank's systems were manipulated by malware infections and a large amount of funds (about 81 million U.S. dollars) were illegally remitted via the SWIFT network.

efforts to enhance resilience of FMI operators and FMI participants against cyber attacks.[27]

In order to clarify some principles in the PFMIs related to cyber security, CPMI-IOSCO developed and published *Guidance on Cyber Resilience for Financial Market Infrastructures* (Cyber Guidance) in June 2016. It identifies challenges and measures that FMI should address and undertake to strengthen resilience against cyber attacks, including the development of governance arrangements and security control systems (Chart IV-1-3).

Chart IV-1-3 Elements to Strengthen Resilience against Cyber Attacks

Primary risk management categories	Overview
Governance	・ Establishment of appropriate strategy and frameworks supported by clearly defined roles and responsibilities of the FMI's board (or equivalent) and its management
Identification	・ Identification of information asset and business functions to be protected
Protection	・ Development of organizational security system
Detection	・ Early detection of signs of cyber attacks by comprehensive and continuous monitoring
Response and recovery	・ Designing arrangement to respond to and recovery from cyber attacks, including continuity planning
Overarching risk management components	**Overview**
Testing	・ Testing of effectiveness of measures with stress tests and testing programs
Situational awareness	・ Collecting information on and in-depth understanding of potential cyber threats
Learning and evolving	・ Monitoring of cyber events, technological development, and application to its own system

Sources: BIS Committee on Payments and Market Infrastructures; International Organization of Securities Commissions.

The CPMI also published a report entitled *Reducing the Risk of Wholesale Payments Fraud related to Endpoint Security* in May 2018. Based on the recognition that a wide range of stakeholders, including operators, participants, and messaging networks of wholesale payment systems (central bank real-time gross settlement systems and private-sector wholesale payment systems) need to take a holistic approach to addressing wholesale payment fraud, the report presents the "strategy" that comprises seven elements for enhancing security (Chart IV-1-4).[28] CPMI is tasked with the monitoring of progress in

[27] For example, Financial Services Agency, *The Policy Approaches to Strengthen Cyber Security in the Financial Sector* (July 2015; Updated in October 2018).

[28] An endpoint in the wholesale payment ecosystem is defined to be a point in place and time at which payment instruction information is exchanged between two parties in the ecosystem, such as between a payment system and a messaging network, between a messaging network and a participant in the network, or between a payment system and a participant in the system.

member jurisdictions. The strategy is not intended to replace the PFMIs or the Cyber Guidance; rather it complements some of these principles and guidance.

Chart IV-1-4 Strategy to Enhance Endpoint Security

Element	Content [stakeholders are listed in square brackets]
1. Identify and understand the range of risks	・ Identification and understanding of the risks related to endpoint security [operator and participants]
2. Establish endpoint security requirements	・ Establishment of clear endpoint security requirements for its participants as part of its participation requirements (prevention, detection, response, and information sharing) [operator] ・ Establishment of own risk-based endpoint security arrangements as needed [participants]
3. Promote adherence	・ Establishment of processes as necessary to help promote adherence to their respective endpoint security requirements [operator and participants]
4. Provide and use information and tools to improve prevention and detection	・ Supporting the provision and use of information and tools that would enhance capabilities to prevent and to detect fraud in a timely manner to the extent feasible [operator and participants]
5. Respond in a timely way to potential fraud	・ Establishment of procedures and practices, and deployment of sufficient resources to respond to fraud in a timely manner [operator and participants]
6. Support ongoing education, awareness, and information sharing	・ Collaboration to identify and promote the adoption of procedures and practices and the deployment of sufficient resources that would support ongoing education, awareness, and information sharing about security risks and risk controls [operator and participants]
7. Learn, evolve, and coordinate	・ Monitoring endpoint security risks and risk controls, and review and update accordingly their endpoint security requirements, etc. [operator and participants] ・ Seeking to coordinate approaches among different systems for strengthening endpoint security across systems where possible and appropriate [operators and participants] ・ Reviewing and updating of regulatory/supervisory/oversight expectations and assessment programs to reflect the evolving risk mitigation strategies [regulators, supervisors, and overseers]

Sources: BIS Committee on Payments and Market Infrastructures; International Organization of Securities Commissions.

B. Oversight of Private-Sector FMIs

The Bank oversees private-sector FMIs pursuant to *The Bank of Japan Policy on Oversight of Financial Market Infrastructures* and in reference to various guidance mentioned in the previous section.

(1) Recent Initiatives in the Private-Sector FMIs

The main private-sector FMIs have been working on initiatives to strengthen risk management and operational security and reliability. These initiatives are summarized as follows.

For the management of credit risk (Principle 4) and liquidity risk (Principle 7), the private-sector FMIs made changes to rules and procedures in order to enhance the adequacy of financial resources for loss compensation in the event of a participant default. In addition, they enhanced liquidity arrangements, so that sufficient liquidity would be available to complete settlement by the end of day, in the event of failure to pay by a participant. A FMI also developed a comprehensive recovery plan based on the revised guidance regarding the recovery of FMIs.

Further, for governance and framework for comprehensive management of risks (Principles 2 and 3), FMIs made various changes, including establishment of risk appetite policy, clarification of the responsibility of the Board of Directors and the reporting line, and development of frameworks for consultation with external experts.

For operational risk (Principle 17), efforts have been made to increase resiliency to cyber attacks through development of contingency plans and establishment of a risk management system with a unified chain of command responsibilities. With respect to business continuity plans, some FMIs set up backup facilities away from Tokyo (Osaka office) or established contingency plans.

Since the first publication in 2015, each private-sector FMI has regularly updated disclosure materials regarding its compliance with the PFMIs, which also cover these initiatives. The Bank refers to those materials for its oversight activities (See Chart IV-2-1). In the previous *Payment and Settlement Systems Report* (March 2016), the Bank concluded that "overall, these private-sector FMIs are in conformity with the PFMIs." Major initiatives by each FMI

since fiscal 2016 (after the release of the previous report) are summarized below.[29]

Chart IV-2-1 PFMI Disclosure by Private-Sector FMIs

FMI	First Disclosure	Subsequent Disclosure
Japanese Banks' Payment Clearing Network	July 2015	July 2017
Foreign Exchange Yen Clearing System		
Japan Securities Depository Center (JASDEC)	July 2015	July 2016, June 2017, April 2018
JASDEC DVP Clearing Corporation (JDCC)		
Japan Securities Clearing Corporation (JSCC)	March 2015	March 2016, March 2017, March 2018
Tokyo Financial Exchange (TFX)	July 2015	August 2017
DTCC Data Repository Japan (DDRJ)	July 2015	July 2016, July 2017, July 2018

Source: Information disclosed by FMIs.

Japanese Banks' Payment Clearing Network (Zengin-Net)

With regard to credit risk management, Japanese Banks' Payment Clearing Network (Zengin-Net) carries out the revaluation of collateral based on market prices every business day in order to mitigate the risk of variance between the appraised value of collateral and the market price. As for operational risk, it has newly defined cyber security risk and manages the risk pursuant to its cyber security policy. Zengin-Net is also in the process of establishing its operational system for emergencies in order to improve effectiveness.

Foreign Exchange Yen Clearing System

The Japanese Bankers Association, which manages the Foreign Exchange Yen Clearing System, has expanded its means of communication used in cases where a state of emergency occurs, in order to further strengthen the business continuity of the system. Specifically, it introduced in April 2018 a Web-based communication service used preferentially for emergency response, while maintaining existing means of communication such as facsimile and e-mail for parallel use.

Japan Securities Depository Center Group (JASDEC, JDCC)

The Japan Securities Depository Center (JASDEC) group set up its Osaka office, and

[29] DTCC Data Repository Japan (DDRJ), one of the firms under the Bank's oversight, is also making progress in understanding and managing risk such as operational risk pursuant to the risk management policy of the DTCC group.

enhanced business continuity in the event that its headquarters ceases to function. It also enhanced cyber resilience, by establishing a risk management system led by the chief information security officer (CISO) and conducting cyber resilience drills involving all employees.

JASDEC DVP Clearing Corporation (JDCC) took measures in April 2016 to ensure that sufficient liquidity would be available to complete payment by the end of day, in a case of the default of a participant who serves as one of the liquidity provider banks.[30] Furthermore, JDCC set an upper limit (60 billion yen) for the total net debit of delivery-versus-payment (DVP) participants in the same financial group in March 2017, so that it could complete payment by the end of day with the secured liquidity resources (up to 60 billion yen), in case of default of a financial group with the largest net debit.

JDCC revised its internal rules in April 2018 in order to clarify the Board of Directors' responsibility with respect to the reviewing of the risk management framework. In addition, to support the Board of Directors' decision-making regarding the risk management framework, JDCC enhanced the disclosure and feedback mechanism in line with international standards. For example, it set up a framework for seeking comments from DVP participants with respect to the annual verification of stress tests models, which are used for assessing the adequacy of financial resources for the participant's default loss.

Japan Securities Clearing Corporation (JSCC)

Japans Securities Clearing Corporation (JSCC) is reinforcing its risk management framework. JSCC established in June 2017 the Risk Committee, which is composed of external members with knowledge and experience in risk management (in addition to the existing advisory committees composed of clearing participants), as one of the advisory bodies to the Board of Directors. It set out the Risk Appetite Framework Management Policy, and set up the framework for operationalizing this policy. In this framework, JSCC defines the level of risk appetite and assesses its compliance, in order for the operational management to be in accordance with the Policy. The compliance status is reported to the

[30] To ensure sufficient liquidity for completing payment by the end of day, in case of failure to pay by a participant, JDCC concluded credit line agreements with several banks, which are called "liquidity provider banks."

Risk Oversight Committee, which is composed of, among others, the President and chief executive officer (CEO), executive officers, and chief risk officer (CRO), on a monthly basis; and to the Board of Directors on a quarterly and annual basis.

In addition, in response to the updating of guidance on FMI recovery and the recommendation to strengthen its recovery plan issued by the International Monetary Fund (IMF) Financial Sector Assessment Program in 2017, JSCC drew up a comprehensive recovery plan entitled *Recovery Plan Based on the Principles of Financial Market Infrastructure* in June 2018. The Recovery Plan identifies stress scenarios where it cannot continue its core services, and describes recovery tools corresponding to each scenario (e.g., content of recovery tools, method of recovering and raising capital, procedures to invoke recovery measures, collaboration with relevant authorities, governance).

Each clearing business unit of JSCC is working on initiatives to improve credit and liquidity risk management and to expand its services based on the PFMIs and their complementary guidance (Chart IV-2-2). With respect to financial resources for the participant's default loss, for example, in listed derivatives trading, an add-on margin system was introduced, whereby JSCC requires participants with excessive positions to deposit margins immediately. It also changed the parameters in the margins model, in order to raise margin levels when market volatility remains low for a long period.

Chart IV-2-2 Major Initiatives by Clearing Business Units of JSCC

	Listed Products	OTC Derivatives	OTC JGBs
Credit Risk Management	・Strengthened default management procedure for equities and listed derivatives ・Revised the margin system and clearing fund for listed derivatives	・Revised the margin system and the clearing fund for IRS and CDS ・Enhanced the portability framework of IRS and CDS	・Reviewed the margin system and clearing fund ・Revised default management procedures
Liquidity Risk Management	・Enhanced liquidity resources	・Enhanced liquidity resources	・Revised the framework for liquidity procurement via JGB repo transactions with clearing participants
Service Enhancement	・Improved clearing and settlement systems in conjunction with system renewal of listed derivatives ・Expanded the range of listed derivative products eligible for clearing ・To revise settlement system of equities (to be implemented in conjunction with shortening of equity settlement cycle to T+2)	・Extended clearing timing for IRS ・Enhanced and introduced IRS compression and assumption function ・Added new single name CDSs for clearing	・Introduced subsequent collateral allocation repos ・Included inflation-indexed JGBs for clearing

Source: Japan Securities Clearing Corporation.

Meanwhile, as for the business continuity plan, JSCC opened its Osaka Office to further strengthen its business continuity arrangements. It also prepared a contingency plan for system failures and cyber security incidents, pursuant to the basic policies on handling system disruption.

Tokyo Financial Exchange (TFX)

For the purpose of ensuring smooth handling of clearing participants' default procedures, Tokyo Financial Exchange (TFX) compiled a manual and shared its content with its participants. It has been conducting default management drills involving the participants on an annual basis. TFX enhanced the robustness of its financial resources. In February 2017, it unified a clearing membership of foreign exchange futures and that of equity index futures, and consolidated financial resources for loss compensation. It also increased the pre-contribution ratio of the required clearing funds (common default funds contributed by all participants) to 100 percent.

(2) Compliance of Private-Sector FMIs with the PFMIs

Taking into account the initiatives taken by private-sector FMIs as described above, the Bank maintains its view that overall private-sector FMIs are in conformity with the PFMIs, and safety and efficiency are ensured.

It is important that each private-sector FMI continues to work on initiatives to improve its safety and efficiency. It is of particular importance to ensure effective implementation of risk management, business continuity arrangements, and recovery plan for extreme shocks, such as through carrying out validation of risk management models and regularly conducting various testing and operational drills. Private-sector FMIs should also pay attention to the trend of international efforts to ensure recoverability and resolvability of CCPs in times of crisis.

Through its oversight activities, the Bank will continue to monitor the progress of various initiatives by private-sector FMIs, and encourage them to take actions if necessary. In the international forums, such as those relating to oversight activities, as well as the PFMIs, the Bank will collaborate and cooperate with organizations such as the Financial Services Agency, overseas authorities, and other central banks.

For the business continuity arrangements, it is important to develop market-wide arrangements, in addition to individual arrangements of private-sector FMI and financial market participants. The Bank enhances its own business continuity arrangements, as a designated public institution, under relevant laws and regulations, including the Disaster Countermeasures Basic Act (Box 4); and supports initiatives to strengthen market-wide response capabilities for the enhancement of the robustness of payment and settlement systems (Box 5).

C. Compliance of the BOJ-NET with the PFMIs

The Bank published disclosures on the BOJ-NET Funds Transfer System (BOJ-NET FTS) and the BOJ-NET JGB Services in July 2015, in accordance with the PFMIs and *Principles for Financial Market Infrastructures: Disclosure Framework and Assessment Methodology*.[31] Based on them, the Bank conducted assessment of both the BOJ-NET FTS and the BOJ-NET JGB Services and concluded that both systems are "compliant with all applicable PFMIs," as shown in the previous *Payment and Settlement Systems Report* (March 2016) (see Chart IV-3 for the applicable PFMIs). Subsequently, the Bank updated the disclosures in June 2017, reflecting the launch of the current BOJ-NET in October 2015.[32] The major changes from the previous disclosures are: (1) change in the frequency of collateral valuation; (2) abolishment of a designated-time settlement; and (3) change in message format. The details are as follows.

[31] Bank of Japan, *Information Disclosure Based on the Principles for Financial Market Infrastructures: The BOJ-NET Funds Transfer System* (July 2015) and *Information Disclosure Based on the Principles for Financial Market Infrastructures: The JGB Book-Entry Transfer System* (July 2015).

[32] Bank of Japan, *Information Disclosure Based on the Principles for Financial Market Infrastructures: The BOJ-NET Funds Transfer System* (June 2017) and *Information Disclosure Based on the Principles for Financial Market Infrastructures: The JGB Book-Entry Transfer System* (June 2017).

Chart IV-3 Applicable PFMIs for the BOJ-NET FTS and the BOJ-NET JGB Services

Principle			Funds Transfer	JGB
General organization	1	Legal Basis	✓	✓
	2	Governance	✓	✓
	3	Framework for the comprehensive management of risks	✓	✓
Credit and liquidity risk management	4	Credit Risk	✓	✓
	5	Collateral	✓	✓
	6	Margin	-	-
	7	Liquidity Risk	✓	✓
Settlement	8	Settlement finality	✓	✓
	9	Money settlements	✓	✓
	10	Physical deliveries	-	-
CSD, DVP	11	Central securities depositories	-	✓
	12	Exchange-of-value settlement systems	✓	✓
Default management	13	Participant-default rules and procedures	✓	✓
	14	Segregation and portability	-	-
General business and operational risk management	15	General business risk	-	-
	16	Custody and investment risks	✓	✓
	17	Operational risk	✓	✓
Access	18	Access and participation requirements	✓	✓
	19	Tiered participation arrangements	✓	✓
	20	FMI links	-	✓
Efficiency	21	Efficiency and effectiveness	✓	✓
	22	Communication procedures and standards	✓	✓
Transparency	23	Disclosure of rules, key procedures, and market data	✓	✓
	24	Disclosure of data by trade repositories	-	-

Note: "✓" denotes it is applicable (not the compliance status).
Source: BIS Committee on Payments and Market Infrastructures; International Organization of Securities Commissions.

First, Principle 5 (collateral) requires collaterals to be marked to market on a daily basis. In the previous BOJ-NET, collateral was marked to market, in principle, on a weekly basis; but after the launch of the current BOJ-NET, it is performed, in principle, on a daily basis.[33]

Second, Principle 8 (settlement finality) states, "where necessary or preferable, an FMI should provide final settlement intraday or in real time." In the previous BOJ-NET FTS, certain transactions with the Bank or the Japanese government were settled at a designated time (i.e., debits and credits were processed simultaneously upon the arrival of certain fixed

[33] As for foreign currency-denominated foreign bonds, the Bank marks them to market in principle on a weekly basis.

hours). This settlement mode was abolished with the launch of the current BOJ-NET. In the current BOJ-NET, individual transactions are, in principle, settled in real time, so that final settlement is completed immediately on the settlement day.

Third, Principle 22 (communication procedures and standards) states, "an FMI should use relevant internationally accepted communication procedures and standards in order to facilitate efficient payment, clearing, settlement, and recording." The current BOJ-NET adopts the internationally prevalent eXtensible Markup Language (XML) message format and ISO 20022 messages, ahead of Europe and the United States (see Box 6 for ISO 20022 adoption initiatives for payment systems operated by central banks).

As these changes contribute to the enhancement of risk management and user convenience, the Bank considers that the BOJ-NET FTS and the BOJ-NET JGB Services are compliant with all the applicable PFMIs. The Bank will periodically update disclosures on the BOJ-NET.

V. New Development of FinTech and Payment

As discussed in the previous chapter, the Bank of Japan conducts oversight, mainly focusing on the systemically important financial market infrastructures (FMIs) in which many financial institutions participate. In addition, the Bank pays close attention to payment service schemes that are increasingly used in the society. Retail payment services support person-to-person (P2P) remittances or person-to-merchant (P2M) payments. Despite the small size of each payment, the volume of transactions is large. They are also closely related to economic activities of many households and businesses. It is unlikely that a user's default in the retail payment system will pose systemic risk that is amplified by other users' defaults along with a chain-reaction of settlement failures. However, as these services' convenience, efficiency, and safety directly impact consumers' behavioral patterns and firms' economic activities, it could in turn influence the entire payment and settlement systems, depending on their future development. For these reasons, the Bank closely pays attention to their developing trend.[34]

As innovations of information technologies rapidly advance, cashless payment methods, especially mobile payments that use mobile devices such as smartphones, have become widespread in recent years. This has caused a substantial change in the user interface of retail payment services. FinTech firms, as well as financial institutions, have joined cashless payment businesses, transforming the market structure of retail payment services. The relationship between financial institutions and FinTech firms, coupled with both collaborative and competitive aspects, has become more diversified and complicated. In light of these changes, the Bank monitors the impact of information technology-based financial services -- that is, FinTech -- on payment systems and conducts research into the applicability of new technologies to payment systems.

The *Payment and Settlement Systems Report Annex Series* has already discussed leading

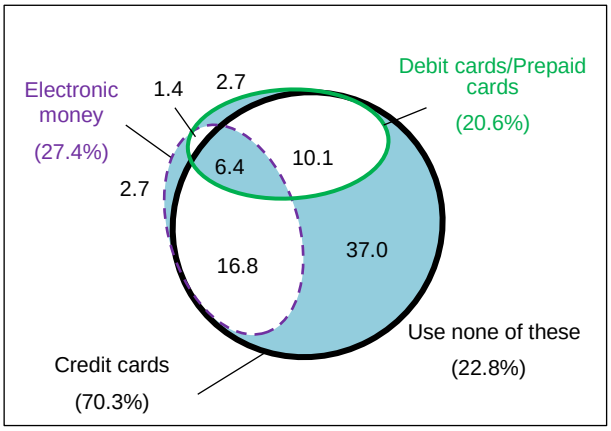
[34] For the impact of the growing presence of non-banks (entities other than banks) on the retail payment market, and the role of a central bank in the market (including oversight), see the following report by the Bank for International Settlements' Committee on Payments and Market Infrastructures (CPMI):
CPMI, *Non-Banks in Retail Payments* (September 2014).

technologies behind FinTech and trends in cashless payments and settlements.[35] In what follows, therefore, we describe structural changes in the retail payment market, mainly focusing on the relationship between FinTech firms and financial institutions, and then present the Bank's recent approaches to FinTech.

A. FinTech and Changes in Market Structure of the Retail Payment Market

The main cashless payment methods in Japan include bank transfer, credit cards, and electronic money. The Bank has conducted a questionnaire survey on the use of cashless payments other than bank transfer. According to its findings, about 70 percent of adults use credit cards and slightly less than 30 percent electronic money (Chart V-1-1). In general, credit cards are often used for relatively expensive payments, whereas electronic money is frequently used for small-amount payments at convenience stores or train stations. Meanwhile, the debit card market continues to remain smaller than those of other cashless payment methods.

Chart V-1-1 Usage of Cashless Payments



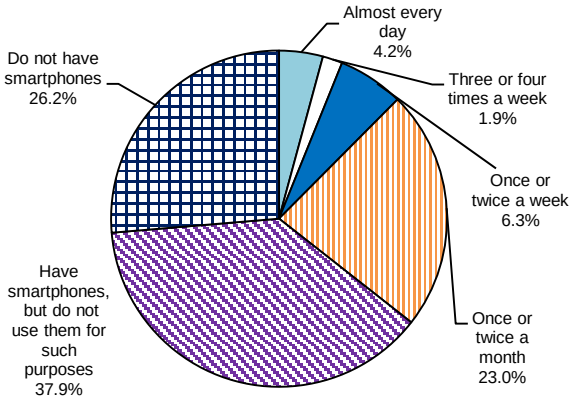
Note: A "prepaid card," in general, refers to a payment method in which the cardholder loads money onto the card before using it; a "credit card," a payment method in which credit function is imparted to the cardholder; "electronic money," either of two electronic retail payment methods, that is, a prepaid method in which the cardholder loads money before using it or a post-pay method in which credit function is imparted to the cardholder for payment. This survey did not provide the detailed definitions of "electronic money," "prepaid card," and "credit card," leaving the designations of payment methods the respondents use to their subjectivity.

Source: Bank of Japan, "Current Status of Cashless Payment," *Payment and Settlement Systems Report Annex Series* (September 2018) (available only in Japanese).

[35] See the following *Payment and Settlement Systems Report Annex Series*:
Bank of Japan, "Current Status of Cashless Payment" (September 2018) (available only in Japanese).
———, "Current Status and Challenges of Mobile Payment" (June 2017) (available only in Japanese).
———, "FinTech Special Edition -- Financial Innovation and FinTech" (February 2018).

The recent emergence of many types of QR code payment using smartphones and contactless payment methods that use communication devices embedded in cards or smartphones has urged efforts to acquire users and retailers. According to the questionnaire survey, smartphone-based payment methods have been used at a certain scale (Chart V-1-2). So far, non-financial institutions (typically FinTech firms) mainly provide these new cashless payment methods.

Chart V-1-2 Use of Payment Services on Smartphones



Note: Smartphone payments include online shopping, purchasing games and subscriptions to e-books, as well as contactless payments made by scanning QR codes or tapping smartphones against the payment terminal at stores.

Source: Bank of Japan, *Results of the 76th Opinion Survey on the General Public's Views and Behavior* (December 2018 survey).

(1) Collaborative and Competitive Relationships between Financial Institutions and FinTech Firms

To understand the impact of FinTech firms' entry into the retail payment service market, let us consider the relationships between financial institutions that provide conventional payment services and FinTech firms in terms of the following three aspects: (1) a vertical relationship; (2) a complementary relationship; and (3) an alternative or competitive relationship.

First, in order for a FinTech firm to provide payment services to its users (consumers and retailers), it is, in principle, essential to have access to their accounts at financial institutions for pre-charge from bank accounts, real-time withdrawals, or remittance of proceeds to participating stores' bank accounts. In other words, FinTech firms cannot, in effect, provide payment services without cooperation with financial institutions. In this sense, they form a vertical relationship in which financial institutions are situated upstream of the market and FinTech firms downstream. This relationship allows financial institutions to charge FinTech firms settlement fees.

On one hand, in terms of users such as consumers and retailers, the payment services provided by FinTech firms and accounts at financial institutions are regarded as forming a complementary relationship, like coffee and sugar. When consumers choose or maintain bank accounts, their decision may depend on whether the banks collaborate with FinTech firms. For example, the bank accounts that allow consumers to put money into cashless payment methods provided by FinTech firms would be more convenient than those that do not. It is just like coffee with sugar is preferable for consumers than coffee without it.

On the other hand, FinTech firms' payment services have an alternative or competitive relationship with those of financial institutions, like coffee and tea. For example, the Zengin More Time System, now fully in operation, has enabled interbank funds transfers 24 hours a day and 365 days a year. This bank transfer in a way competes with P2P transfer provided by FinTech firms.

In terms of collaboration with FinTech firms, there are various cases in which financial institutions allow these firms to access customers' accounts: some financial institutions allow many FinTech firms to access customers' accounts; others do so in a selective way; still others are reluctant about collaboration. Financial institutions in active collaboration with FinTech firms often seek to enhance customer satisfaction (to avoid the risk of customers' closing their accounts and to increase new accounts), keeping in mind the complementary relationship with FinTech firms. There are also financial institutions that selectively work with FinTech firms based on the level of settlement fees paid by these firms in a vertical relationship. In contrast, financial institutions that promote cashless methods themselves are reluctant to collaborate with FinTech firms with which they are in an alternative or competitive relationship.[36]

(2) Profitability and Stability of Payment Services Provided

It is desirable that FinTech firms' entry into the retail payment market and the advancement of their consequent collaboration or competition with financial institutions improve

[36] Some financial institutions are reluctant to cooperate with FinTech firms, because they will have to bear an additional burden for system enhancement. For FinTech firms as well, some are not very positive in collaborating with small-scale financial institutions with a small number of clients' deposit accounts.

convenience and cost efficiency of payment for households and businesses. Under the new market structure, however, whether efficient and convenient payment services are stably provided in the long term largely depends on the profitability of both financial institutions and FinTech firms.

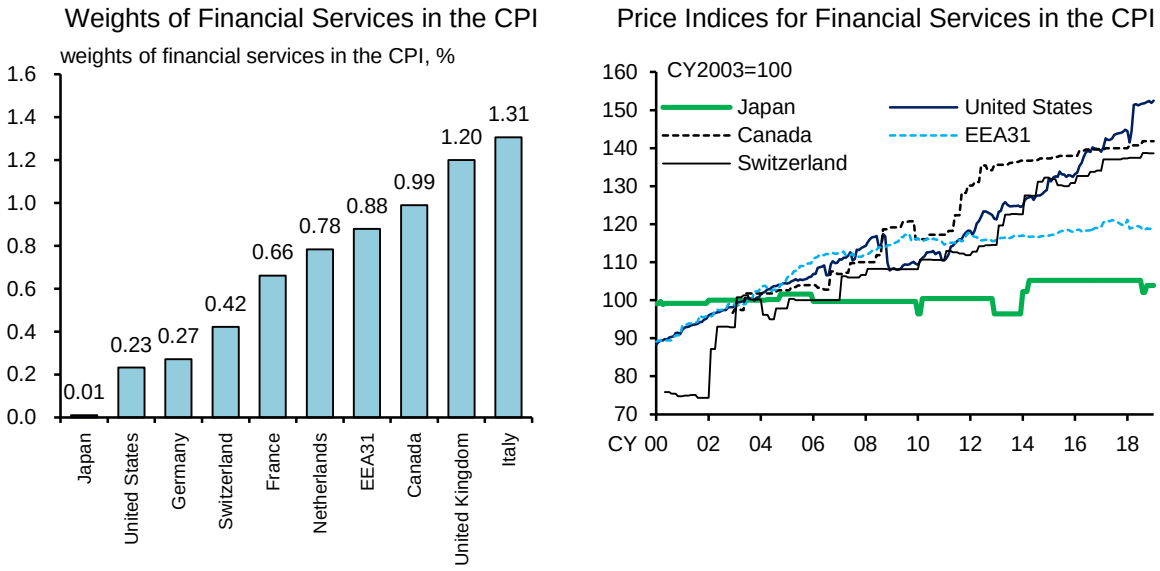
Many FinTech firms do not see payment services alone as a single source of profit; rather, they pursue a business model where the payment services are combined with other financial businesses (entry into insurance, securities, or lending) and non-financial businesses (e.g., e-commerce, promotion and marketing businesses) to ensure sufficient profits on a total basis. These firms seem to regard offering payment services as a way to attract and secure participants by making their platforms more convenient. Whether they can continue to stably provide efficient and convenient payment services in the long term, therefore, presumably depends on the extent to which they can increase the number of participants on their platforms (consumers and retailers) and how profitable their non-payment businesses can be. In a retail payment market crowded with a number of cashless payment methods, none of these firms seems to have yet achieved a sufficient size of platform to stably provide efficient payment services.

Financial institutions, for their part, provide payment services to customers through bank accounts. Unlike those in other advanced countries, most of the Japanese financial institutions do not charge account maintenance fees: they have not, so far, received fair return in exchange for their provision of payment services.[37] In fact, each country's consumer price index (CPI) components indicate that the weight of financial services in Japan is considerably lower than those in the United States and Europe. They also indicate that the prices of financial services in the United States and Europe have been rising at an annual pace of about 2 percent, whereas those in Japan have been more or less flat for a long time (Chart V-1-3). This suggests that while fee income from households provides a stable source of revenue for the U.S. and European financial institutions, Japanese financial

[37] For more information, refer to the following documents:
Bank of Japan, *Financial System Report* (October 2017).
Hiroshi Nakaso, "New Frontier of Macroprudential Policy: Addressing Financial Institutions' Low Profitability and Intensified Competition," Speech at the Kin'yu Konwa Kai (Financial Discussion Meeting) Hosted by the Jiji Press in November 2017.

institutions lack such a source.

Chart V-1-3 The Ratio of Financial Services to Household Consumption Expenditure

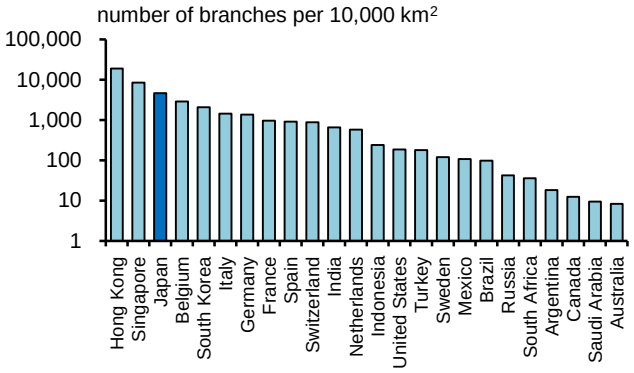


Notes: 1. The chart on the left is as of 2015. For Japan the weight of "bank transfer fees" of 2015-base CPI is used. The latest data of the chart on the right is as of January 2019.
2. EEA31 refers to the member countries in the European Economic Area (28 EU countries, Iceland, Liechtenstein, and Norway). Up to 2006 they are 28 countries and up to 2012, they are 30 countries. From 2019, they are 30 countries (excluding the United Kingdom).

Sources: Bank of Japan, *Financial System Report* (October 2017); Ministry of Internal Affairs and Communications; Eurostat; Statistics Canada; U.S. Bureau of Labor Statistics; Swiss Federal Statistical Office.

The reason for Japanese financial institutions not having received fair return in exchange for providing payment services is intense competition among themselves. An international comparison of the number of financial institutions' branches per habitable area reveals that Japan ranks among the highest (Chart V-1-4). Concentration of branches within a small country would likely intensify their competition by giving much choice to households and firms. Financial institutions have been keenly aware that charging account maintenance fees in this environment would possibly lead to deposits flowing out into other financial institutions.

Chart V-1-4 International Comparison of the Number of Financial Institutions' Branches per Habitable Area

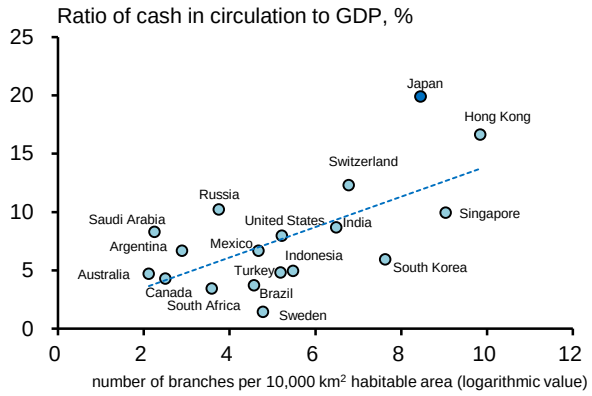


Note: The chart shows the latest possible international comparison as of the end of 2016 (the figure for Japan is as of the end of fiscal 2016). The habitable area is calculated by deducting the forest areas from the total area.
Sources: BIS, *Statistics on Payments and Financial Market Infrastructures*; World Bank, etc.

Fierce competition among branches can also explain why many financial institutions that are positive in collaborating with FinTech firms to benefit from complementary relationship are keen to improve customer satisfaction (inversely, to prevent the risk of losing customers) by enhancing deposit services. On the other hand, conscious of competition with other banks, financial institutions maintain geographically dense networks of branches and automated teller machines (ATMs) without charging account maintenance fees to households and firms. This, in a way, supports inexpensive and convenient cash payment networks for users. In fact, according to an international comparison of the relation between the ratio of cash in circulation to nominal GDP and the number of financial institutions' branches per habitable area, cash in circulation is smaller in the countries with fewer branches; whereas it is greater in Japan with a larger number of branches (Chart V-1-5).[38] In this sense, not only cashless payment methods (e.g., interbank funds transfer) provided by financial institutions, but also cash payment networks supported by branches and ATMs would be in an alternative or competitive relationship with cashless payment methods provided by FinTech firms.

[38] The positive correlation between cash in circulation and the number of financial institutions' branches can be explained as a two-directional relationship: (1) the amount of cash in circulation impacts the number of branches (e.g., the decrease of cash in circulation caused financial institutions to reduce the number of branches); and (2) conversely, the number of branches influences cash in circulation (e.g., the decrease of the number of branches caused inconvenience for users' cash payments, resulting in reduced cash in circulation).

Chart V-1-5 Correlation between the Ratio of Cash in Circulation to GDP and the Number of Branches per Habitable Area



Notes: 1. The chart is as of 2016 -- the latest possible international comparison of the number of branches (the figure for Japan is as of fiscal 2016). The habitable area is calculated by deducting the forest areas from the total area.

2. Of the plotted 18 jurisdictions' samples, cross-section regression was conducted using the data of 14 jurisdictions for which deposit interest rate was available. The regression has resulted in the following estimation:

$$\left(\begin{array}{c}\text{Ratio of cash in circulation to GDP}\end{array}\right) = 1.7 + 1.3 \times \left(\begin{array}{c}\text{Logarithmic value of the number of branches per 10,000 km}^2\text{ habitable area}\end{array}\right) - 0.1 \times \left(\begin{array}{c}\text{Deposit interest rate}\end{array}\right)$$

It has confirmed that the estimated coefficient on the number of branches per 10,000 km^2 habitable area is statistically significant where opportunity costs of holding cash are controlled.

Sources: BIS, *Statistics on Payments and Financial Market Infrastructures*; World Bank; IMF, etc.

Competition among financial institutions has helped maintain geographically dense networks of branches and ATMs, resulting in convenient and inexpensive cash payment networks for users. In such a situation, it would not necessarily be easy to rapidly expand cashless payment platforms. At the same time, however, in a situation where the continuous decline of population and the number of firms stagnates demand for financial and payment services, it has gradually become difficult for financial institutions to continue as in the past to maintain both an immense number of accounts and their branch and ATM networks without receiving fair return in exchange for the provision of payment services.

If financial institutions diminish their branch and ATM networks going forward, making cash payment less convenient, this will serve as a tailwind for the expansion of the cashless payment platform. In this case, however, competition between FinTech firms and financial institutions can become more intense over the provision of cashless payment methods. As the market structure is very complicated, it is difficult to predict its future with high accuracy. How financial institutions maintain their branch and ATM networks depends on, in addition to users' needs, return for payment services that originate in accounts (including account maintenance fees). Cashless payment services, whether provided by FinTech firms or financial institutions, basically do not come into existence unless they have, or have

access to, bank accounts. Cash payment networks are also supported by accounts at financial institutions. In this sense, accounts at financial institutions constitute an important social infrastructure that provides the basis for retail payment services. How fees for this infrastructure (e.g., account maintenance fees) will be shared among many users in the future will be a critical issue to maintain the stable provision of services. For financial institutions, FinTech firms are users of their accounts. At the same time, payment services provided by FinTech firms are complementary, and alternative or competitive to those provided by financial institutions. The Bank will pay close attention to future developments in retail payment services that have such a complicated market structure.

(3) Value of Payment Information and Financial Business

To assess the impact of FinTech firms' entry into the retail payment market, the flow of payment information requires close attention. Advanced information technologies have now enabled vast amounts of digital data that could not have been conceivable in the past, to be accumulated as big data in the format appropriate to computer processing. As technologies analyzing and utilizing big data -- such as Artificial Intelligence (AI) -- develop, businesses that create new added value by utilizing data have been spreading. By entering the payment business, FinTech firms aim at not only enhancing the convenience for users, but also finding new profit opportunities by providing more wide-ranging services for participants in their platforms with the use of payment information that they have collected through the provision of payment services.

To collect and accumulate information and seek profit opportunities by providing payment services, it is essential to have contact with users (providing front-end services) or be able to control platform design. Even if financial institutions collaborate with FinTech firms and allow them to have access to their accounts, they often have difficulties in obtaining payment information on when, where, and who bought what, as they are on the back-end, as opposed to FinTech firms on the front-end. On the other hand, to provide fine-tuned financial or non-financial services that meet users' potential needs, they need, in addition to payment flow information, users' basic profiles (name, birthdate, address, occupation, and annual income) and vast amounts of financial transaction records (e.g., outstanding financial assets and liabilities) -- that is, stock information. As for the collection and accumulation of the latter information, financial institutions have an advantage. To roll out

value-added services such as solutions business, it is ideal to utilize big data that consists of payment flow information and stock information on users.

In this regard, financial institutions that hold stock information on users have several options, such as (1) they themselves collect payment flow information by providing front-end services in the market or (2) they leave FinTech firms to provide front-end services while collaborating with FinTech firms on the back-end. Regarding option (1), however, a single financial institution might face challenges and limitations in collecting front-end payment information. For example, such an institution might not be able to obtain a sufficient size of target population of payment information required for accurate analysis or might not have the capacity to accurately analyze big data obtained. In this case, one solution would be for multiple financial institutions to form a consortium or for the banking industry as a whole to create a pool of payment information for use. In fact, several joint schemes of cashless payment provided by some banks are under way.[39] As to option (2), financial institutions can share their stock information under proper management through open application programming interfaces (APIs) with FinTech firms, which have comparative advantage in information processing. Combined with the payment flow information held by FinTech firms, stock information will be utilized in new business.[40]

Thus, financial institutions would be better off, as they act on business strategies that take into account the collaborative or competitive relationships with FinTech firms in using payment information. With this in mind, the Bank will pay close attention to structural changes in the retail payment market.

B. The Bank's Approaches to FinTech

The Bank monitors the impact of FinTech on the market structure of payment service and also conducts research and studies on the applicability of FinTech to the payment and settlement infrastructure that it operates. Specifically, in April 2016 it established the FinTech Center within its Payment and Settlement Systems Department to play an active

[39] For example, multiple schemes are under way for QR code payment in the banking industry, such as J-Debit, Ginko Pay, and J-Coin Pay.

[40] API refers to connection specifications in which an application calls and uses another application's functions or data it manages, of which "open APIs" are accessible from other firms.

role as a catalyst for promoting interaction among financial practices and innovative technologies, research and study, and the needs of the economic society. There are many cases where central banks have established FinTech-related sections (Chart V-2-1).

Chart V-2-1 Institutional Approaches to FinTech by Central Banks

Bank of England	・Established the FinTech Accelerator to conduct joint proof-of-concept studies into the application of FinTech to central bank operations with FinTech companies.
Monetary Authority of Singapore	・Established a department dedicated to FinTech (FinTech & Innovation Group) within the bank to formulate FinTech policies and run a joint lab with private companies. ・Established the organization that coordinates domestic authorities and signed many agreements on FinTech promotion with the authorities of the United Kingdom, Japan, Australia, and other countries.
Hong Kong Monetary Authority	・Established the FinTech Facilitation Office to address, in cooperation with private financial institutions, FinTech's practical application, such as the operation of a system that applies the DLT to trade financing.
People's Bank of China	・Established the FinTech Committee to make strategic plans and provide policy guidance on FinTech development and to study its influence on monetary policy.
Bank of Canada	・Established a new digital economy team to study and analyze the impact of technological innovations, for example, impacts of digital economy on transmission mechanisms of policies.
European Central Bank	・Established an organization that studies and analyzes issues including the applicability of the DLT to settlement systems or economic implications of the issuance of digital currencies by central banks, and an innovation-related division (Innovation and Architecture Services Division) with the Directorate General Information Systems.
Banque de France	・Established Le Lab, an open space for experimenting or working on new concepts and technologies relevant to the central bank's operations while securing contact with diverse entities that deal with innovations.
Federal Reserve System	・Established a liaison office for staffs engaged in settlement, research, and technology to bring together their wide-ranging and cross-sectional expertise to analyze various FinTech issues.

Source: Information disclosed by authorities in each country or region.

Currently, there has been a growing interest among many central banks in central bank digital currency (CBDC), or digital currencies issued by central banks (Box 7). CBDC is (1) significant as it could achieve efficient transactions and provide means of payment and settlement without credit risk, but at the same time, it could (2) raise a few issues that require careful consideration, including its impacts on financial stability and financial intermediation, as well as the possible implications on securing the privacy aspect of payment and settlement information and data. Currently, therefore, only a limited number of countries, such as Sweden where the circulation of banknotes is rapidly decreasing, are considering specific plans for CBDC. At present, the Bank has no plan to issue CBDC, which can be widely used for general payments and settlements; however, the Bank will

continue research and study into CBDC.

Research into the Applicability of the Distributed Ledger Technology in the Area of Financial Market Infrastructures

In the meantime, studies on the applicability of new technologies in the area of FMIs are becoming increasingly important in terms of improving efficiency and safety of payment and settlement systems. Among the new technologies, distributed ledger technology (DLT) has gained attention for its potential inside and outside the financial sector over the past few years. Working closely with the European Central Bank (ECB), the Bank has conducted a joint research project (Project Stella) on the applicability of DLT in the area of FMIs. So far the ECB and the Bank published the phase 1 report in September 2017 and the phase 2 report in March 2018.[41]

Stella phase 1 implemented some functionalities of the funds transfer systems run by the two central banks (i.e., the BOJ-NET and TARGET2) in a DLT-based environment and conducted an analysis in terms of efficiency and safety. The analysis found that a DLT application could process volumes of payment requests comparable to those routed to the central banks' current funds transfer systems, and proved the feasibility of implementing the processing logic of liquidity saving mechanisms (queuing and bilateral offsetting) in a DLT environment. The analysis also confirmed that the DLT's performance is affected by both network size and distance between nodes. In addition, in terms of safety, it was observed that the system availability was not affected even when a limited number of validating nodes failed. However, the report also noted, given the relative immaturity of the technology in many other respects, "DLT is not a solution for large-scale applications like BOJ-NET and TARGET2 at this stage of development."

Phase 2 concerned delivery-versus-payment (DVP), which links the delivery of securities and the payment of funds. It considered the following two approaches: (1) a single-ledger

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[41] Bank of Japan and the European Central Bank, *STELLA: A Joint Research Project of the European Central Bank and the Bank of Japan: Payment Systems: Liquidity Saving Mechanisms in a Distributed Ledger Environment* (September 2017).
———, *STELLA: A Joint Research Project of the European Central Bank and the Bank of Japan: Securities Settlement Systems: Delivery versus Payment in a Distributed Ledger Environment* (March 2018).

DVP approach given a single network where both securities and cash are recorded on the same ledger; and (2) a cross-ledger DVP approach given multiple networks where securities and cash are recorded on two separate ledgers. According to its findings, DVP can run in a DLT environment based on both approaches. The report also confirmed that, as for the second approach, DLT could achieve DVP without any connection among the multiple networks, which is not achieved by existing arrangements. However, the report pointed out that this method entails certain complexities and there are additional challenges that need to be addressed in the future.

Like the Bank and the ECB, many other central banks have also experimented with DLT. Recently, some of them have conducted experiments on the applicability of the DLT to more complex transactions to enhance the value added by DLT (Chart V-2-2). For example, the Bank of England has experimented with synchronized movement of multiple currencies in different systems to investigate the interoperability between systems.

Chart V-2-2 Main DLT-Related Initiatives by Central Banks

European Central Bank	・Studied, in collaboration with the Bank, the applicability of DLT to (1) funds transfer and (2) DVP settlement (the report on (1) was published in September 2017; and the one on (2) in March 2018) [Project Stella].
Deutsche Bundesbank	・Studied, in collaboration with the Deutsche Börse, the applicability of DLT to DVP settlement, etc. (the report was published in October 2018) [Blockbaster].
Bank of England	・Conducted proof-of-concept on the synchronized movement of multiple currencies processed in different systems using DLT-related technologies (the report was published in July 2017). ・Conducted proof-of-concept on connectivity between a DLT-based settlement system and a non-DLT-based RTGS system (the report was published in July 2018).
Bank of Canada	・Studied the applicability of DLT to (1) funds transfer and (2) DVP settlement (the report on (1) was published in September 2017 and the one on (2) in October 2018) [Project Jasper]. ・Announced work on linking its DLT platform to that of the Monetary Authority of Singapore, to explore the applicability of the DLT to cross-border transactions (November 2018).
Hong Kong Monetary Authority	・Exchanged a MoU with the Monetary Authority of Singapore to develop a DLT-based infrastructure that can be used to exchange information between Hong Kong's trade infrastructure and that of Singapore (November 2017).
Monetary Authority of Singapore	・Studied the applicability of the DLT to (1) funds transfer, (2) the liquidity saving mechanism, (3) DVP settlement (the report on (1) was published in May 2017, the one on (2) in November 2017, and the one on (3) in November 2018) [Project Ubin]. ・Announced work on linking its DLT platform to that of the Bank of Canada, to explore the applicability of the DLT to cross-border transactions (November 2018). ・Exchanged a MoU with the Hong Kong Monetary Authority to develop a DLT-based infrastructure that can be used to exchange information between Singapore's trade infrastructure and that of Hong Kong (November 2017).
South African Reserve Bank	・Studied the applicability of DLT to funds transfer (June 2018) [Project Khokha].

Source: Information disclosed by authorities listed above.

VI. Conclusion

The payment and settlement systems are a vital foundation for a nation's economic activities. They are expected to constantly improve their safety and efficiency, in line with the changing economic environment and advancing technologies. Japan's payment and securities settlement systems have been making steady progress in mitigation of settlement risk and improvement in convenience of payment and settlement services. Examples of these efforts are: shortening of the Japanese government bond settlement cycle; realization of real-time 24/7 fund transfers through the Zengin Data Telecommunication System (Zengin System); and launch of the Zengin EDI System (ZEDI). Meanwhile, in the retail payment market, new services have been introduced, as new information technology spreads and profit opportunities through data utilization prompt various businesses, including FinTech firms, to enter the market.

To maintain safety of payment and settlement systems and further improve their efficiency under such circumstances, it is important to address the following three issues.

The first challenge is to make the best use of new functions and services of payment and settlement infrastructures, and fully realize their benefits, such as further sophistication of financial and settlement services, smoother execution and cost reduction of various economic activities, and utilization of data. For example, effectively using the Zengin More Time System that enables real-time 24/7 fund transfers and the ZEDI that enables exchange of information on commercial transactions, such as transaction details, will not only increase the convenience for end users, but also contribute, by improving the efficiency of finance and accounting processing tasks for firms, to solve the issue that Japan's economy as a whole is facing, such as decreasing labor forces. Information on settlement and commercial transactions stored in the ZEDI can also create new profit opportunities for financial institutions, should the information be utilized more effectively together with customer data that each financial institution has. It is also considered to be effective for financial institutions to strategically develop collaborations with other businesses, including FinTech firms, using open application programming interface (API) in expanding financial businesses building on payment and settlement services.

The second is to pave the way to a retail payment market in which consumers and retailers can fully benefit from convenience and efficiency of numerous cashless payment methods.

In the long term, the widespread use of new cashless payment methods is expected to lead to more convenient and efficient retail payment services. However, it may be possible to say that so many services are introduced in the market, and it is difficult for consumers to understand the differences among each settlement method and make the right choice. Such a situation could make consumers rather hesitant to use the services. For cashless payment service providers, the current situation might be a factor hindering expansion of the overall market size. Further discussion among a wide range of stakeholders is necessary to find the best balance between competition that promotes innovation and better services, and coordination that contributes to the expansion of the overall market size.

The third is to secure safety of payment and settlement as a precondition for promoting further improvement in convenience and efficiency, by ensuring resiliency against cyber attacks and improving business continuity arrangements. Threats to the safety of payment and settlement, including cyber attacks, are becoming more and more complex and sophisticated. It is important, for both financial market infrastructures (FMIs) and their participants, to understand the nature and significance of constantly changing risks and continue their efforts to improve resilience against those risks. Furthermore, in the retail payment market, ensuring users' confidence and sense of safety is also quite crucial to promote new cashless payment methods. This would require various efforts by payment service providers, such as ensuring security through the suitable use of information technologies, responding appropriately to unauthorized use, and improving user literacy through, for example, information disclosures by payment service providers.

The Bank of Japan will, through its oversight activities, encourage stakeholders to take actions to address these issues. At the same time, it will also play a role as a catalyst and promote cooperation and collaboration among stakeholders, to enhance the safety and efficiency of payment and settlement systems as a whole. Furthermore, the Bank, as an FMI operator, will continue to work on the initiatives to improve functionality of the Bank of Japan Financial Network System (BOJ-NET). For example, the Bank, in cooperation with the Hong Kong Monetary Authority, aims to initiate the operation of a cross-border delivery-versus-payment (DVP) link between Japan and Hong Kong around the spring of 2021. Moreover, in the monitoring and research of payment and settlement systems, the Bank will particularly focus on the structural change of the retail payment market, where an

increasing number of FinTech firms is entering, as well as the applicability of distributed ledger technology to FMIs. Although the Bank has no plan to issue a digital currency that can be widely used for payments and settlements, it continues to pay attention to international trends regarding central banks' digital currencies and applicable information technologies.

Box 1 24/7 Real-time Payment and New Private-Sector Services in Other Countries

In many countries and regions, private entities have started to provide services to improve user convenience along with the introduction of 24/7 real-time payment.[42] The case described below, a fund transfer service using a mobile phone number, is an example of the services.

Payments using mobile phone numbers enable users to send money without knowing recipients' bank account numbers where bank account numbers are linked to mobile phone numbers. A sender only needs to input a recipient's phone number on their devices such as smartphones to make payment. While such a service was initially targeted at person-to-person (P2P) payment, it is expanding to person-to-business (P2B) and business-to-business (B2B) payments by linking bank account numbers not only to mobile phone numbers but also to e-mail addresses or unique entity numbers.

For example, mobile phone payment services utilizing the infrastructures of 24/7 real-time payments are provided in countries including the United Kingdom, Singapore, and Sweden. The services are used mainly in P2P daily small-value payment (Chart B1). In Singapore, a bank account number can be also linked to a National Registration Identity Card (NRIC) number. Furthermore, a payment service linking a bank account number to a unique entity number started in August 2018. In Australia, a payment service using a simplified address (PayID) such as a phone number, an e-mail address, or a unique entity number, is available through the use of 24/7 real-time payment infrastructures (The New Payments Platform [NPP]), which started in February 2018.

[42] For the trend of 24/7 real-time fund transfer services in major countries, refer to *Payment and Settlement Systems Report Annex Series*:
Bank of Japan, "Global Trend of the Introduction of 24/7 Real-Time Transfer" (July 2018) (available only in Japanese).

Chart B1 24/7 Real-time Payment Infrastructures and Payment Services via Mobile Phone Numbers, etc.

	United Kingdom	Singapore	Sweden	United States	Australia
Service	Paym	PayNow	Swish	Zelle	NPP
Year	2014	2017	2012	2017	2018
Number of participating banks	15	9	11	60	About 70
Main IDs for payment	Mobile phone number	Mobile phone number NRIC Unique entity number	Mobile phone number	Mobile phone number E-mail address	Phone number E-mail address Unique entity number
Infrastructure	Faster Payments Service (FPS)	Fast And Secure Transfers (FAST)	Payments in Real Time (BiR)	Real-Time Payments (RTP) [provisional]	New Payments Platform (NPP)

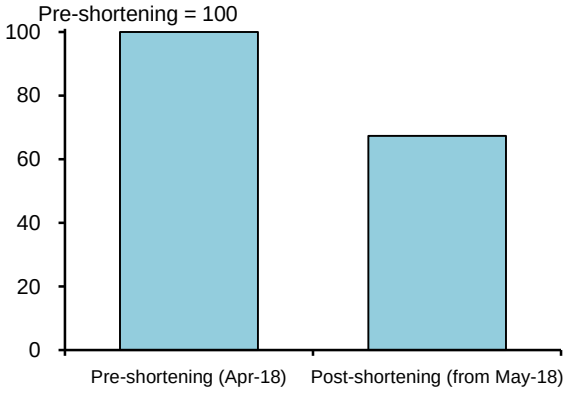
Notes: 1. Based on information as of the end of January 2019.
2. Currently private-sector ACH (EPN) is used as a payment infrastructure of Zelle in the United States.
Source: Publicly released information of each service.

In the United States, payment services by individual financial institutions and payment firms that use identifications such as mobile phone numbers are widely used (e.g., Zelle, which is led by major banks, and Venmo, which is provided by PayPal). Among those services, it is considered that the 24/7 real-time payment infrastructures, which were initiated in November 2017, could be used for interbank settlements of transactions through Zelle.

Box 2 Risk Reduction Effects of Shortening of Japanese Government Bond Settlement Cycle

Shortening of the Japanese government bond (JGB) settlement cycle (a period from trade execution to settlement) restrains the accumulation of unsettled positions and reduces the risk that a party executing the transaction would suffer a loss should the settlement not be implemented (settlement risk). The outstanding exposures of Japan Securities Clearing Corporation (JSCC) related to JGBs have reduced by about 30 percent on an estimate basis, after the JGB settlement cycle was shortened to T+1 (Chart B2-1).

Chart B2-1 Effect of Shortening Settlement Cycle to Unsettled JGB Positions



Note: Estimated by the Bank of Japan, using average share of each settlement cycle (T+0, T+1, T+2, etc.), for JSCC's obligation assumption value, same as for Chart III-2-3. The latest data is as of January 2019.
For example, supposing obligations assumed with value of 100, if 90 are settled on T+1 and the rest (10) are settled T+2, the outstanding value of the end of the day (T) will be 100. At the end of the next business day (T+1), 90 is settled and 10 will be left. Repeating this process, the average outstanding value will be 110. Based on this calculation, outstanding value is estimated using JSCC's obligation assumption value before and after shortening of the settlement cycle and distribution ratio for each settlement cycle.
Sources: Japan Securities Clearing Corporation; Bank of Japan.

On the other hand, it should be noted that shortening of the settlement cycle also shortens the time available for a series of post-trading processes, such as matching, netting, and settlement. In particular, when general collateral (GC) repo transactions are settled on the day of transaction, a series of post-trading processes has to be completed on the trade day. This could become a factor to postpone JGB delivery-versus-payment (DVP) settlement during the day. Furthermore, the JSCC's subsequent collateral allocation repo structure itself may be influencing the timing of settlements. To be more specific, under the subsequent collateral allocation method, (1) parties to the transaction agree on a repo for a basket of securities (a group of multiple issues of JGBs) without specifying individual issues, and (2) on the settlement day, JSCC assumes obligation, conducts netting, and based on the netting results, allocates individual issues to be delivered. This leads parties to the

transaction to execute JGB DVP settlements only after the allocation of specific issues (three times a day at 7:00 a.m., 11:00 a.m., and 2:00 p.m.) (Chart B2-2).

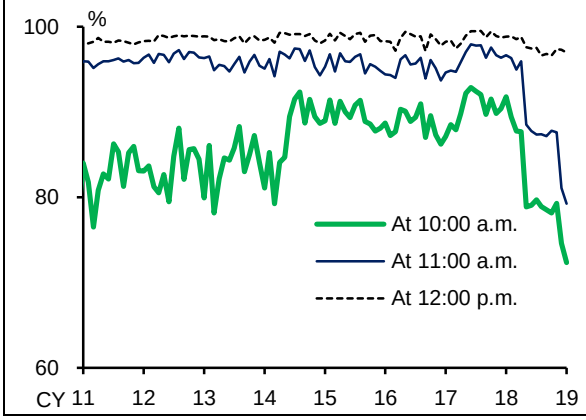
Chart B2-2 Timelines for Subsequent Collateral Allocation Repos

	Application time	Clearing and collateral allocation	Settlement cutoff time*	
			DVP1	DVP2
1st	2:00 p.m. - 9:00 p.m. on the day before the settlement day	7:00 a.m. on the settlement day	10:30 a.m.	11:00 a.m.
2nd	7:00 a.m. - 11:00 a.m.	11:00 a.m.	1:30 p.m.	2:00 p.m.
3rd	11:00 a.m. - 2:00 p.m.	2:00 p.m.	3:30 p.m.	4:00 p.m.

Note: Participants need to complete settlements before cutoff time. "DVP1" denotes settlements between participants delivering JGBs and JSCC, and "DVP2" denotes settlements between JSCC and the participants receiving JGBs.
Source: Japan Securities Clearing Corporation.

With respect to the progress of JGB DVP settlement during the day on the Bank of Japan Financial Network System (BOJ-NET), about 90 percent of settlement on value-basis was completed by 10:00 a.m., and about 95 percent by 11:00 a.m., before the shortening of the JGB settlement cycle in May 2018. After the cycle was shortened to T+1, the progress of settlement for both 10:00 a.m. and 11:00 a.m. has declined (Chart B2-3). However, more than 95 percent of JGB DVP settlements, including subsequent collateral allocation repos, are completed by noon, suggesting the influence of settlement delay is limited.

Chart B2-3 Progress of JGB DVP Settlements



Note: Figures on Value basis. The latest data is as of January 2019.
Source: Bank of Japan, *Payment and Settlement Statistics*.

Box 3 The United Kingdom's Exit from the European Union and Regulations and Supervision of Central Counterparty

The United Kingdom's exit from the European Union (EU) -- that is, Brexit -- has raised many issues regarding financial transactions. In particular, the continuity of clearing operations by a central counterparty (CCP) in the EU has drawn much attention. After Brexit, CCPs located in the United Kingdom will lose licenses as EU-based CCPs. To continue clearing operations inside the EU region, they need to be recognized as non-EU CCPs by the EU authorities. There was once a risk that, if a withdrawal agreement was not ratified between the United Kingdom and the EU (no-deal Brexit), and transitional measures were not taken, all the U.K.-based CCPs would lose licenses to operate inside the EU and need to liquidate all positions they have against EU-based clearing participants. This is because CCPs are not allowed to apply for recognition as non-EU CCPs until Brexit is complete. However, this issue has been resolved after the European Commission indicated that, even under a no-deal Brexit, it would allow U.K.-based CCPs to continue their clearing operations inside the EU region for 12 months after the day the United Kingdom leaves the EU.

Meanwhile, the EU and the United States took Brexit as an opportunity to initiate the move to review the regulations and supervision of cross-border CCPs according to each CCP's systemic importance. In the EU, proposals to amend EU regulations have been considered against the backdrop that U.K.-based CCPs handling a large amount of the euro-denominated interest rate swaps would become non-EU CCPs after Brexit. These proposals indicate that: (1) non-EU CCPs with systemic importance for the EU should comply with a soundness standard equivalent to the one applied for EU-based CCPs, and accept inspections by the European Securities and Markets Authority (ESMA); and (2) CCPs with significant systemic importance for the EU should obtain licenses as EU-based CCPs (as of February 2019).

In the United States, possible revision to CCP regulation and supervision is under consideration. The outline of revisions is: (1) non-U.S. CCPs that might pose a systemic risk to the U.S. financial system would continue to be regulated and supervised by the U.S. authority; and (2) for non-U.S. CCPs that do not pose such a risk, the U.S. authorities would act with deference to regulations and supervision of home countries of those CCPs, as long

as comparable regulation and supervision are carried out by the home authorities in accordance with international standards. The U.S. Commodity Futures Trading Commission (CFTC) indicates that these revisions avoid the fragmentation of the global markets caused by redundant applications of inconsistent regulations, help foster market competition, and improve market liquidity, thereby enhancing the robustness of the overall financial market.[43]

[43] Refer to *White Paper* by CFTC Chairman J. Christopher Giancarlo, "Cross-Border Swaps Regulation Version 2.0 -- A Risk-Based Approach with Deference to Comparable Non-U.S. Regulation" (October 2018).

Box 4 The Bank of Japan's Initiatives to Strengthen Business Continuity Arrangements

Under the Disaster Countermeasures Basic Act and other relevant laws, the Bank of Japan is required to continue its operation in times of disaster as a designated public institution.[44] The Bank has worked on its business continuity arrangements, taking into account *The Bank of Japan's Strategic Priorities for Fiscal 2014-2018*, which states, "based on its experience following the Great East Japan Earthquake and the government's reappraisal of potential damage for large-scale earthquakes such as those directly under Tokyo or in the Nankai Trough, the Bank will reinforce its business continuity arrangements through the effective use of its management resources." The Bank enhances its cooperation with the relevant administrative bodies through participation in Central Disaster Management Council of the government and prefectural disaster prevention councils. It also continues to strengthen its cooperation with financial institutions to enhance resilience to disasters, by exchanging opinions with the Bank of Japan Financial Network Systems (BOJ-NET) users and holding regular meetings with relevant financial institutions, which deal with preparations for the earthquakes directly under Tokyo.

As part of its recent efforts, the Bank has been working on the development of necessary schemes and revisions to operational flows, in order to enhance resilience of the Head Office and branches in times of disaster. Specifically, the Bank worked on the improvement of the backups for the BOJ-NET and other information technology systems whose recovery needs to be prioritized in times of disaster (e.g., various operational systems and messaging networks). In September 2018, to support financial institutions' efforts to secure cash in multiple ways, the Bank introduced a scheme that enables financial institutions to receive cash, in times of disaster, at financial institutions' branches other than the Bank's Head Office or branches with which they have their current accounts. Furthermore, to continue its business smoothly in times of disaster, the Bank takes initiatives for developing multiple

[44] In the Bank's disaster prevention operation plan, the Bank lists the following functions as those to be carried out in emergency situations: (1) issuance of banknotes and carrying out currency and monetary control; (2) measures to ensure smooth settlement of funds, thereby contributing to the maintenance of stability of financial systems; (3) requests to financial institutions to take certain financial measures; (4) publicity campaigns on various measures taken; and (5) liaison and coordination with the authorities such as central banks overseas.

operational flows for processing a wide range of transactions with financial institutions.

The Bank has also been working on reinforcing the disaster preparedness of its facilities and equipment, as well as strengthening the security of its Head Office and branches. It is working to make its buildings more resilient by installing private power-generation equipment to prepare for a large-scale blackout and introducing equipment to prevent floods. Furthermore, the Bank prepares a stockpile of emergency resources, so that it can continue its operations as a designated public institution, even when the handling of emergency is prolonged.

Meanwhile, the Bank has been conducting simulation exercises for responding to various disaster scenarios. Some examples include operation drills of the Disaster Management Team assuming earthquakes directly under Tokyo, operational testing for switchover to the backup system assuming a system failure of the BOJ-NET,[45] and disaster drills for responding to the outbreak of a new pandemic such as influenza. The Bank also offers exercises for operating facilities and infrastructures based on experiences of recent natural disasters. To improve the staff's ability to respond to various disasters, these exercises are conducted using blinded scenarios, in which participants are left uninformed of the assumed disaster conditions, and by cooperating with the governments, financial institutions, and private-sector financial market infrastructures (FMIs).

[45] Participants in system failure testing included, in addition to the Bank, financial institutions and securities firms connected to the BOJ-NET, money market brokers, and private-sector FMIs (e.g., the Japanese Banks' Payment Clearing Network [Zengin-Net] and Japan Securities Depository Center [JASDEC]). The testing held in March 2019 confirmed the effectiveness of the staff's responses to practical changes made by the revision of transaction procedures, such as shortening of the Japanese government bonds settlement cycle.

Box 5 Initiatives to Strengthen Business Continuity Arrangements of Financial Institutions and Financial Markets

To maintain functioning of the overall financial market and payment and settlement systems under natural disasters or cyber attacks, it is important to take a collaborative approach among financial institutions and across financial markets, in addition to individual efforts by financial institutions. From this perspective, financial market players in Japan have been working to strengthen the market-wide business continuity arrangements (a market-level business continuity plan [BCP]). The market-level BCP is a framework for the participants of the money market, securities market, and foreign exchange market, aiming to maintain and quickly recover the functioning of markets when normal market operations are in difficulty because of disasters. Stakeholders participate in regular drills to share information on a dedicated website and consult on changes to market practices in times of disaster. Recently, the 10th joint exercise for the three markets was held in November 2018 with more than 500 market participants and settlement infrastructure operators joining the event. The large number of participants indicates the exercise has been firmly established as a cross-market practice. The training aims to improve the participants' ability to respond to various disasters, by introducing blinded disaster scenarios, making some members participate in the exercise from backup locations, and adding a training menu related to liquidity supply for some participants.

The Bank of Japan also supports these initiatives. In response to requests from market participants, it carried out in 2017 and 2018 a funds-supplying operation against pooled collateral (loans to all branches) on a same-day basis for training purposes. On this occasion, financial institutions, including regional ones, confirmed funding operations in times of disaster.

When a series of natural disasters occurred in 2018,[46] although the market-level BCP was not put into effect, its framework was spontaneously utilized: some market participants proactively reported business situations (the capability of transactions and settlements) on the dedicated website; and securities exchanges reported the situations of trading halts.

[46] Disasters include the Earthquake with its Epicenter under Northern Osaka Prefecture in June 2018 and Hokkaido Eastern Iburi Earthquake in September 2018.

Given the increasing importance of cyber resilience, financial institutions are, in addition to individual efforts, making collaborative efforts to conduct various joint exercises for cyber security. For example, major financial institutions are participating in global joint cyber exercises, while regional financial institutions are taking training offered by the Financial Services Agency and industry groups to enhance their capabilities to respond to cyber attacks. The Bank has conducted a survey (April 2017) on cyber resilience of financial institutions, and provides support for the financial institutions' efforts through on-site examination and monitoring.

Box 6 ISO 20022 Adoption Initiatives for Payment Systems Operated by Central Banks

Principles for Financial Market Infrastructures (PFMIs; Principle 22: Communication procedures and standards) state that "a FMI should use, or at a minimum accommodate, relevant internationally accepted communication procedures and standards" with regard to interoperability. Central banks have also taken initiatives to adopt ISO 20022 messaging standards for their large-value payment systems.

In the United Kingdom, the Bank of England (BOE) announced its vision to adopt ISO 20022 messaging standards for their payment systems, including Clearing House Automated Payment System (CHAPS), to ensure wider interoperability, in the paper published in May 2017.[47] The BOE published the consultation response paper in November 2018 and announced its plan to migrate CHAPS payments from the current MT messaging format to the ISO 20022 from 2022 onward in a series of phases including a transitional period.[48]

In the Euro area, the European Central Bank (ECB) proposed the introduction of ISO 20022 compliant messaging to allow the participants to communicate to all Eurosystem market infrastructures with the ISO 20022 compliant messages, in the market consultation on the future real-time gross settlement (RTGS) services in May 2017. The ECB decided in December 2017 that its system will adopt the ISO 20022 standard from November 2021 on the new consolidated platform, in which the RTGS system (TARGET2) and the securities settlement platform (T2S) will be integrated.

In the United States, the Federal Reserve System (Fed) indicated its aim to achieve greater efficiency of domestic and cross-border payments and consider the adoption of ISO 20022 as part of these strategies, in *Strategies for Improving the U.S. Payment System* published in January 2015.[49] In July 2018, the Fed consulted on the adoption of ISO 20022 for the Fedwire by November 2023.[50] In the consultation paper, the Fed mentioned that many

[47] Bank of England, *A Blueprint for a New RTGS Service for the United Kingdom* (May 2017).

[48] Bank of England, *ISO 20022 Consultation Response Paper: A Global Standard to Modernise UK Payments* (November 2018).

[49] Federal Reserve System, *Strategies for Improving the U.S. Payment System* (January 2015).

[50] Federal Reserve System, "New Message Format for the Fedwire Funds Service," *Federal*

domestic and international payment systems have already adopted (or announced plans to adopt) ISO 20022, and explained one of the potential benefits of adopting ISO 20022 for the Fedwire: "adopting ISO 20022 messages could also improve domestic and cross-border interoperability between the Fedwire Funds Service and other payment or messaging systems."[51]

Register 83, no.129 (July 2018).

[51] In the consultation paper, the Fed suggested that the potential benefit of adopting ISO 20022 for the Fedwire -- other than the aforementioned improvement of interoperability -- is that the ISO 20022 messaging standards would allow users to include richer and more structured data in their messages and this "could help banks and other entities meet evolving requirements to screen payments for sanctions and anti-money laundering purposes."

Box 7 International Discussions over Central Bank Digital Currency

The Bank for International Settlements (BIS) published a report on central bank digital currencies (CBDCs) in 2018.[52] In the report, the BIS classified CBDC into two main variants. One variant is "a wholesale CBDC," which limits access to a predefined group of users, and the other is "a general purpose CBDC," which is widely accessible.

The report, while noting, "wholesale CBDCs, combined with the use of distributed ledger technology, may enhance settlement efficiency for transactions involving securities and derivatives," indicates that "currently proposed implementations for wholesale payments . . . not clearly superior to, existing infrastructures. While future proofs of concept may rely on different system designs, more experimentation and experience would be required before central banks can usefully and safely implement new technologies supporting a wholesale CBDC variant."

The report points out that "the benefits of a widely accessible CBDC may be limited if fast (even instant) and efficient private retail payment products are already in place or in development." As potential risks of a general purpose CBDC, the report raised the following three points: (1) in periods of stress, a flight toward CBDC from commercial banks may occur on fast and large scale; (2) an anonymous CBDC could raise concerns about anti-money laundering and combating the financing of terrorism (AML/CFT); and (3) for currencies widely used in cross-border transactions, the introduction of a CBDC may affect financial markets of other countries greatly during times of flight to safety.

Based on the points mentioned above, the report notes that central banks have "tended to limit access to (digital) account-based forms of central bank money to banks and, in some instances, to certain other financial or public institutions. By contrast, physical central bank money, i.e., cash, is widely accessible. This approach has, in general, served the public and the financial system well, setting a high bar for changing the current monetary and financial structure." Furthermore, the report states, "any steps towards the possible launch of a CBDC should be subject to careful and thorough consideration."

The BIS also conducted a survey (as of 2018) of central banks' initiatives for CBDCs.[53]

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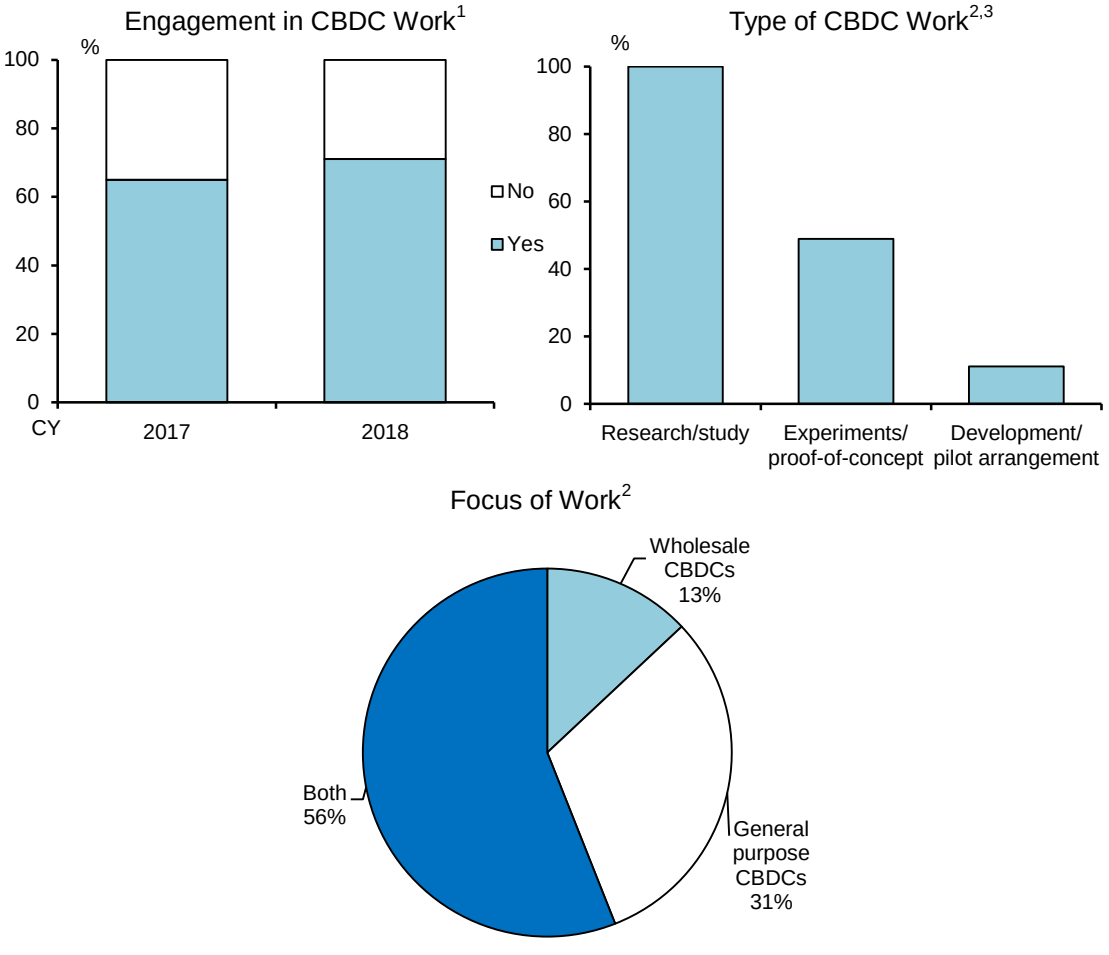
[52] BIS, *Central Bank Digital Currencies* (March 2018).

[53] Christian Barontini and Henry Holden, "Proceeding with Caution -- A Survey on Central Bank Digital Currency," *BIS Papers*, No. 101 (January 2019).

The survey results showed two main characteristics. First, among the 63 respondent central banks, about 70 percent are currently engaged in CBDC work, most of which is in the form of survey or research (Chart B7-1). Of those that are engaged in work, over half cover both general purpose and wholesale CBDCs. Second, regarding the possibility of the CBDC issuance in future, over 80 percent of the respondent central banks see themselves as unlikely to issue CBDC in the short term for both wholesale and general purpose variants. More than 60 percent see themselves as unlikely to issue both types of CBDC in the medium term as well (Chart B7-2).

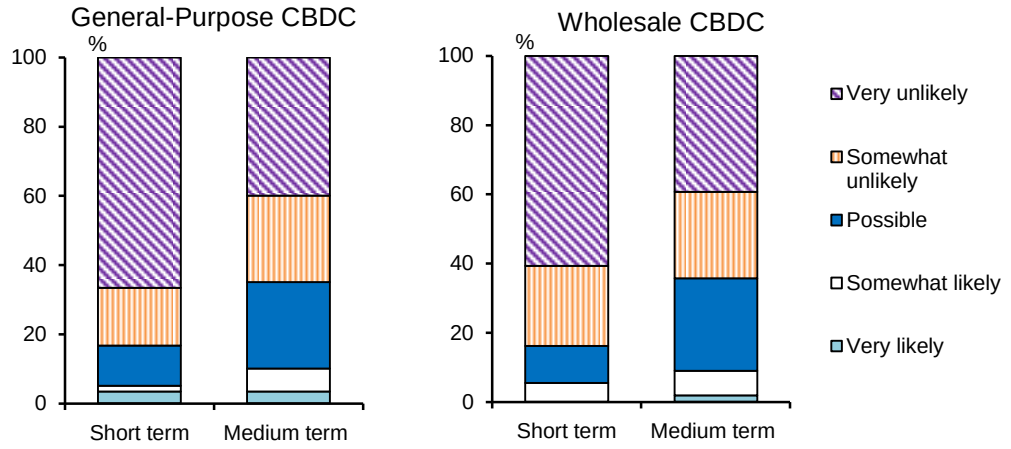
Chart B7-1 Initiatives for Central Bank Digital Currency



Notes: 1. Share among the respondent central banks.
2. Share among the respondent central banks that answered that they were engaged in CBDC work in 2018 survey.
3. Multiple answers were allowed.

Source: Christian Barontini and Henry Holden, "Proceeding with Caution -- A Survey on Central Bank Digital Currency," *BIS Papers*, No. 101 (January 2019).

Chart B7-2 Likelihood of Issuing a CBDC in the Short and Medium Term



Note: Share among the respondent central banks. "Short term" denotes 1-3 years and "Medium term" denotes 1-6 years.

Source: Christian Barontini and Henry Holden, "Proceeding with Caution -- A Survey on Central Bank Digital Currency," *BIS Papers*, No. 101 (January 2019).

Some respondent central banks consider CBDCs more seriously; especially those of the countries experiencing a rapid decrease of banknote circulation and of the emerging countries that aim for a wide scope of financial inclusion. For example, Sweden's central bank (Riksbank) discusses the issuance of a general purpose CBDC (e-krona) as payment methods without a credit risk amid the wide spread of cashless payment led by private sectors in the country. In the report released in October 2018, Riksbank stated that it "has not decided whether to issue an e-krona or not," but it will initiate a pilot programme in 2019 with the focus "on developing an e-krona that constitutes a prepaid value (electronic money) without interest and with traceable transactions."[54]

Meanwhile, Uruguay's central bank implemented a social experiment of issuing and circulating a general purpose CBDC (an e-Peso) between November 2017 and April 2018 as an initiative to promote financial inclusion.[55] Specifically, it issued 20 million e-Pesos -- Uruguayan pesos in digital -- to 10,000 smartphone users. The users installed an e-Peso application (digital wallet) developed by private firms to deposit e-Pesos (up to 30,000 pesos per wallet) and made payment transactions in about 80 registered stores and businesses. Uruguay's central bank indicates that it needs more consideration to decide whether to do further experiments or actually issue an e-Peso in the future.

[54] Sveriges Riksbank, *The Riksbank's E-Krona Project: Report 2* (October 2018).

[55] Gerardo Licandro, *Uruguayan E-Peso on the Context of Financial Inclusion* (November 2018).

Appendix: Acronym Glossary

AI	Artificial Intelligence
AML/CFT	Anti-Money Laundering and Combating the Financing of Terrorism
API	Application Programming Interface
ATM	Automated Teller Machine
BCBS	Basel Committee on Banking Supervision
BCP	Business Continuity Plan
BIS	Bank for International Settlements
BOE	Bank of England
BOJ-NET	Bank of Japan Financial Network System
CBDC	Central Bank Digital Currency
CCP	Central Counterparty
CDS	Credit Default Swap
CEO	Chief Executive Officer
CFTC	Commodity Futures Trading Commission
CHAPS	Clearing House Automated Payment System
CISO	Chief Information Security Officer
CLS	Continuous Linked Settlement
CP	Commercial Paper
CPI	Consumption Price Index
CPMI	Committee on Payments and Market Infrastructures
CPSS	Committee on Payment and Settlement Systems
CRO	Chief Risk Officer
CSD	Central Securities Depository
DDRJ	DTCC Data Repository Japan
DLT	Distributed Ledger Technology
DVP	Delivery Versus Payment
ECB	European Central Bank
EDI	Electronic Data Interchange
ESMA	European Securities and Markets Authority
EU	European Union

Fed	Federal Reserve System
FMI	Financial Market Infrastructure
FSB	Financial Stability Board
FTS	Funds Transfer System
FX	Foreign Exchange
FXYCS	Foreign Exchange Yen Clearing System
GC	General Collateral
HKMA	Hong Kong Monetary Authority
IMF	International Monetary Fund
IOSCO	International Organization of Securities Commissions
IRS	Interest Rate Swap
JASDEC	Japan Securities Depository Center
JGB	Japanese Government Bond
JDCC	JASDEC DVP Clearing Corporation
JSCC	Japan Securities Clearing Corporation
JSDA	Japan Securities Dealers Association
NETD	Non-Exchange Transaction Delivery
NPP	New Payments Platform
NRIC	National Registration Identity Card
OTC	Over-The-Counter
PFMI	Principles for Financial Market Infrastructures
PVP	Payment Versus Payment
QQE	Quantitative and Qualitative Monetary Easing
RTGS	Real-Time Gross Settlement
SC	Special Collateral
TFX	Tokyo Financial Exchange
TR	Trade Repository
XML	eXtensible Markup Language
ZEDI	Zengin EDI System