

ISSN 2234-2524

Payment and Settlement Systems Report 2021

2022. 4



BANK OF KOREA

Bank of Korea Mid- and Long-term Strategic Plan (BOK 2030)

- **Vision** **Bank of Korea**
 : Taking the lead in stabilizing and developing the national economy

- **Strategic** **Agility** Pursue Innovation in a Flexible and Swift Manner
Directions **Collaboration** Bolster Synergy Through Collaboration
 Expertise Reinforce Policy and Research Capability

BANK OF KOREA

**Payment and Settlement
Systems Report 2021**

2022. 4

Payment and settlement refers to the act of discharging obligations arising from economic activities between individuals and businesses by means of payment instruments such as cash, payment cards, or funds transfers. In order to ensure that payment and settlement transactions that support economic activities take place smoothly, payment and settlement systems, comprised of payment instruments, payment systems, and participating institutions, need to be managed and operated in a stable and efficient manner.

In its capacity as the central bank, the Bank of Korea (BOK) plays a pivotal role in ensuring the smooth operation and development of payment and settlement systems in Korea, in accordance with the Bank of Korea Act. The BOK operates BOK-Wire+, a large-value payment system that finalizes settlements between financial institutions, and provides financial institutions with intra-day liquidity support to resolve settlement risks, such as those arising from settlement delays. The BOK also conducts oversight of payment and settlement systems by monitoring and assessing operating institutions and making recommendations for improvements as necessary.

As an operator, overseer, and facilitator of the development for payment and settlement systems, the BOK publishes an annual Payment and Settlement Systems Report regarding tasks performed during the year and future policy directions.

The goal of this report is to enable system participants and the public to gain a greater overall understanding of payment and settlement systems.

Bank of Korea Act (excerpts)

Article 28 (Decisions on Monetary and Credit Policies) The Monetary Policy Board shall deliberate and decide on matters involving the following Clauses on monetary and credit policies:10. Basic matters for the operation and management of the payment and settlement systems according to the provisions of Article 81;

Article 81 (Business Concerning Payment and Settlement Systems) ① For the purpose of promoting the safety and efficiency of the payment and settlement system as a whole, the Bank of Korea may determine all the necessary matters concerning the payment and settlement systems that it operates.

② Concerning the payment and settlement systems that are operated by institutions other than the Bank of Korea, the Bank of Korea may if necessary request such operating institutions or the supervisory body responsible to take measures for the improvement of the operating rules, etc.

③ For the purpose of the smooth operation of overall payment and settlement systems, the Bank of Korea may require institutions operating payment and settlement systems referred to in Paragraph ② to provide materials related to payments and settlements. In such cases, the operating institutions shall comply.

④ The Bank of Korea may require participant institutions of payment and settlement systems operated by the Bank of Korea referred to in Paragraph ① to provide any relevant materials.

Article 81-2 (Support to Settle Temporary Shortages) The Bank of Korea may as determined by the Monetary Policy Board temporarily provide intraday funds to participant institutions of payment and settlement systems operated directly by the Bank of Korea to meet shortage of funds.

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Abbreviations

| | |
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| ATM | Automated Teller Machine |
| BCP | Business Continuity Plan |
| BIS | Bank for International Settlements |
| BOK-Wire+ | Bank of Korea Financial Wire Network System |
| CBDC | Central Bank Digital Currency |
| CCP | Central Counterparty |
| CLS | Continuous Linked Settlement |
| CPMI | Committee on Payments and Market Infrastructures |
| DNS | Deferred Net Settlement |
| DvP | Delivery versus Payment |
| EMEAP | Executives' Meeting of East Asia and Pacific central banks |
| FMI | Financial Market Infrastructure |
| FSB | Financial Stability Board |
| IMSG | Implementation Monitoring Standing Group |
| IOSCO | International Organization of Securities Commissions |
| ISO | International Organization for Standardization |
| NFC | Near Field Communication |
| PFMI | Principles for Financial Market Infrastructures |
| RTGS | Real-time Gross Settlement |
| SWIFT | Society for Worldwide Interbank Financial Telecommunication |

Guide to Using URLs and QR Codes for Related Materials

- In order to promote user convenience, the Payment and Settlement Systems Report 2021 contains URLs and QR codes that directly link to materials uploaded onto the Bank of Korea's website and YouTube channel.
- Users who read this report using a personal computer or tablet can access related material by clicking the URLs included in the report. For the printed version, users may access related material by scanning the QR codes at the end of each chapter or section with a smartphone.

Digital file of the report

Click the URLs included in the report to directly access related material.

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Printed version of the report

Scan the QR codes included at the end of each chapter or section with a smartphone.



Executive Summary

[Policy Responses and Oversight of Payment and Settlement Systems]

1 Amid the stable operation of the net settlement risk management arrangements, the BOK endeavored to alleviate the burden on participants due to increase of the collateral-to-net debit cap ratio.

In retail payment systems operated by the Korea Financial Telecommunications and Clearings Institute (KFTC), such as Electronic Banking System or the Interbank Remittance System, it is convenient for payee to withdraw funds immediately when a payment order is received. However, no funds are credited to the payee's bank until the time of net settlement, exposing it to credit risk. To control such a risk, the BOK operates net settlement risk management arrangements, consisting of a net debit cap set by each participating bank, collateral pledged in amounts tied to the net debit cap, and loss-sharing arrangements to cover losses in excess of pledged collateral.

Meanwhile, the new international standards for financial market infrastructures, introduced after the global financial crisis, require the complete elimination of credit risk. So, the BOK planned to raise the collateral-to-net debit cap ratio from the existing 30% to 100%. In 2016, the collateral ratio was increased by 20%p from 30% to 50% and then to 70% in 2019.

However, in April 2020, as the outbreak of the COVID-19 pandemic caused a rapid deteriora-

tion in liquidity conditions in financial markets, the BOK temporarily lowered the collateral-to-net debit cap ratio from 70% to 50% and deferred the originally planned dates for an annual increase of 10%p to later dates.

With the expiration of this temporary measure at the end of January 2022, the collateral-to-net debit cap ratio was restored to the pre-pandemic level of 70% on Feb. 1, 2022, and a plan to increase it by 10%p annually to 100% by February 2025 was announced.

Collateral-to-Net Debit Cap Ratio Increase Schedule

| Aug. 2016 | Aug. 2019 | Apr. 2020 | Feb. 2022 | Feb. 2023 | Feb. 2024 | Feb. 2025 |
|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| 50 | 70 | 50 | 70 | 80 | 90 | 100 |

(%)

Source: Bank of Korea

Meanwhile, as some securities pledged to guarantee net settlements, such as government bonds and Monetary Stabilization Bonds, have been excluded from high-quality liquid assets for the purpose of calculating the liquidity coverage ratio, banks have expressed the opinion to BOK and Financial Supervisory Service (FSS) that the compliance burden is increasing. To reduce the compliance burden on banks, the BOK decided, in consultation with the FSS, to treat the value of pledged collateral minus the portion of the net debit cap that is already encumbered at the time of calculation of the liquidity coverage ratio, as the unencumbered portion of collateral and include it in high-quality liquid assets. The net debit cap management system was also updated for the calculation of the unencumbered portion of collateral. To reflect this change, the FSS amended the relevant regulations ("Detailed Regulations on the Supervision of Banking Business") (effective as of Feb. 1, 2022).

② The BOK assessed the Open Banking System and implemented safety improvement measures in accordance with the Bank of Korea Act.

The Open Banking System, a payment system that can be used by fintech firms, was deployed in August 2016. Initially, companies eligible to use this system were limited to small and medium-sized fintech firms with no more than KRW 2 billion in capital. This restriction was removed in December 2019 to strengthen support for fintech innovation. Later, as the surge in the value of funds transferred through the Open Banking System increased its impact on the safety of the overall payment and settlement systems, the BOK conducted an assessment of this system according to the Bank of Korea Act.

The BOK decided on a comprehensive set of measures to strengthen the safety of the Open Banking System including its designation as a payment and settlement system subject to settlement finality and strengthening oversight. The BOK plans to make further headway in the implementation of these measures in 2022 by closely working with the Korea Financial Telecommunications and Clearings Institute (KFTC) and participating institutions.

③ Preparation work was faithfully carried out in case the introduction of CBDC is decided.

In case the introduction of CBDC is decided, the BOK made efforts to build up the necessary technical and institutional foundations. These efforts were paired with an increase in external communication and closer cooperation with other central banks.

As part of the effort to build up technical foundation, external consultations were held to define unit operations and work processes for CBDC system and simulation project, designed based on the results of consultations, has been implemented. During the first phase of the simulation (Aug.–Dec. 2021), the fundamental life-cycle of a CBDC, including minting, issuance, circulation, redemption and destruction, were tested for normal functioning in a virtual environment.

The second phase of the simulation (Jan.–Jun. 2022) tested the extended functionality of a CBDC, including offline payments in an environment without the on-line network connection, trading of digital assets, such as digital artworks and copyright, and cross-border payments. The feasibility of privacy-enhancing technology to guarantee the anonymity of CBDC users was also assessed during this phase.

Meanwhile, a legal advisory group consisting of external experts was formed to examine the direction and scope of any amendments necessary to the Bank of Korea Act or to other relevant laws related to the CBDC. In tandem, technical issues, including the scalability of the distributed ledger technology, were examined by a technical advisory group. Analysis was conducted on global trends in CBDC discussions and further in-depth research was carried out to investigate the implications of the introduction of a CBDC on monetary policy, financial stability, and currency issuance, etc.

④ The BOK promoted expansion of financial inclusion through improvement of ATM services and supported innovation and development in payment and settlement systems by standardizing distributed ledger technology-based authentication services.

The Committee on Financial Informatization Promotion, chaired by the senior deputy governor of the Bank of Korea, has undertaken a project to bring improvements to ATM services in order to minimize any inconveniences in terms of consumer access to cash. In November 2021, the “mobile financial map service,” based on a comprehensive database built using banks’ data about ATM networks nationwide, was launched to provide consumers with information about ATM access locations.

In December 2021, the “Standards for the Operation of Decentralized ID Services and Sharing Systems by Financial Corporations” was established. Decentralized ID is a digital identity scheme enabled by distributed ledger technology. The new standards are expected to help guarantee interoperability between decentralized ID services, prevent redundant investment, and induce the adoption of decentralized ID services.

Meanwhile, the establishment of the “Guidelines on the Management of Financial Data in Remote Locations” in December 2021 has made available actionable guidance to protect critical financial data more safely from wide-area disasters.

⑤ The BOK effectively carried out its oversight duties on payment and settlement systems by assessing financial market infrastructures and conducting joint examinations of participants.

In 2021, the BOK conducted the regular assessments of BOK-Wire+ and the systemically important payment and settlement systems operated by the Korea Exchange (KRX) and the Korea Securities Depository (KSD). These systems were assessed against relevant international standards including the “Principles for Financial Market Infrastructures” (PFMI) and the “Guidance on Cyber Resilience for Financial Market Infrastructures.”

The assessments found that BOK-Wire+ has mostly observed the international standards. For some areas needing improvement, such as recovery capabilities, timely corrective actions are planned. The KRX was also determined to have generally observed the international standards. However, some areas, including recovery and response procedures, the margin management system, operational risk, and cyber resilience management, were found to be in need of some improvement. Concerning the KSD, the assessment is focused on operational risk and cyber resilience management.

The BOK also conducted joint examinations of three banks and a financial investment company to evaluate the management status of intraday liquidity and settlement risk. For areas with issues of concern, such as procedures for reporting system downtime or outages to the BOK, and the liquidity crisis response process, including stress tests, recommendations for improvement were made.

At the international level, the BOK conducted cooperative oversight of the CLS system and SWIFT together with other participating central banks.

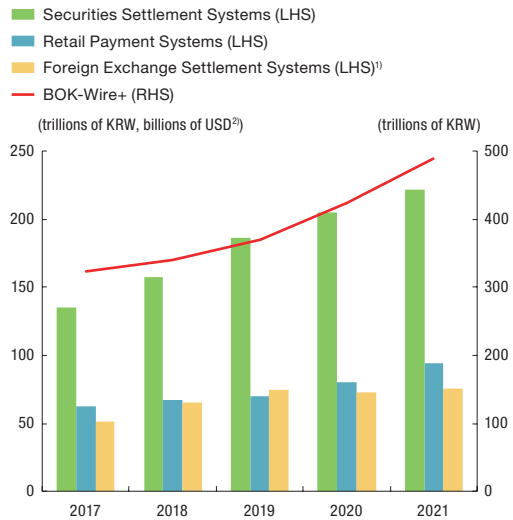
[Payment and Settlement Trends and Settlement Risk Management]

⑥ settlements processed through major systems showed a steady upward trend, driven mainly by securities settlement transactions by financial institutions and electronic funds transfers by individuals and businesses.

The daily average value of settlements in the securities settlement systems was buoyed by inter-institutional repo transactions to KRW 221.7 trillion, representing an increase of 8.1% from the previous year. The value of payments through the retail payment systems jumped by 17.6% over the previous year on the continuous increase in funds transfers via the Electronic Banking System, including the internet banking, to record KRW 94.3 trillion (on a daily average basis). The daily average value of settlements in the CLS system also rose by 4.0% from a year earlier to USD 75.3 billion.

The daily average value of settlements in BOK-Wire+, where the final settlement of obligations between financial institutions arising from transactions initiated in the securities settlement and retail payment systems and the CLS system occurs, increased by 15.3% from 2020 to hit KRW 488.5 trillion.

Value of Settlements by Major System (daily average)



Notes: 1) Based on the value settled through the CLS system.

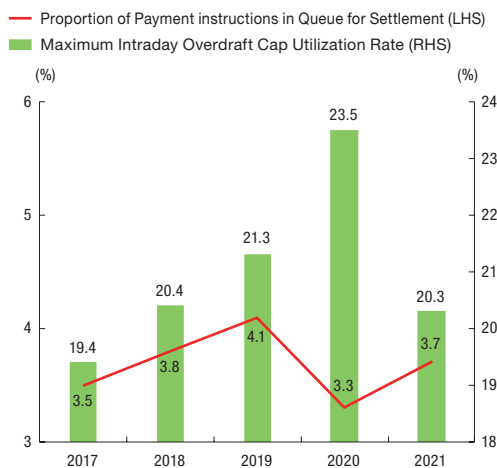
2) Value settled through the foreign exchange settlement system expressed in billions of USD.

Sources: Bank of Korea, KFTC, KRX, KSD

⑦ The settlement risks of major payment and settlement systems were managed in a stable manner.

The final settlement service provided by BOK-Wire+ for funds transfers between participants, securities settlements, retail payments and the CLS system were performed smoothly and efficiently throughout the year. Among the indicators of settlement liquidity of BOK-Wire+ participants, while the ratio of queued to submitted transfer instructions edged up 3.7% from the previous year (3.3%), the maximum intraday overdraft cap utilization rate fell to 20.3% from 23.5%.

Queued-to-Submitted Payment Order Ratio¹⁾ and Maximum Intraday Overdraft Cap Utilization Rate²⁾ (based on value)



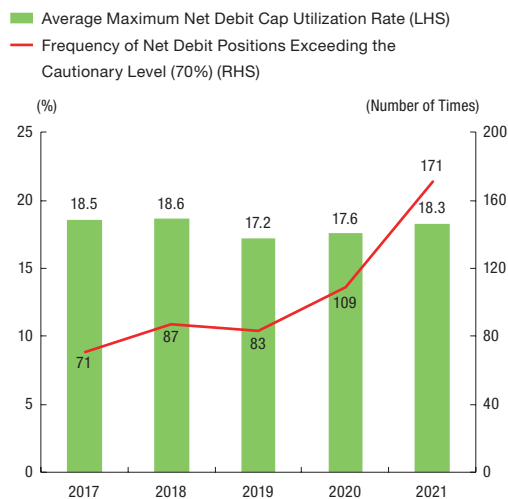
Notes: 1) Average value of payments in queue relative to the total value of payment orders submitted. (excluding payment orders placed in queue for liquidity saving)

2) Average daily value of maximum intraday net overdraft relative to the intraday overdraft cap.

Source: Bank of Korea

During 2021, the maximum net debit cap utilization rate (daily average) among net settlement participants recorded a minor uptick from the previous year (17.6%) to 18.3%. The frequency of net debit positions exceeding the cautionary level (70%) increased from a year earlier (109 times) to 171 times due to high volumes of funds transferred in connection with initial public offering (IPO) orders and the related refund procedure.

Average Maximum Net Debit Cap Utilization Rate¹⁾ and Frequency of Net Debit Positions Exceeding the Cautionary Level (70%)



Note: 1) Average maximum net debit utilization rate among participants.

Source: Bank of Korea

The securities settlement systems of the Korea Exchange (KRX) and the Korea Securities Depository (KSD) also operated stably and reliably. In exchange-traded stock market, all transactions were settled before the penalty deadline. In the inter-institutional OTC repo settlement system, the share of free-of-payment (FoP) transactions, a form of settlement in which securities are delivered without a simultaneous transfer of funds, stood at 5.9%, essentially the same level as the previous year.

[Future Policy Directions]

8 To increase the safety and efficiency of payment and settlement systems, the BOK will continuously expand infrastructure.

To prepare for the potential cross-border inter-linking of payment and settlement systems and

to enhance the safety of payment and settlement systems by reducing credit risk, the BOK will be developing a plan to implement an RTGS-based fast payment system.

Moreover, as a further preparatory step ahead of the cross-border interlinking of payment systems and for improved efficiency of payment and settlement processes, the BOK will explore ways of adopting ISO 20022.

In tandem, the BOK will implement measures to strengthen the safety of the Open Banking System, such as designating it as a system subject to settlement finality and a systemically important payment and settlement system, the improvement of participation policy, and the enhancement of its business processes.

⑨ The BOK will facilitate innovation and development in payment and settlement systems by intensifying CBDC research and further enhancing the access and usability of ATM systems.

As the BOK will follow up its phase 2 of CBDC simulation with new simulations, it will continue to explore and test a variety of system designs and technologies to seek out a CBDC architecture that is most suitable for the financial and economic environment of Korea.

In addition, the BOK will engage in efforts to improve the public's understanding of CBDCs by increasing external communication while also closely monitoring ongoing research and development trends through cooperation with central banks and international organizations worldwide.

Finally, to prevent the near-ubiquitous adoption of digital payment solutions from causing un-

due inconvenience to cash-reliant segments of the population, the BOK will continue to make improvements to ATM systems to facilitate consumer access to cash and to enhance the convenience of its use.

⑩ The BOK will conduct more robust oversight of payment and settlement systems to respond to the changing environment.

Amid the growing influence of big tech companies in the payment and settlement sector, there has been a developing consensus among international organizations, such as the BIS, that risks associated with payment services provided by them need to be analyzed and that more robust oversight is needed in their regard. To address these safety risks, the BOK plans to develop an oversight framework for payment service platforms operated by big tech companies.

Moreover, to enhance the effectiveness of its oversight, the BOK plans to take an active part in the discussions to amend the Bank of Korea Act so that greater clarity may be provided regarding its roles and responsibilities and that more powerful policy tools may be made available to it.

Amid the surge in hacking and cyber security risks, the BOK will strengthen the assessment of cyber resilience and cyber risk management status of payment and settlement system operators. In assessing the cyber resilience of payment and settlement system operators, the BOK plans to make extensive use of the methodology employed by the BIS and IOSCO during their joint assessments of payment and settlement systems in various member jurisdictions in 2021 to evaluate the IT resilience.

I

Policy Responses and Oversight

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1. Enhancement of Payment and Settlement Systems

Stable Operation of the Net Settlement Risk Management Arrangements

(Upward adjustment of the collateral-to-net debit cap ratio in compliance with international standards)

In the retail payment systems operated by the Korea Financial Telecommunications and Clearings Institute (KFTC), such as the Electronic Banking System and the Interbank Remittance Systems, when a transfer order is received, funds are immediately credited to the payee's account (available for withdrawal by the payee). However, the resulting obligations between banks are settled based on a deferred net settlement, at a designated time (11:00 a.m.) of the following business day. Although it is convenient for the payee that unsettled funds are immediately made available for withdrawal, this exposes the payee's bank to the credit risk of not receiving the funds credited to the customer until the time of net settlement. To control such a credit risk, the BOK operates risk management arrangements consisting of a net debit cap¹⁾ as set by each participants, collateral pledged in amounts tied to the net debit cap,²⁾ and loss-sharing arrangements to cover losses beyond the value of the pledged collateral in the event of default of a bank.

However, under the new international standards established after the global financial crisis, the PFMI, payment and settlement systems are required to eliminate the credit risk. Therefore, in order to observe the new credit risk standards, the BOK planned to raise the collateral coverage ratio from the existing 30% to 100%. To avoid the strain that such a sudden large increase in collateral requirements could place on financial institutions, the BOK opted for a phased-in increase. Accordingly, in 2016, the collateral-to-net debit cap ratio was increased by 20%p from 30% to 50%, and then to 70% in 2019. At the time of the 2019 increase, a plan to raise the net settlement collateral ratio by 10%p annually to 100% by 2022 was also announced.

This plan was, however, put on hold in early 2020 in response to the rapid worsening in liquidity conditions in financial markets amid the global spread of COVID-19. The BOK temporarily lowered the collateral-to-net debit cap ratio from 70% to 50% and deferred the initially planned dates in the plan for an annual increase of 10%p to later dates.

After this temporary measure expired at the end of January 2022, the collateral-to-net debit cap ratio was restored to the pre-pandemic level of 70% (Feb. 1, 2022), and a plan to increase it by 10%p annually, to 100%, by February 2025, was announced at the same time.

1) "Net debit cap" refers to the maximum amount of unsettled net obligations, calculated by subtracting the cumulative value of payment orders received from the cumulative value of payment orders issued, that an institution can incur during a business day. When an institution's net debit position reaches its cap due to a sudden increase in the amount of funds paid, i.e., payment orders issued, this results in the suspension of customer transfers. To reduce the risk of an excessive increase in unsettled net obligations leading to a failure of net settlement, the BOK requires participants to establish an upper limit on their net debit position.

2) Net settlement system participants must pledge eligible securities as collateral. The current collateral requirement is 70% of the net debit cap for transactions subject to the net debit cap and 70% of the average net clearing value for other types of transactions.

Table I-1. Collateral-to-Net Debit Cap Ratio Increase Schedule

| (%) | | | | | | |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Aug. 2016 | Aug. 2019 | Apr. 2020 | Feb. 2022 | Feb. 2023 | Feb. 2024 | Feb. 2025 |
| 50 | 70 | 50 | 70 | 80 | 90 | 100 |

Source: Bank of Korea

(Easing the collateral burden on participating institutions)

In 2016, ahead of raising the collateral-to-net debit cap ratio, the BOK took a series of actions to reduce the burden that increased collateral requirements would have on participants,³⁾ including having BOK-Wire+ handle large-value funds transfers by individuals and businesses, which were previously processed through retail payment systems.

Subsequently, as government bonds and Monetary Stabilization Bonds pledged as collateral to guarantee net settlement have been excluded from high-quality liquid assets for the purposes of calculating the liquidity coverage ratio (LCR), banks appealed to the BOK and to the Financial Supervisory Service (FSS) for relief from the regulatory compliance burden.⁴⁾ The BOK examined relevant international standards and practices in other countries and concluded that the portion of

collateral that is not yet encumbered to cover net debit positions at the time of calculation of the LCR may be recognized as high-quality liquid assets. According to an estimation by the BOK, this would increase the value of high-quality liquid assets eligible in the calculation of the LCR by KRW 26.4 trillion, which would, in turn, improve the LCR of domestic banks by 5.8%p. The BOK then consulted with the FSS about this new way of calculating the LCR and reached an agreement that the value of the pledged collateral minus the portion of the net debit cap that is already encumbered at the time of calculation of the LCR will be treated as the unencumbered portion of collateral and will be included as high-quality liquid assets. To reflect this change, the FSS amended its “Detailed Regulations on the Supervision of Banking Business” (effective as of Feb. 1, 2022). At the request of BOK, the KFTC developed a new system for the calculation of the unencumbered portion of collateral securities in the KFTC.

Going forward, the BOK plans to make continuous efforts to reduce the collateral burden associated with net settlement on financial institutions.

3) Three main examples of measures undertaken to alleviate the collateral burden on participants in 2015-2016 include: the implementation of the straight through process (STP) in December 2015 in which a payee-designated funds transfer system processes all elements of the transaction flow for large-value funds transfers by individuals and businesses within BOK-Wire+; the implementation of an RTGS system in February 2016 to handle large-value transactions by individuals and businesses by directly linking BOK-Wire+ and the Electronic Banking System of the KFTC; and the revising of the rules for the net debit cap in February 2016 to allow changes in net debit cap (including a newly established debit cap), which determines the collateral requirement for retail payment system participants, to take effect during the same business day instead of within two days for more flexible management of net debit exposures.

4) The LCR is a short-term liquidity ratio regulation for banks, introduced as part of Basel III, whereby banks are expected to hold high-quality liquid assets, such as cash, government bonds, or central bank bonds, to fund cash outflows for 30 days in amounts corresponding to 100% or more of the net cash outflow. Accordingly, the exclusion of government bonds and Monetary Stabilization Bonds pledged by banks as net settlement collateral from high-quality liquid assets causes their LCRs to drop.

Shoring up the Safety of the Open Banking System

In August 2016, the KFTC created a payment system (Open Banking System), concentrating on information-sharing arrangements and system access between financial institutions and fintech companies and processing funds transfers between them. Initially, as this system was created with the goal of fostering the growth of small fintech firms, access was restricted to companies with no more than KRW 2 billion in capital. This restriction was, however, removed in December 2019 to also allow access by big tech companies as part of an effort to provide increased support for fintech innovation.

As a result of this change, the volume of funds transfers through the Open Banking System has rapidly risen, considerably increasing the system's impact on the safety of the overall payment and settlement systems. The BOK, therefore, conducted an assessment of the Open Banking System in accordance with the Bank of Korea Act and issued recommendations requiring the KFTC to bring its risk management procedures into compliance with relevant international standards.

To implement the recommendations for improvement by the BOK, the KFTC took a series of corrective actions. First, to protect users of the Open Banking System, the KFTC changed the way prepaid deposits are displayed in the interface of an application so that they are not confused with deposits at a financial institution.⁵⁾ Meanwhile, to reflect risks

associated with third-party service providers in the business continuity plan (BCP), external service providers were made to participate in disaster simulation exercises and structural risks inherent in the Open Banking System were taken into consideration in the recovery scenarios. It was furthermore decided that the eligibility to access the Open Banking System will be periodically reviewed, either annually or every two to three years depending on the volume and value of transactions carried out by a fintech firm and the history of payment disruption incidents. Finally, the KFTC's charter and bylaws were amended so that its board, composed of member banks, has the final responsibility for issues pertaining to risk management.

The BOK also decided on a comprehensive set of measures to strengthen the safety of the Open Banking System, including the improvement of the access policy, its designation as a payment and settlement system subject to settlement finality, and improving business process and strengthening oversight. To allow the implementation of these measures, relevant regulations will be amended during 2022 with updates also made to the IT systems.⁶⁾

Expansion of Financial Inclusion through Enhancement of Accessibility and Usability of ATM Systems

In November 2021, under the joint initiative with banks, the Committee on Financial Informatization Promotion (CFIP), which is chaired by the senior deputy governor from the Bank of Korea,⁷⁾ introduced the "financial

5) To prevent the confusion of preloaded funds for fintech services with funds covered by the deposit insurance, changes were made in the way they are displayed within an application so that they are more clearly distinguished from deposits held at financial institutions.

6) For further details, refer to Section 3, Subsection 1, "Enhancing the Safety of the Open Banking System."

map service,” an ATM access location service provided in cooperation with the banking sector. The new service was made to increase financial inclusion through the enhancement of the accessibility and usability of ATM systems. This mobile application-based service is supported by a comprehensive database of aggregated nationwide ATM network data. Beyond basic information such as locations and operating hours, the application provides information about the range of services available at each location, fees, and accessibility features for people with disabilities. Users can look up ATM locations meeting their specific requirements by setting search filters. A supply-side analysis website was also developed to assist in the development of ATM operating strategies and policies by financial institutions.

As a much-needed centralized source of ATM network information, putting an end to the struggle of finding a place to conveniently withdraw cash, the financial map service is expected to significantly improve the accessibility and usability of ATM systems for consumers. Meanwhile, the supply-side analysis website will likely contribute to a more efficient operation of ATM systems by financial institutions.

Key Measures Undertaken to Improve FMIs

(Korea Exchange)

In January 2021, the Korea Exchange (KRX) established its “Detailed Implementation Plan for the General Business Recovery Plan.” This plan adds concrete details to the “General Business Recovery Plan” to reflect the requirements set forth in the CPMI-IOSCO report on “Recovery of Financial Market Infrastructures.” The plan covers the decision-making criteria for the activation of the recovery plan, the activation procedure, and the organizational structure responsible for the task.

Furthermore, for a more rigorous management of central counterparty (CCP) risk, in April 2021, its risk management unit, which was previously a part of the trading execution division, was made into an independent division, at the same time as the “Clearing Management Committee” was newly established.

A change was also made to the rules for setting the recovery point objective (RPO)⁸⁾ under its business continuity plan (BCP). Previously, the same RPO was set at the level of unit system. After the change, RPOs are now set at the level of unit operations so that the same

7) Formed in September 1984, under the original name of the Committee on Financial Computerization, chaired by the governor of the Bank of Korea, the CFIP spearheaded the establishment of major interbank shared networks, such as the CD Network System and the Interbank Payment System. In November 2009, the committee was restructured and was given its current name, and is now chaired by the senior deputy governor of the Bank of Korea. As of the end of 2019, 32 financial institutions and related organizations participated in the CFIP. The CFIP is supported by a Working Committee responsible for conducting preliminary reviews for the selection of joint financial informatization projects and financial standardization projects. The Working Committee has several sub-committees under it, including the Standardization Committee, the Safety Countermeasures Committee, the Digital Innovation Committee and the Committee on Financial Inclusion.

8) The recovery point objective (RPO) refers to the cycle of the data recovery process. For example, an RPO of six hours means that the data must be backed up every six hours. The RPO determines the acceptable level of data losses in the event of a system incident.

system may have different RPOs depending on the type of unit operations. This was in consideration of the fact that the impact of a business disruption caused by a system incident or other unexpected event can vary between unit operations. Moreover, during the BCP drill conducted in April 2021, the KRX carried out a joint examination of performance in the recovery of backup data with the Korea Securities Depository.

In November 2021, to limit the risk of margin calls in a stress situation causing liquidity shortages among its member firms, the KRX decided on measures to improve the margin system for exchange markets. These measures aimed at reducing the risk of margin calls by maintaining a sufficient level of margin include increasing the amount of margin by applying a buffer⁹⁾ and the introduction of floor to its margin requirements.¹⁰⁾

(Korea Securities Depository)

In July 2021, the Korea Securities Depository (KSD) deployed a new DvP settlement system for foreign currency repurchase agreements,¹¹⁾ linking its securities book-entry system and the foreign currency funds transfer system

of Hana Bank. Although RP transactions in Korean won have always been settled on a delivery versus payment (DvP) basis by linking BOK-Wire+ and the book-entry system of the KSD, foreign currency repo transactions have been settled until now on a free of payment (FoP) basis, a transfer of securities without a corresponding transfer of funds. The launch of the new DvP settlement system is expected to contribute to the safety of the payment and settlement process by eliminating the principal risk¹²⁾ associated with foreign currency repo transactions between financial institutions at its root.

Moreover, in line with the entry into effect of the initial margin requirement¹³⁾ for non-centrally cleared OTC derivatives in September 2021, the KSD began a custodial service for initial margin collateral. The initial margin requirement was introduced through a decision of the G20¹⁴⁾ in an effort to reduce risk in OTC derivatives transactions. Currently, this requirement applies only to financial companies with a balance of KRW 70 trillion or more in non-centrally cleared OTC derivatives.¹⁵⁾ However, starting in July 2022, the requirement will be extended to include financial companies with a balance of KRW 10 trillion

9) The margin buffer imposes an additional percentage to the margin calculated using the margin model.

10) The margin floor sets a lower limit for the margin posted to ensure that the margin level calculated by the margin model remains above a certain level at all times.

11) A repurchase agreement is a sale of securities with a commitment to buy back the same securities at a future date, at a pre-agreed price.

12) Principal risk refers to the risk of non-delivery of securities by the seller or the risk of non-payment by the buyer of securities.

13) Margin exchanged between counterparties as protection against the risk of future default of either party.

14) In 2011, as the spread of systemic risks from OTC derivatives trading was identified as a major trigger of the global financial crisis, the G20 decided to regulate margin requirements on non-centrally cleared OTC derivatives. In accordance with this decision, the BCBS and the IOSCO established minimum standards for margin requirements for non-centrally cleared derivatives in March 2015.

15) The requirement of exchanging variation margin between counterparties took effect in March 2017 for financial companies with a balance of KRW 10 trillion or more in OTC derivatives and in September 2017 for financial companies with a balance of KRW 3 trillion or more.

or more in non-centrally cleared OTC derivatives.

(Korea Financial Telecommunications and Clearings Institute)

8

In September 2021, the Korea Financial Telecommunications and Clearings Institute (KFTC) launched “Datop,” a shared data platform for the financial sector. While primarily intended to serve financial institutions, this platform also allows limited public access for statistical and research purposes.

Meanwhile, to support the growth of the new “credit information self-management business,” the KFTC implemented a data relay system. The new data relay system will be used to transmit consumer credit information on behalf of those organizations that are required under the Credit Information Use and Protection Act to provide credit data providers (financial institutions, public institutions, fintech companies, etc.), but are without the necessary system infrastructure because of capacity for system-buildup.

In tandem, the KFTC made improvements to the Open Banking System. Credit card companies and fintech firms are now permitted to participate in the Open Banking System as long as they provide their own information which was originally restricted to.¹⁶⁾ Fintech accounts were also included in the integrated account information management system to

make it more convenient for customers of fintech companies to add accounts when opening an Open Banking account.¹⁷⁾

16) Credit card companies are only authorized to provide customers with information about card accounts and transaction data and fintech companies (issuers of prepaid electronic payment means) are only authorized to provide customers with balance and transaction information.

17) The integrated account information management system is a dashboard system by the KFTC, allowing users to aggregate all their financial accounts in one place. As fintech accounts are now listed alongside accounts held at financial institutions, fintech app users no longer have to manually enter their account information when opening an Open Banking account.

2. Support for Innovation and Advancement in Payment and Settlement Systems

Preparation for the Introduction of a CBDC

As a way of ensuring that the decision to launch a central bank digital currency (CBDC) is preceded by sufficient research and examinations, the BOK has been making efforts to lay the technical and institutional foundations for the introduction of a CBDC. External communications with regard to the CBDC have been increased at the same time and cooperation with central banks and monetary authorities in other economies strengthened.

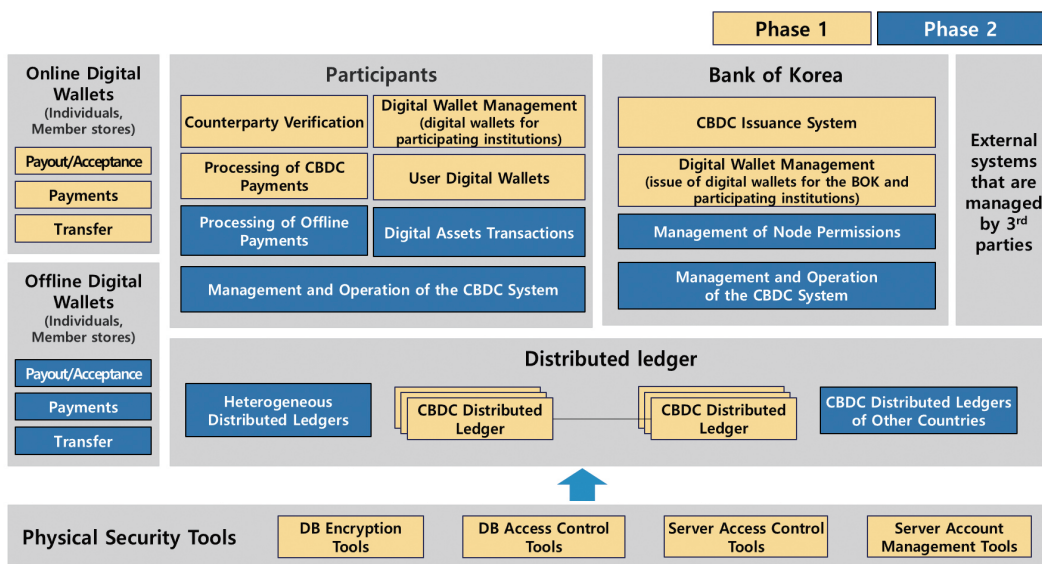
At the technical level, external consultations were held from November 2020 to March 2021

to define unit operations and work processes for the CBDC system. Based on the results of these consultations, a CBDC simulation was designed and has been implemented in two successive phases.

During the first phase of simulation, from August to December 2021, a cloud-based virtual testing environment was created to develop a hybrid CBDC model¹⁸⁾ with a distributed ledger technology. Using this simulation system, the fundamental life-cycle of a CBDC, including minting, issuance, circulation, redemption and destruction, were tested.

During the second phase, from January to June 2022, the simulation system models and tests the offline payment functionality of the CBDC whereby users will be able to make payments even in an environment without the on-line network connection by tagging a smartphone

Figure I-1. Scope of CBDC Simulation Projects



Source: Bank of Korea

18) A public-private partnership model in which its circulation is jointly handled with private institutions, and the central bank is solely responsible for the minting, issuance, and redemption of a CBDC.

with an integrated circuit (IC) card on which the CBDC is stored. Extended functionalities, such as the purchase of digital assets, including digital artwork and copyrights, and cross-border payments, are also tested. The second phase of simulation, furthermore, assesses the feasibility of privacy-enhancing technology. As the simulation project is limited to evaluate a few technical feasibility of a specific CBDC architecture, more research will be needed to test various types of CBDC architectures. Accordingly, the final version of any CBDC system that might actually be introduced could be different from the models tested under these simulation studies.

Continuous research is also being conducted on legal and technical issues anticipated in connection with the introduction of a CBDC, as well as on its impact on the key roles and responsibilities of the BOK. A legal advisory group consisting of external experts was formed to examine the directions and scope of any amendments necessary to the Bank of Korea Act or to other relevant laws.¹⁹⁾ At the same time, a technical advisory group was created to examine technical issues, such as the scalability of the distributed ledger technology. Analysis was conducted on global trends related to CBDCs²⁰⁾ and further in-depth research was carried out to investigate the implications of the introduction of a CBDC

on monetary policy and financial stability, etc.

Meanwhile, the BOK increased communication with stakeholders keenly interested in the potential introduction of a CBDC, including academia and the research community, the financial sector, and technology companies, as well as foreign central banks. In November 2021, a Payment and Settlement System Conference was held on the theme “CBDC: Main Issues and Challenges for Central Banks.” Academics, financial research institutions, and experts from international organizations participating in the conference exchanged views on the impacts of a CBDC, legal and technical issues it could entail, and the future tasks of central banks.²¹⁾

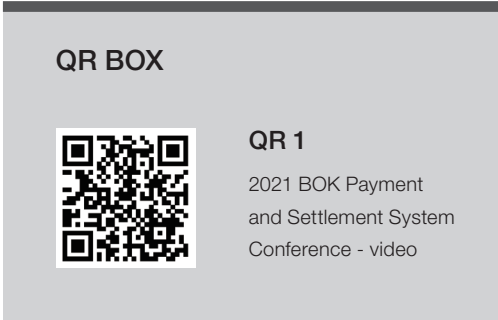
The BOK also held a briefing on the progress of its CBDC research in November 2021 to present the current status of the simulation project and future plans for a follow-up simulation with external participants to the financial institutions and fintech companies.

The BOK, moreover, held bilateral working-level discussions with other central banks and international organizations, and participated in working groups to monitor CBDC-related developments and share its research results.

19) A bill to partially amend the Bank of Korea Act was introduced in the National Assembly (by Representative Suh Byung-soo in September 2021) to provide a legal basis for the issuance of a CBDC and to confer the status of legal tender on the CBDC.

20) The BOK created a dedicated CBDC research unit (Section for Digital Currency Analysis) and assigned additional human resources to related tasks. Global central banks and international organizations and in academia’s discussions on background and purpose, system designs and architectures, and impacts were examined. For further details on this subject, refer to “CBDC: Recent Developments and Discussions Across the Globe” (BOK, January 2022).

21) For details about this event, see “2021 BOK Payment and Settlement System Conference,” which is available both as a video and as an e-book, viewable at the Bank of Korea’s official YouTube channel (<https://www.youtube.com/watch?v=qgfmOuyEt0k>) and at its website, respectively.



Standardization of Decentralized ID-based Authentication Services

In December 2021, in collaboration with the banking sector, the Committee on Financial Informatization Promotion (CFIP) established the “Standards for the Operation of Decentralized ID Services and Sharing Systems by Financial Corporations.” Decentralized ID (DID) is a distributed ledger technology-based authentication system in which users store personal information (name, resident registration number, official residence address, etc.) in a digital wallet in the form of a smartphone application, and when necessary for the verification of identity, provide only the required information to the user organization.

Despite active discussions on decentralized ID-based services in recent times, service standards that can be practically applied by financial companies have been largely lacking. To fill this vacuum, the Committee on Financial Informatization Promotion (CFIP) issued a set of actionable service standards. The service standards, developed by the Korea Financial Telecommunications and Clearings Institute (KFTC), were reviewed by financial institutions (banks, securities companies, card companies, etc.) and experts on standards before adoption.

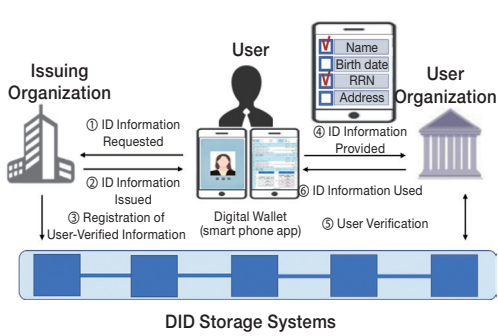
These standards, providing service models that may be used as a basis for designing decentralized ID services by financial companies, set out their functional requirements and the procedures for the issuance and submission of personal identity data. The standardization of decentralized ID services is expected to help guarantee their interoperability, prevent redundant investment, and accelerate their adoption.

Establishment of the Guidelines on the Management of Financial Data in Remote Locations

In December 2021, the Committee on Financial Informatization Promotion (CFIP) issued its “Guidelines on the Management of Financial Data in Remote Locations.” These guidelines provide principles and requirements for data dispersion²²⁾ by financial institutions to safeguard critical financial data from wide-scale disasters.

The guidelines address requirements for the management of critical financial data in re-

Figure I-2. Overview of Decentralized ID Services



Source: Bank of Korea

22) Dispersion refers to storing copies of data in geographically dispersed locations to better improve data resiliency. Copies of data are periodically stored in a remote facility, located at a significant distance from the primary data center, according to a set cycle (days, weeks, months, etc.) determined by the recovery point objective (RPO).

mote locations in three key areas: ① dispersion policy, ② management of dispersed data by stage, and ③ security and operation of secondary data storage facilities. To guard against the possibility of the primary data center and the secondary data storage facility becoming damaged or destroyed simultaneously by a major disaster, such as an earthquake, a nuclear accident, or a terrorist attack, the guidelines establish a minimum distance between them (100 km), at the same time as providing standards for the management of data and the protection of data storage facilities.

3. Oversight of Payment and Settlement Systems

Regular Assessments of Domestic Payment and Settlement Systems and BOK Recommendations

In 2021, the BOK conducted regular assessments of BOK-Wire+ and systemically important payment and settlement systems (SIPs) operated by the Korea Exchange (KRX) and the Korea Securities Depository (KSD), which followed up on the previous year's regular assessments of three systemically important payment and settlement systems and the Open Banking System operated by the Korea Financial Telecommunications and Clearings Institute (KFTC)

BOK-Wire+

In 2021, BOK-Wire+²³⁾ was assessed on 18 of the 24 PFMI principles that are applicable to large-value payment systems and on the "Guidance on Cyber Resilience for Financial Market Infrastructure."²⁴⁾ Given that the next-generation BOK-Wire+ began operations relatively recently, in October 2020, particular focus was placed on the business continuity management framework. The assessment evaluated BOK-Wire+'s ability to respond to the operational risk presented by events such as hacking attacks or system disruptions. To improve the objectivity and quality of the assessment process, the opinions of external experts from the information security field was solicited and reflected.

The results of the assessment indicated that BOK-Wire+ was generally in compliance with the PFMI, although some areas were identified as needing improvement. For these areas, the BOK plans to implement appropriate and timely corrective actions with regard to improvement of business recovery capabilities and the cyber resilience management.

Korea Exchange

The BOK conducted an assessment of the central counterparty (CCP) of exchange-traded securities and exchange-traded derivatives and OTC derivatives, operated by the Korea Exchange (KRX). The assessment standards included 22 of the 24 PFMI principles applicable to the CCP and "Resilience of Central Counterparties (CCPs): Further Guidance on the PFMI." Based on the tentative results of the assessment, the KRX was mostly in compliance with the PFMI, but needed improvement in some areas including recovery and response procedures, its margin management system, operational risk, and cyber resilience management.

Korea Securities Depository

The BOK has been conducting assessments of two systemically important payment and settlement systems operated by the Korea Securities Depository (KSD), the OTC bond settlement system and the OTC repo settlement system. The two systems have been assessed against 20 relevant PFMI principles out of the total 24 principles and the "Guidance on Cyber Resilience for FMIs," with a particular fo-

23) BOK-Wire+ is a wholesale payment system to process settlements for short-term financial product transactions between financial institutions, net settlements of retail payment systems, and settlements for securities and foreign exchange transactions.

24) "Guidance on Cyber Resilience for FMIs" (CPMI-IOSCO, Jun. 2016).

cus on operational risk and the management of cyber resilience.

Table I-2. Joint Examinations of Banks and Financial Investment Companies in 2021

| Institution examined | Dates examined | Items examined |
|----------------------|--|--|
| Kakao Bank | Apr. 20 to Apr. 23 (4 business days) | ·Management of Intraday liquidity ·Management of foreign exchange, securities, and net settlement risks |
| Kookmin Bank | Jul. 5 to Jul. 8 (4 business days) | ·Establishment and implementation of a BCP ·Compliance with payment and settlement-related standards |
| Kyongnam Bank | Nov. 17 to Nov. 19 (3 business days) | |
| Meritz Securities | Jun. 14 to Jun. 29 (12 business days) | ·Status of funds transfer operations ·Management of settlement liquidity related to funds transfers, etc. |

Source: Bank of Korea

Joint Inspections of Banks and Financial Investment Companies

In 2021, the BOK conducted joint examinations with the Financial Supervisory Service of three domestic banks to evaluate their payment and settlement-related procedures, including the management status of intraday liquidity and the management of foreign exchange, securities, and net settlement risks. A joint inspection was also conducted on a financial investment company²⁵⁾ to verify the compliance of its funds' transfer procedures and settlement liquidity management practices.

The liquidity management system of these institutions was found to be generally adequate with the status of net settlement risk periodically monitored and a contingency funding and fund operation plan in place to deal with a liquidity crisis. However, it was determined that there was room for improvement in the ways they managed IT operational risk, including the procedure for immediately reporting system downtime or system outages to the BOK. Recommendations for improvement were also made regarding certain elements of their liquidity risk response system, such as early warning indicators and stress tests.

International Cooperative Oversight

The CLS system provides payment-versus-payment (PvP) settlement services in multiple currencies by linking with the large-value payment systems in jurisdictions of the settlement currencies. To ensure compliance of the CLS system with existing standards, cooperative oversight is conducted by the CLS Oversight Committee, composed of 23 central banks, including the BOK.²⁶⁾

International oversight by the Society for Worldwide Interbank Financial Telecommunications (SWIFT) is performed by the SWIFT Oversight Forum (hereafter the "Oversight Forum"), composed of the G20 central banks. The BOK is a member of the Oversight Forum.²⁷⁾ During 2021, oversight was conducted on the overall operation of SWIFT, includ-

25) In 2021, due to the ongoing COVID-19 pandemic, the number of joint examinations of financial companies was reduced to one from three annually. In exchange, the BOK ramped up the non-face-to-face monitoring to ensure the compliance of financial investment companies in settlement risk management.

26) The 23 central banks composing the committee include 18 central banks of CLS eligible currencies and five euro-zone central banks.

27) Oversight activities for SWIFT, headquartered in Belgium, are carried out mainly by the National Bank of Belgium (NBB), which shares the results with other central banks.

ing its organization, policies, procedures, and internal control activities. The overseers found that the operation of SWIFT was stable in spite of challenges posed by the ongoing pandemic. To prevent cyber-enabled financial crime, such as the unauthorized withdrawal of funds, SWIFT issued more stringent security guidelines to its member institutions worldwide and urged compliance with the new guidelines.

II

Payment and Settlement Trends and Settlement Risk Management

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1. Large-value Payment System

Settlement Trends

(Korean Won Funds)

In 2021, large-value KRW funds transferred through BOK-Wire+, which provides the final settlement between financial institutions, jumped 15.3% from a year earlier to KRW 488.5 trillion in terms of daily average value, mainly due to the increased transfers of securities settlement funds.¹⁾

Table II-1. Settlement Value in BOK-Wire+ by Type (daily average)

| | (trillions of KRW, %) | | | |
|---|-----------------------|-------|-------|----------|
| | 2019 | 2020 | 2021 | % change |
| Total KRW Funds Transfers | 369.9 | 423.6 | 488.5 | 15.3 |
| Transfers between participants | 353.9 | 405.0 | 465.4 | 14.9 |
| Call Transaction Funds | 21.1 | 21.6 | 20.6 | -4.5 |
| Securities Settlement Funds | 214.6 | 236.1 | 257.4 | 9.0 |
| Foreign Exchange Settlement Funds ¹⁾ | 19.3 | 15.9 | 14.6 | -2.5 |
| Customer Payments ²⁾ | 50.2 | 63.2 | 73.6 | 16.5 |
| Net Settlement Funds ³⁾ | 18.1 | 22.5 | 25.9 | 15.3 |
| Other | 35.3 | 46.9 | 73.4 | 56.5 |
| Transfers between participants and BOK ⁴⁾ | 16.1 | 18.5 | 23.1 | 24.7 |
| Total Foreign Currency-Denominated Funds Transfers (in billions of USD)⁵⁾ | 0.7 | 1.0 | 1.1 | 12.6 |

Notes: 1) Settlement value of KRW funds transfers related to foreign exchange transactions.

2) Large-value funds transfers by individual or corporate customers, processed through BOK-Wire+, including payments through a linked system.

3) Net settlement between participants associated with retail payment systems.

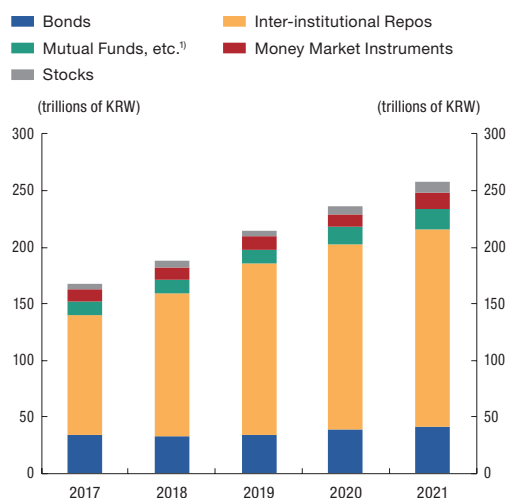
4) Including payments on government and public bonds, payments to and from the Treasury, loans from the BOK, etc.

5) Including deposits and withdrawals.

Source: Bank of Korea

By type of funds transfer, call transaction funds decreased from the previous year (-4.5%) as the temporary increase in the call transaction funds limit, put in place in 2020, expired.²⁾ Securities settlement funds,³⁾ on the other hand, edged up 9.0% from 2020, driven by inter-institutional repo transactions. Transfers related to inter-institutional repo transactions were up 6.7% as their upward trend continued into 2021.

Figure II-1. Securities Transaction Funds Settled through BOK-Wire+ (daily average)



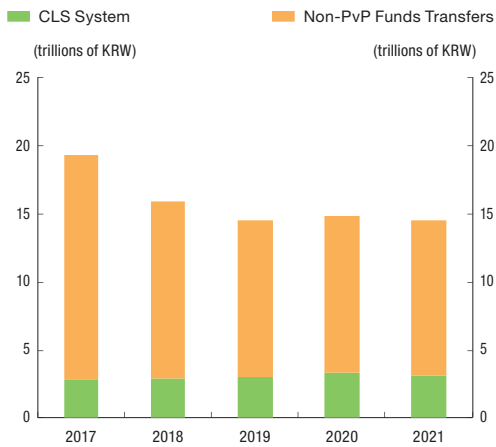
Note: 1) Collective investment securities under the Financial Investment Services and Capital Markets Act.

Source: Bank of Korea

The value of foreign exchange settlement funds⁴⁾ fell 2.5% from a year earlier on the decline in both non-PvP funds transfers through the interbank correspondent network (-1.5%) and funds transfers via the CLS system (-5.9%).

1) During 2021, the daily average volume of payments made through BOK-Wire+ increased 6.7% from a year earlier (20,806) to 22,206 transactions.

Figure II-2. Foreign Exchange Funds¹⁾ Settled through BOK-Wire+ (daily average)

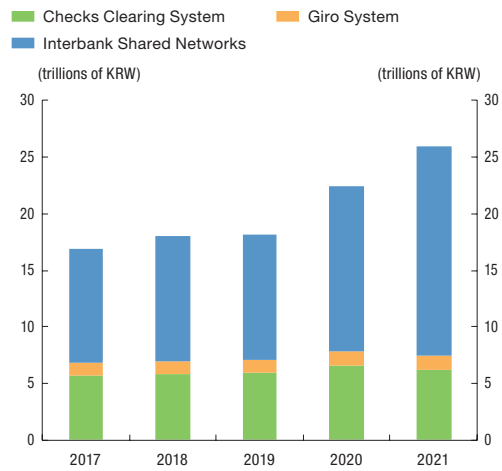


Note: 1) Net value for CLS-related transfers, gross value for non-PvP transfers.

Source: Bank of Korea

The value of net settlements between BOK-Wire+ participants jumped 15.3% over the previous year on the increase in payment activity in the Interbank Shared Networks⁵⁾.

Figure II-3. Net Settlement Funds Transferred through BOK-Wire+ (daily average)



Source: Bank of Korea

Meanwhile, the daily average value of settlements made between BOK-Wire+ participants and the BOK for transactions in government and public bonds, payments to and from the Treasury, and BOK loans amounted to KRW 23.1 trillion, up 24.7% from the previous year. This was mainly due to the continuous growth in new loans following the raising of the ceiling on the Bank-Intermediated Lending Support Facility⁶⁾ during 2020 and the increase both in the volume of Korea Treasury bond issues⁷⁾ and national tax receipts.⁸⁾

2) In March 2020, to ease concern in the short-term money market, the government raised the call money borrowing limits of securities companies from 15% to 30%. This limit was progressively lowered later during the year to 25% in May, 20% in June, and to 15% in August. The call loan limits of asset management companies, which was also adjusted upward to 4% of collective investment assets from the existing 2% in March 2020, was brought down successively to 3.5% in May, 3% in June, and then to 2% in August.

3) Including the value of FoP settlements in addition to DvP and bond redemption transactions. For bank bonds, municipal bonds and corporate bonds, the KSD submits redemption certificates of all bonds maturing on the same clearing date to receive their principal and interest payments in a single batch. The funds are then distributed to individual investors through BOK-Wire+ and the Electronic Banking System.

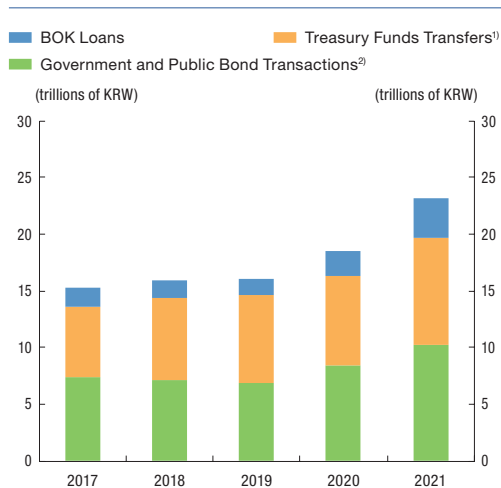
4) For the settlement of foreign exchange transactions, Korean won funds transfers are processed through BOK Wire+. The CLS System simultaneously settles payments related to FX trades without any timing mismatch between the sold currencies and the bought currencies by connecting the CLS Bank to the IT systems of central banks.

5) Including the Electronic Banking System, the Interbank Remittance System, and the CD Network.

(Foreign Currency Funds)

The BOK provides foreign exchange banks with transfer, deposit, and withdrawal services for USD and JPY funds, through foreign currency-denominated deposit accounts that were opened with the BOK by these banks to meet their foreign currency reserve requirements. In 2021, the daily average value of foreign currency funds transfers (including deposits and withdrawals) increased by 12.6% from a year earlier to USD 1.13 billion.

Figure II-4. Funds Transferred Between Participants and BOK (daily average)



Notes: 1) Including only transactions with processed through BOK-Wire+ (investment and redemptions of surplus funds, payment of national tax, etc.).

2) Issues and redemptions of government bonds and Monetary Stabilization Bonds, sales and purchases of repos (including repurchases).

Source: Bank of Korea

Supply of Intraday Liquidity

To help cover temporary gaps in the cash flows of BOK-Wire+ participants and to minimize settlement risk posed by insufficient liquidity, the BOK provides intraday liquidity facilities in the forms of intraday overdrafts and intraday repos. In 2021, the daily average value of settlement liquidity supplied by the BOK recorded a slight uptick of 0.2% from 2020 to reach KRW 3.4921 trillion.

Table II-2. Foreign Currency Funds Transferred through BOK-Wire+ (daily average)

| | (millions of USD, %) | | | | |
|-------------|----------------------|-------|---------|---------|----------|
| | 2018 | 2019 | 2020 | 2021 | % Change |
| Transfers | 0.3 | 0.2 | 0.1 | 0.2 | 52.9 |
| Deposits | 347.0 | 333.0 | 510.5 | 568.4 | 11.3 |
| Withdrawals | 359.5 | 343.2 | 491.1 | 559.5 | 13.9 |
| Total | 706.8 | 676.3 | 1,001.7 | 1,128.1 | 12.6 |

Source: Bank of Korea

(Intraday Overdrafts)

Intraday overdraft is a facility providing short-term liquidity to BOK-Wire+ participants experiencing a temporary liquidity shortage in the form of a daylight loan to ensure the smooth processing of funds transfers between financial institutions as well as transfers between companies that are mediated by them. In 2021, the daily average value of intraday overdrafts edged up 5.0% from a year earlier to KRW 633.2 billion. By type of bank, this value fell by KRW 71.6 billion to KRW 76 bil-

6) During 2020, the BOK raised the ceiling on the Bank-Intermediated Lending Support Facility three times (by KRW 5 trillion in March, by KRW 5 trillion in May, and by KRW 8 trillion in October) by a total of KRW 18 trillion to KRW 43 trillion, which is the limit currently in effect.

7) The outstanding balance of Korea Treasury Bond as of the end of 2021 stood at KRW 843.7 trillion (KRW 180.5 trillion worth of new issues added and KRW 63.6 trillion worth of issues redeemed in 2021), representing a 16.1% increase from the end of the previous year (KRW 726.8 trillion).

8) In 2021, the government's tax revenue rose by KRW 58.5 trillion to KRW 344.1 trillion on the increased receipts of corporate income tax and capital gains tax from the previous year.

Table II-3. Supply of Intraday Liquidity (daily average)

| | (billions of KRW, %) | | | |
|-----------------------------------|----------------------|---------|---------|----------|
| | 2019 | 2020 | 2021 | % change |
| Intraday Overdrafts ¹⁾ | 432.1 | 603.0 | 633.2 | 5.0 |
| Intraday Repos | 2,618.1 | 2,883.2 | 2,858.9 | -0.8 |
| Total | 3,050.2 | 3,486.2 | 3,492.1 | 0.2 |

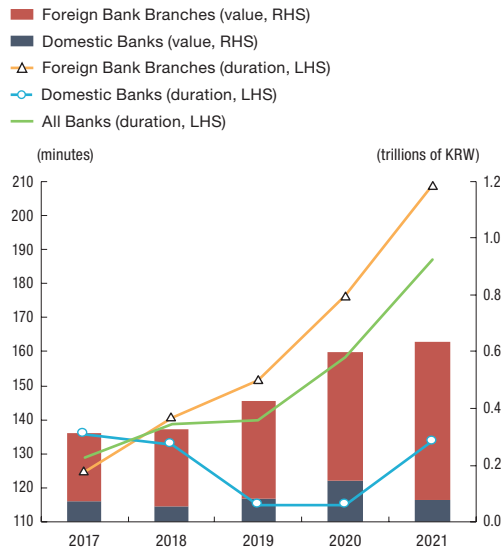
Note: 1) Based on net intraday overdraft balance after subtracting the current account balance from the gross value of intraday overdrafts.

Source: Bank of Korea

lion for domestic banks, while it rose by KRW 101.8 billion to KRW 557.2 billion for domestic branches of foreign banks during the same period.

The daily average duration of an outstanding intraday overdraft increased by 29 minutes compared to the previous year to 188 minutes. By type of bank, this duration was 134 minutes for domestic banks, up by 19 minutes from 2020, and 210 minutes for foreign bank branches, up by 33 minutes.

Figure II-5. Value¹⁾ and Duration²⁾ of Intraday Overdrafts (daily average)



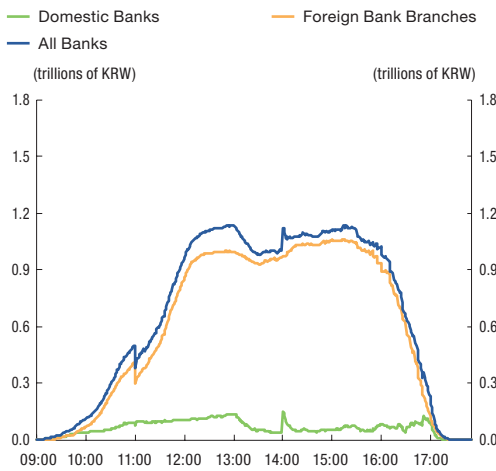
Notes: 1) Based on net intraday overdraft balance obtained by subtracting the current account balance from the gross value of overdrafts.

2) Based on the total daily duration per participant (Ex. If a participant has an intraday overdraft position between 11:00-12:00 and, then, between 14:00-15:00, the total duration is 120 minutes).

Source: Bank of Korea

The intraday overdraft balance of participants rapidly increased during morning hours, particularly among foreign bank branches, and then decreased sharply starting from around 16:00. Foreign bank branches tended to use intraday overdrafts during morning hours to repay call money loans and settle securities transactions and started to pay off the overdraft balance from 16:00 on as their liquidity was replenished by new call money. The daily high in intraday overdraft balance fell from a year earlier (KRW 1.4849 trillion) to KRW 1.1397 trillion.

Figure II-6. Intraday Overdraft Balance by Hour of Day¹⁾(daily average)



Note: 1) Based on net intraday overdraft balance after subtracting the current account balance from the gross value of overdrafts.

Source: Bank of Korea

(Intraday Repos)

The BOK uses intraday repos to provide short-term liquidity support to the Korea Exchange (KRX) and financial investment companies with the objective of encouraging participants to complete securities settlements conducted through BOK-Wire+ earlier in the business day, and of reducing the concentration of settlement activity toward the closing time of the system. In 2021, the daily average value of settlement liquidity supplied through intraday repos decreased slightly by 0.8% to KRW 2.8589 trillion despite the increase in their use by the KRX, as this increase was more than offset by the decrease in their use by financial companies.

Table II-4. Settlement Liquidity Supplied through Intraday Repos (daily average)

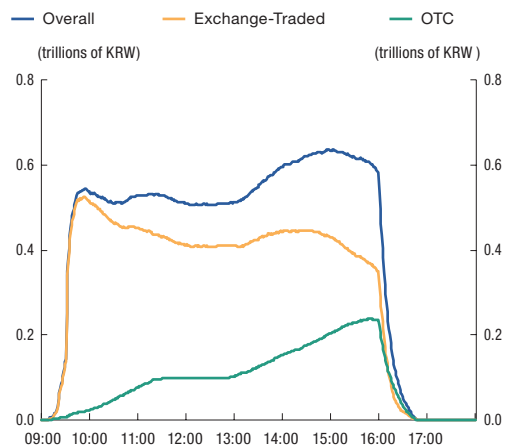
(billions of KRW, %)

| | 2020 | | | 2021 | | | % change |
|--------------------------------|-----------------|--------------|----------------|-----------------|--------------|----------------|-------------|
| | Exchange Traded | OTC | Total | Exchange Traded | OTC | Total | |
| KRX | 1,742.5 | - | 1,742.5 | 1,910.9 | - | 1,910.9 | 9.7 |
| Financial Investment Companies | 472.0 | 668.8 | 1,140.8 | 460.6 | 487.5 | 948.0 | -16.9 |
| Total | 2,214.5 | 668.8 | 2,883.2 | 2,371.5 | 487.5 | 2,858.9 | -0.8 |

Source: Bank of Korea

During 2021, the use of intraday repos followed its customary pattern dictated by the closing time of the exchange bond market. Their use increased sharply until 10:00 and, then, again embarked on a steady upward trend from 13:00 onward as demand related to the settlement of OTC bond transactions kicked in. After the closing time for intraday repo purchases by the BOK (16:00), the balance rapidly fell and was completely paid off by the end of the business day. In 2021, the daily high in the intraday repo balance was reached earlier than during the previous year (15:02) by 5 minutes at 14:57 (KRW 636.2 billion).

Figure II-7. Intraday Repo Balance by Hour of Day¹⁾ (daily average)



Note: 1) Net supply per minute (intraday cumulative supply – intraday cumulative repayment).

Source: Bank of Korea

Risk Management Status

The proportion of queued payment orders for settlement⁹⁾ and the rate of maximum intraday overdraft cap utilization, both of which are key indicators of the settlement liquidity of BOK-Wire+ participants, suggest that the operation of BOK-Wire+ was stable in 2021. Although the proportion of payment orders in the queue edged up slightly from a year earlier (3.3%) to 3.7%, the rate of maximum intraday overdraft cap utilization fell from 23.5% to 20.3%

Table II-5. Proportion of Payment Orders in Queue for Settlement and Maximum Intraday Overdraft Cap Utilization Rate (based on value)

| | (%) | | | | |
|--|------|------|------|------|------|
| | 2017 | 2018 | 2019 | 2020 | 2021 |
| Proportion of Payment Orders in Queue for Settlement ¹⁾ | 3.5 | 3.8 | 4.1 | 3.3 | 3.7 |
| Maximum Intraday Overdraft Cap Utilization Rate ²⁾ | 19.4 | 20.4 | 21.3 | 23.5 | 20.3 |

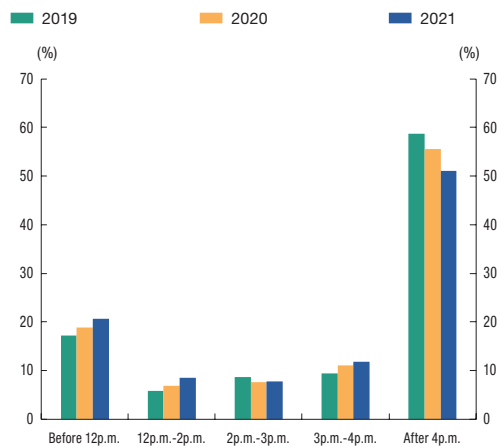
Notes: 1) Total value of payments in queue relative to gross settlement value (excluding payments processed through multilateral netting for liquidity savings).

2) Average ratio of the daily maximum intraday net overdraft amount to the intraday overdraft cap.

Source: Bank of Korea

Meanwhile, the proportion of payment orders (based on value) settled after 16:00, during the final 30 minutes before the closing of BOK-Wire+, decreased in 2021 to 51.2% from 55.5% in 2020.

Figure II-8. Proportion of Settlements through BOK-Wire+ by Time Slot¹⁾ (based on value)



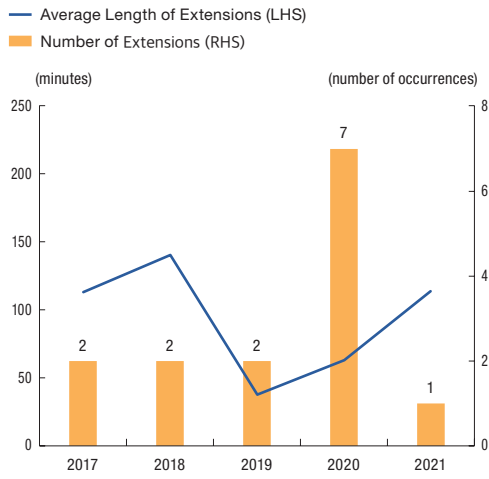
Note: 1) Value settled in each time period relative to gross settlement value.

Source: Bank of Korea

In 2021, the closing time of BOK-Wire+ was extended once. Although the frequency of extensions sharply fell from the previous year (seven times), its length increased compared to the previous year's average (63 minutes) to 114 minutes. The extension in October 2021 was due to a system issue at a participating institution. It was recommended to the participating institution in question that it amend its business continuity plan to allow for the speedy resumption of business, increase the relevant education and training provided to its staff, and develop measures to prevent the recurrence of similar incidents.

9) The proportion of transfer orders received by BOK-Wire+ that are temporarily placed in queue due to the insufficient current account balance.

Figure II-9. Extension of BOK-Wire+ Operating Hours



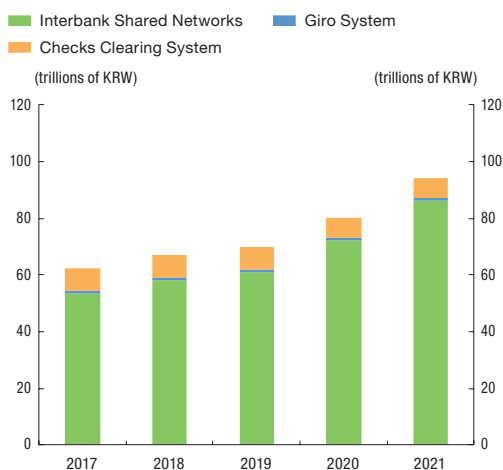
Source: Bank of Korea

2. Retail Payment Systems

Payment Trends

In 2021, the daily average volume and value¹⁰⁾ of payments processed through the retail payment systems operated by the KFTC increased by 17.0% and 17.6% from a year earlier to 32.61 million transactions and KRW 94.3 trillion, respectively. Despite a drop in clearing activity through the Check Clearing System, the overall volume and value increased, as this drop was largely offset by the rise in payment activity through the Interbank Shared Networks.

Figure II-10. Value of Payments Made through Retail Payment Systems (daily average)



Source: KFTC

The volume and value of funds transfers through the Interbank Shared Networks jumped 20.6% and 19.9% from 2020 to 28.32 million transactions and KRW 86.2 trillion, respectively. The continuously growing use of internet and mobile banking, and firm

banking, caused both the volume and value of transactions in the Interbank Shared Networks to rise.

Table II-6. Funds Transferred through Interbank Shared Networks, Checks Clearing & Giro Systems (daily average)

| | | (thousands of transactions, billions of KRW, %) | | | |
|---------------------------|--|---|--------|--------|----------|
| | | 2019 | 2020 | 2021 | % change |
| Volume | Interbank Shared Networks | 20,951 | 23,485 | 28,319 | 20.6 |
| | (Electronic Banking System) | 14,236 | 16,114 | 19,041 | 18.2 |
| | (Interbank Funds Transfer System) | 295 | 273 | 254 | -6.8 |
| | (CD/ATM System) | 1,548 | 1,226 | 1,064 | -13.2 |
| | Checks Clearing System | 252 | 200 | 175 | -12.7 |
| | (Cashier's Checks) | 245 | 195 | 170 | -12.8 |
| | (Promissory Notes and Others ¹⁾) | 5 | 4 | 4 | -12.1 |
| | Giro System | 4,301 | 4,193 | 4,120 | -1.7 |
| | (Credit Transfers) | 798 | 727 | 659 | -9.3 |
| | (Direct Debits) | 3,136 | 3,094 | 3,073 | -0.7 |
| (Direct Credit Transfers) | 311 | 328 | 354 | 7.7 | |
| Total | | 25,505 | 27,878 | 32,614 | 17.0 |
| Value | Interbank Shared Networks | 60,917 | 71,906 | 86,201 | 19.9 |
| | (Electronic Banking System) | 54,823 | 65,261 | 78,757 | 20.7 |
| | (Interbank Funds Transfer System) | 4,679 | 5,191 | 5,504 | 6.0 |
| | (CD/ATM System) | 818 | 722 | 655 | -9.3 |
| | Checks Clearing System | 7,661 | 7,254 | 7,039 | -3.0 |
| | (Cashier's Checks) | 1,132 | 1,043 | 916 | -12.2 |
| | (Promissory Notes and Others ¹⁾) | 3,892 | 3,442 | 3,437 | -0.1 |
| | Giro System | 1,030 | 1,042 | 1,098 | 5.4 |
| | (Credit Transfers) | 392 | 392 | 408 | 4.0 |
| | (Direct Debits) | 380 | 383 | 396 | 3.4 |
| (Direct Credit Transfers) | 247 | 257 | 286 | 11.4 | |
| Total | | 69,608 | 80,201 | 94,338 | 17.6 |

Note: 1) Including current account checks, household checks, and bills of exchange.

Sources: Bank of Korea, KFTC

10) The value of payments for the Interbank Shared Networks and the Giro System, and the value cleared for the Check Clearing System.

In comparison, the daily average volume and value cleared through the Check Clearing System fell to 0.18 million transactions and KRW 7 trillion, respectively, continuing the downward trend from the previous year. The volume of clearing declined particularly substantially for cashier's checks, which are increasingly being replaced by KRW 50,000 banknotes and electronic payment instruments.

As for funds transfers through the Giro System, while their daily average volume dropped by 1.7% from 2020 to 4.12 million transactions, their daily average value edged up 5.4% to KRW 1.1 trillion.

Risk Management Status

As funds transfers between customers of financial institutions, conducted through retail payment systems, tend to be high in terms of volume of transactions, but low in per-transaction value, only net obligations between financial institutions are settled through BOK-Wire+, after offsetting credits and debits among them. To manage net settlement risk in retail payment systems, the BOK requires participants to establish and maintain a net debit cap. At the end of 2021, the aggregate net debit cap of all participants stood at KRW 68.7 trillion, up 25.1% from the end of the previous year.

Table II-7. Net Debit Cap¹⁾ by Type of Participant

| (year-end basis, trillions of KRW, %) | | | | |
|---------------------------------------|-------------|-------------|-------------|-------------|
| | 2019 | 2020 | 2021 | % change |
| Direct Participants | 43.5 | 50.7 | 64.2 | 26.6 |
| Indirect Participants | 3.8 | 4.2 | 4.4 | 4.8 |
| Financial Investment Companies | 2.0 | 2.0 | 2.1 | 5.0 |
| Others ²⁾ | 1.8 | 2.2 | 2.3 | 4.5 |
| Total | 47.3 | 54.9 | 68.7 | 25.1 |

Notes: 1) Upper limit on the unsettled net obligation that a retail payment system participant is allowed to incur during a business day (cumulative amount of payment orders issued to other banks minus cumulative amount of payment orders received from other banks).

2) Korea Federation of Community Credit Cooperatives, National Forestry Cooperative Federation, Korea Federation of Savings Banks, National Credit Union Federation of Korea, National Agricultural Cooperative Federation.

Source: Bank of Korea

In 2021, the daily average maximum net debit cap utilization rate among the participants of retail payment systems recorded a minor increase from the year earlier (17.6%) to 18.3%.

The frequency of participant net debit positions exceeding the cautionary level (70%) increased substantially from 2020 (109 times) to 171 times, due mainly to the large volume of funds transferred in connection with orders for IPO shares¹¹⁾ and the related refund procedure.

Table II-8. Status of Net Debit Cap Utilization

| (% , number of instances) | | | | | |
|---|------|------|------|------|------|
| | 2017 | 2018 | 2019 | 2020 | 2021 |
| Average Maximum Net Debit Cap Utilization Rate ¹⁾ | 18.5 | 18.6 | 17.2 | 17.6 | 18.3 |
| Number of Instances Where Net Debit Positions Exceeded Cautionary Level | 71 | 87 | 83 | 109 | 171 |

Note: 1) Average daily maximum net debit cap utilization rates of all participants

Source: Bank of Korea

11) During 2021, the value of IPO funds raised by domestic companies more than quadrupled from 2020 levels (KRW 4.5 trillion) to reach an all-time high of KRW 19.7 trillion.

Meanwhile, to cover the net settlement exposure, participants are required to pledge collateral to the BOK equivalent in value to a fixed percentage of their net debit cap, the collateral-to-net debit cap ratio. At the end of 2021, the recognized value of net settlement collateral increased by KRW 7.3 trillion from the end of 2020 (KRW 30.8 trillion) to KRW 38.1 trillion as participants set higher caps for their net debit positions during this period.

Box II-1.

Trends in the Use of Non-cash Payment Instruments

Checks and Bills

In 2021, the use of checks and bills (daily average) decreased from the previous year on a volume basis (-11.9%), but increased on a value basis (+3.6%). This was mainly due to an increase in the issuance of electronic bills by financial investment companies¹⁾ amid the massive inflow of IPO subscription deposits.

Checks and Bills¹⁾ (daily average)

| | | (thousands of transactions, billions of KRW, %) | | | |
|--------|--------------------------------------|---|---------------|---------------|--------------|
| | | 2019 | 2020 | 2021 | % change |
| Volume | Cashier's Checks | 366 | 295 | 259 | -12.1 |
| | Preset Value | 322 | 255 | 223 | -12.5 |
| | (KRW 100,000 denominated) | 225 | 170 | 145 | -14.7 |
| | Non-Preset Value | 44 | 39 | 36 | -9.3 |
| | Promissory Notes, etc. ²⁾ | 13 | 11 | 10 | -8.8 |
| | Electronic Bills | 7.7 | 7.0 | 6.5 | -6.5 |
| | Others ³⁾ | 1.9 | 1.6 | 1.6 | -4.4 |
| | Total | 381 | 308 | 271 | -11.9 |
| Value | Cashier's Checks | 1,455 | 1,346 | 1,206 | -10.4 |
| | Preset Value | 119 | 102 | 92 | -9.2 |
| | (KRW 100,000 denominated) | 22 | 17 | 14 | -14.7 |
| | Non-preset Value | 1,336 | 1,244 | 1,114 | -10.5 |
| | Promissory Notes, etc. ²⁾ | 13,175 | 14,124 | 15,008 | 6.3 |
| | Electronic Bills | 1,262 | 2,283 | 3,886 | 70.2 |
| | Others ³⁾ | 2,637 | 2,769 | 2,686 | -3.0 |
| | Total | 17,267 | 18,240 | 18,900 | 3.6 |

Notes: 1) Including checks and bills cleared through the Check Clearing System and those that were directly presented at a teller window, as well as electronic bills.

2) Including promissory notes, current account checks, household checks, bills of exchange, and electronic bills.

3) Postal money orders, receipts for principal and interest payments on securities, etc.

Source: KFTC

Account Transfers

In 2021, the daily average volume and value of account-to-account transfers between financial institutions, excluding transfers made through BOK-Wire+, rose by 17.7% and 19.7%, respectively. This is mainly explained by the sharp surge in the use of the Electronic Banking System amid the increase in electronically-enabled non-face-to-face funds transfers through internet banking and firm banking.

Account Transfers (daily average)

| | | (thousands of transactions, billions of KRW, %) | | | |
|--------|---|---|---------------|---------------|-------------|
| | | 2019 | 2020 | 2021 | % change |
| Volume | Credit Transfers ¹⁾ | 16,678 | 18,388 | 21,363 | 16.2 |
| | Electronic Banking System ²⁾ | 14,236 | 16,114 | 19,041 | 18.2 |
| | (Internet Banking ³⁾) | 7,838 | 8,980 | 10,934 | 21.8 |
| | (Firm Banking ⁴⁾) | 5,418 | 6,146 | 7,077 | 15.1 |
| | Interbank Remittance System | 295 | 273 | 254 | -6.8 |
| | Debit Transfers | 7,883 | 8,768 | 10,604 | 20.9 |
| | Total | 24,560 | 27,156 | 31,967 | 17.7 |
| Value | Credit Transfers ¹⁾ | 60,843 | 71,753 | 85,656 | 19.4 |
| | Electronic Banking System ²⁾ | 54,823 | 65,261 | 78,757 | 20.7 |
| | (Internet Banking ³⁾) | 25,125 | 29,663 | 37,407 | 26.1 |
| | (Firm Banking ⁴⁾) | 21,752 | 25,606 | 30,364 | 18.6 |
| | Interbank Remittance System | 4,679 | 5,191 | 5,504 | 6.0 |
| | Debit Transfers | 936 | 1,049 | 1,496 | 42.7 |
| | Total | 61,779 | 72,801 | 87,152 | 19.7 |

Notes: 1) Excluding transfers conducted through BOK-Wire+.

2) Based on transfers to and from external bank accounts.

3) Including mobile banking transactions.

4) Corporate financial transactions systems provided by financial institutions.

Sources: Bank of Korea, KFTC

Payment Cards

In 2021, the daily average volume and value of payment card transactions increased by 5.7% and 9.0%, respectively, from 2020 on the back

1) Financial investment companies borrow funds against IPO subscription proceeds by depositing them with the Korea Securities Finance Corporation and issuing electronic bills.

of recovering consumption.

By card type, the daily average volume and value of transactions grew by 7.2% and 9.6% for credit cards and 4.2% and 7.6% for debit cards, known as check cards in Korea. On the other hand, the use of prepaid cards slipped 31.3% and 25.8%, respectively, as the amount of Emergency Disaster Relief Funds from the government²⁾ decreased during this period compared to 2020.

Payment Card Usage (daily average)¹⁾

| | | (thousands of transactions, billions of KRW, %) | | | |
|--------|---------------------|---|--------|--------|----------|
| | | 2019 | 2020 | 2021 | % change |
| Volume | Credit Cards | 40,685 | 39,211 | 42,044 | 7.2 |
| | Check Cards | 24,141 | 23,187 | 24,163 | 4.2 |
| | Prepaid Debit Cards | 86 | 734 | 504 | -31.3 |
| | Other | 141.4 | 141.8 | 189.5 | 33.7 |
| | Total | 65,053 | 63,273 | 66,900 | 5.7 |
| Value | Credit Cards | 2,131 | 2,109 | 2,312 | 9.6 |
| | Check Cards | 532 | 540 | 581 | 7.6 |
| | Prepaid Debit Cards | 2.5 | 17.0 | 12.6 | -25.8 |
| | Other | 2.4 | 2.3 | 2.8 | 24.6 |
| | Total | 2,669 | 2,669 | 2,909 | 9.0 |

Notes: 1) Card transactions at accepting merchants by individuals and companies.

Sources: Stand-alone payment card companies, banks and bank subsidiaries issuing payment cards, KFTC

By type of payment, the use of device-not-present-payments increased 16.2% from the previous year because online transactions increased as people were refraining from outdoor activities due to the spread of COVID-19. In the case of device-present payments, the use of mobile

devices or computers, instead of physical cards, dropped by 9.7%.

Payment Card Transactions¹⁾ by Type (daily average)²⁾

| | | (thousands of transactions, billions of KRW, %) | | | |
|-----------------------------|-----------------------------|---|-------|-------|----------|
| | | 2019 | 2020 | 2021 | % change |
| Device Present Payments | (Physical Card) | 1,355 | 1,255 | 1,282 | 2.2 |
| | (Mobile Device or Computer) | 122 | 139 | 152 | 9.7 |
| | Total | 1,477 | 1,394 | 1,434 | 2.9 |
| Device Not Present Payments | | 728 | 849 | 986 | 16.2 |
| Total | | 2,205 | 2,242 | 2,421 | 8.0 |

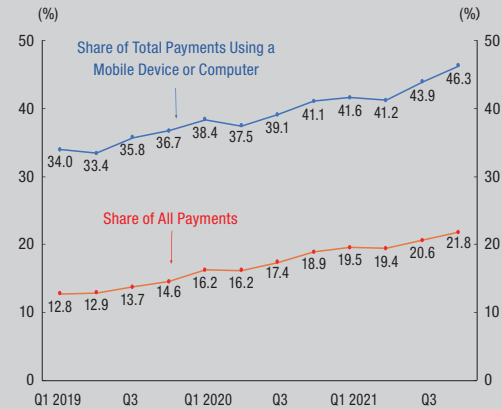
Notes: 1) Based on credit cards and check card transactions

2) Card transactions at accepting merchants by individuals and companies (estimated value).

Sources: Stand-alone card companies, banks and bank subsidiaries issuing payment cards, KFTC

Meanwhile, among mobile or computer-based payment services, the use of “easy payment services”³⁾ has steadily gained ground due to their convenience.

Card-based Easy Payment Services¹⁾



Note: 1) Based on credit card and check card transactions.

Source: Bank of Korea

2) In 2020, out of a total of KRW 14.2 trillion distributed as Emergency Disaster Relief Funds, KRW 1.84 trillion was issued in the form of prepaid cards. In 2021, out of a total of KRW 10.7 trillion distributed as “COVID-19 National Support Funds” (excluding additional amounts subsequently paid to those that were initially excluded from payments in error), KRW 1.11 trillion was issued as prepaid cards.

3) Payment services for goods and services, provided using card information stored in the service provider’s database, requiring simple authentication, i.e., passwords or biometrics, such as fingerprints or face recognition.

3. CLS System

Payment Trends

Foreign exchange transactions are settled either through the interbank correspondent banking network, the CLS system,¹²⁾ or the domestic foreign currency funds transfer system.¹³⁾ In 2021, the daily average value of foreign exchange transactions settled through the CLS system on a payment-versus-payment (PvP) basis¹⁴⁾ increased 4.0% from a year earlier, to USD 75.3 billion.

Table II-9. Settlement Value on the CLS System¹⁾ (daily average)

| 2018 | 2019 | 2020 | 2021 | (billions of USD, %) |
|------|------|------|------|----------------------|
| | | | | % change |
| 65.4 | 74.3 | 72.4 | 75.3 | 4.0 |

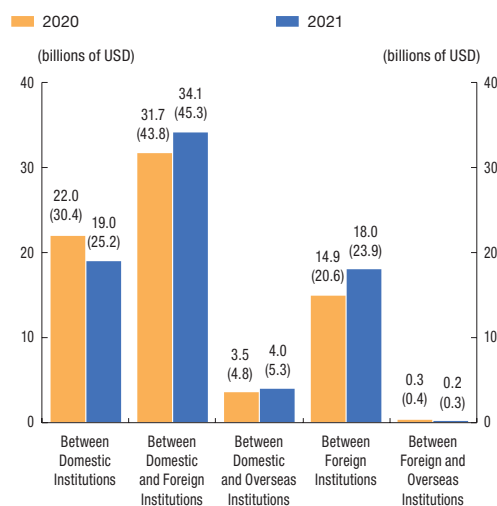
Note: 1) Based on the aggregate value of foreign exchange spot, forward, and swap transactions reported by financial institutions (gross value before multilateral netting).

Source: Bank of Korea

By type of counterparty,¹⁵⁾ settlement between domestic and foreign institutions accounted

for the highest share of 45.3% out of the total number of CLS settlements, followed by settlements between domestic institutions (25.2%), and then those between foreign institutions (23.9%), in that order.

Figure II-11. CLS Settlements by Transaction Counterparty¹⁾²⁾ (daily average)



Notes: 1) Based on the aggregate value of foreign exchange spot, forward, and swap transactions reported by financial institutions (gross value before multilateral netting).

2) Figures inside () are the percentage shares in total settlement.

Source: Bank of Korea

12) To eliminate problems arising from the fact that different countries operate in different time zones, a root cause of foreign exchange settlement risk, the CLS Bank set a common settlement window (07:00-12:00 Central European Time (CET)) for the operation of its PvP foreign exchange settlement system, during which most transactions are settled. CLS (Continuous Linked Settlement) refers to a funds transfer process for making and receiving payments in which the accounts of member banks and the CLS Bank at central banks of eligible currencies are linked in such a way that settlement takes place continuously in real time. The CLS system is currently linked with the large-value payment systems of central banks for 18 CLS currencies (i.e., BOK-Wire+), including the U.S. dollar, the euro, and the Japanese yen.

13) Systems operated by domestic institutions (Hana Bank, Kookmin Bank, Shinhan Bank, Woori Bank) that offers foreign currency deposit accounts in U.S. dollars, euros, Japanese yen, and a number of other currencies to allow other banks to conduct foreign currency funds transfers. Using these systems, foreign currencies funds can be transferred in local time in Korea. Since November 2014, Chinese yuan/renminbi (CNY) transfers have been processed through the Seoul branch of the Bank of Communications, acting as a dedicated renminbi clearing bank.

14) The discussion of foreign exchange settlements in this report is centered on PvP settlement through the CLS system due to the availability of accurate transaction data.

15) Counterparties are classified into three categories, including domestic institutions (domestic banks and financial investment companies), foreign institutions (domestic branches of foreign banks and financial investment companies), and overseas institutions (foreign banks and financial investment companies located outside Korea).

As of the end of 2021, the CLS system serves over 28,000 financial institutions from 22 countries worldwide, including 46 domestic institutions (17 domestic banks, 9 domestic financial investment companies, 19 domestic branches of foreign banks, and one domestic branch of a foreign financial investment company). In 2021, another domestic financial investment company (Kiwoom Securities) joined the CLS system.

Table II-10. Local Participants in the CLS System

(End of 2021)

| Counterparty Type | | Institutions |
|-------------------|------------------------------------|---|
| Domestic | Banks (17) | Kookmin Bank, Nonghyup Bank, Kwangju Bank, Daegu Bank, Hana Bank, Suhyup Bank, Export-Import Bank of Korea, Busan Bank, Jeonbuk Bank, Kyongnam Bank, Korea Development Bank, Industrial Bank of Korea, Woori Bank, Shinhan Bank, Jeju Bank, Standard Chartered Bank Korea, Citibank Korea |
| | Financial Investment Companies (9) | Samsung Securities, Mirae Assets, NH Investment & Securities, Korea Investment and Securities, Meritz Securities, Shinhan Investment, KB Securities, Hana Financial Investment, Kiwoom Securities |
| Foreign | Banks (19) | HSBC, BOA, BNP Paribas, SMBC, ING, Morgan Stanley, Credit Agricole, JPMorgan Chase & Co, MUFG, Credit Suisse, Deutsche Bank, DBS, BNY Mellon, State Street, Societe Generale, United Overseas Bank, Bank of China, Mizuho Bank, ANZ |
| | Financial Investment Companies (1) | Nomura Financial Investment |

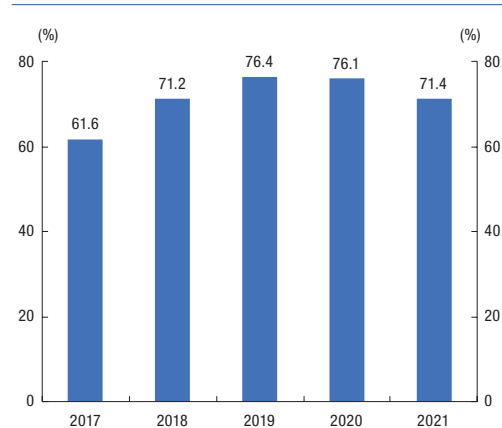
Source: Bank of Korea

Risk Management Status

A growing presence of PvP settlement among foreign exchange transactions leads to a proportional decrease in risk associated with the separate settlement of the two legs of a trans-

action. In 2021, the share of PvP settlements among the total foreign exchange transactions slipped by 4.7%p from the year earlier (76.1% to 71.4%).

Figure II-12. Share of FX Transactions Settled in CLS¹⁾²⁾ (daily average)



Notes: 1) Share of transactions settled in CLS relative to all CLS-eligible transactions.

2) Based on transactions by domestic banks and branches of foreign banks.

Source: Bank of Korea

Meanwhile, the CLS system uses a multilateral netting process to offset foreign exchange receivables against payables, which results in significant liquidity savings. In 2021, the rate of liquidity savings for financial institutions from the use of the CLS system¹⁶⁾ amounted to an estimated 97.6%.

16) Liquidity savings rate (%) = $[1 - (\text{net settlement value} / \text{gross settlement value})] \times 100 = (\text{liquidity savings} / \text{gross settlement value}) \times 100$

4. Securities Settlement Systems

Settlement Trends

In 2021, the daily average value of securities settled through the systems operated by the KRX and the KSD reached KRW 221.7 trillion, representing an 8.1% increase from 2020. The daily average settlement value in the exchange markets rose 8.4% to KRW 3.6 trillion. The daily average settlement value of OTC transactions was lifted by 8.1% to KRW 218.0 trillion on the increase in the settlement of inter-institutional repos (+6.8%).

Table II-11. Settlement Value in Securities Settlement Systems (daily average)

| | | (billions of KRW, %) | | | |
|-----------------|--|----------------------|---------|---------|----------|
| | | 2019 | 2020 | 2021 | % change |
| Exchange-traded | Stocks | 484 | 758 | 945 | 24.7 |
| | Bonds ¹⁾ | 1,898 | 2,413 | 2,568 | 6.4 |
| | Derivatives | 108 | 195 | 135 | -30.6 |
| | Subtotal | 2,489 | 3,366 | 3,648 | 8.4 |
| OTC | Stocks ²⁾ | 669 | 915 | 1,108 | 21.0 |
| | Bonds ³⁾ | 10,508 | 12,399 | 12,120 | -2.2 |
| | Inter-institutional Repos | 155,271 | 169,422 | 180,953 | 6.8 |
| | Money Market Instruments ⁴⁾ | 10,061 | 9,964 | 13,338 | 33.9 |
| | Collective Investment Securities ⁵⁾ | 7,357 | 8,961 | 10,424 | 16.3 |
| | Derivatives ⁶⁾ | 45 | 66 | 65 | -1.6 |
| | Subtotal | 183,911 | 201,727 | 218,008 | 8.1 |
| Total | | 186,400 | 205,093 | 221,656 | 8.1 |

Notes: 1) Settlement value of government bonds (including repos) and corporate bonds.

2) Value settled between financial investment companies and institutional investors.

3) Final settlement value after netting receivables and payables in chain settlement.

4) Final settlement value of certificates of deposit (CD), commercial paper (CP), and electronic short-term bond transactions after continuously netting receivables and payables in chain settlement.

5) Value based on both subscription and redemption transactions.

6) Eligible IRS value settled through KRX.

*A settlement method in which transactions between participants buying and selling shares of the same securities engaged in a chain of transactions are settled as a single transaction instead of multiple transactions.

Source: KSD, KRX

Risk Management Status

In 2021, settlement risk in the securities settlement systems, whether associated with the failure to deliver securities or to submit payment by the deadline, or to simultaneously exchange securities and payments, generally remained low.

All exchange-traded stock transactions were settled by the penalty deadline. On the other

hand, two transactions, one exchange government bond transaction and one institutional OTC stock transaction, were settled after the applicable penalty deadline. However, the value of the transactions settled past the deadline represented only an infinitesimal share of total settlement value (0.57% of the total exchange-traded government bond transactions, 0.001% of the total OTC stock transactions by institutional investors, respectively).

Table II-12. Proportion of Securities Settlements Completed After Deadline

| Type | Payment Deadline ¹⁾ | Penalty Deadline ²⁾ | (number of instances) | | |
|--|--------------------------------|--------------------------------|-----------------------|------|------|
| | | | 2019 | 2020 | 2021 |
| Exchange-Traded Stocks | 16:00 | 16:00 | 0 | 0 | 0 |
| Exchange-Traded Government Bonds | 16:00 | 17:00 | 0 | 0 | 2 |
| Institutional Investors for OTC Stocks | 16:50 | 16:50 | 3 | 0 | 2 |

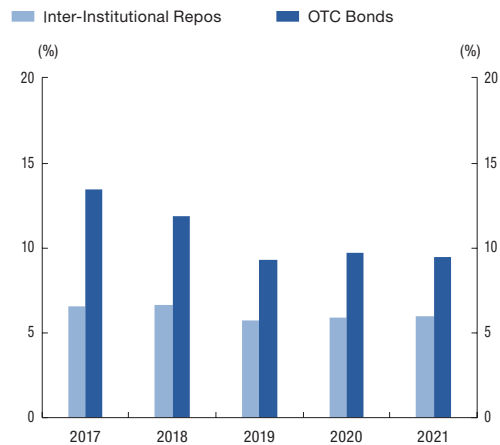
Notes: 1) Settlement deadline under the system operating rules.

2) Deadline after which penalties for late settlement are assessed.

Source: Bank of Korea

In 2021, the share of inter-institutional repo and OTC bond transactions settled on a free-of-payment (FoP) basis¹⁷⁾ was mostly stable from the year earlier at 5.9% and 9.5%, respectively.

Figure III-13. Proportion of FoP in OTC Transactions¹⁾²⁾



Notes: 1) Proportion of settlement value not made through BOK-Wire+ (DvP) among total settlement value.

2) OTC bonds include CDs, CPs, and electronic short-term bonds. (based on final settlement after chain netting*)

*A settlement method in which transactions between participants buying and selling shares of the same securities engage in a chain of transactions are settled as a single transaction instead of multiple transactions.

Source: KSD

17) FoP is a settlement method in which the delivery of securities is not linked to the corresponding transfer of funds, which carries settlement risk due to the time lag between the delivery and payment legs, unlike DvP transactions.

III

Future Policy Directions

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1. Expanding and Enhancing the Safety of Payment and Settlement Infrastructures

Plan to Introduce an RTGS-based Fast Payment System

In addition to the large-value payment system, a growing number of central banks have started to directly operate real-time gross settlement RTGS-based fast payment systems. Even in jurisdictions such as the U.S., the Eurozone, and Sweden, where similar systems are already in operation by private-sector institutions, additional RTGS fast payment systems operated by the central bank have recently been introduced or is in the process of being introduced. This points to a shift away from the paradigm that RTGS is a settlement method reserved for central banks' large-value payment systems while for retail payments, deferred net settlement (DNS) would be the general settlement method.¹⁾

Going forward, as more countries introduce RTGS-based fast payment systems, RTGS will also likely become the preferred method for cross-border interlinking of fast payment systems. Given the many practical challenges of interlinking systems that are based on different settlement methods, it is also important for Korea to start preparing for initiatives of

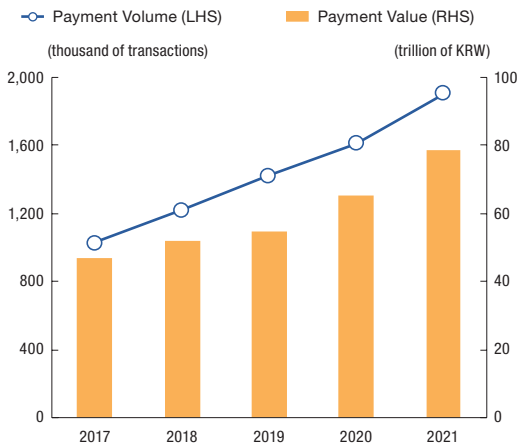
interlinking RTGS-based fast payment systems.

In Korea, its Electronic Banking System, the world's first real-time customer-to-customer funds transfer system operating around the clock and year-round, was launched in 2001. However, this system, in which funds are paid to recipients (customers) before net settlement occurs between sending and receiving banks, exposes its participants to credit risk until the following business day (11:00 a.m.) when their credits and debits are settled.

The effective management of credit risk, which is especially critical in a country like Korea where the use of internet banking and mobile banking is nearly ubiquitous, has gained further importance since early in the pandemic (after 2020) as the growing demand for non-contact, non-face-to-face electronic payments has caused a sharp surge in the volume of transactions in the Electronic Banking System.

1) Payment and settlement systems are divided into large-value payment systems and retail payment systems according to the type of settlement transactions. Large-value payment systems are generally used to settle high-value transactions for which the timing of settlement matters critically, such as funds transfers, securities or foreign exchange transactions settlement etc. between financial institutions. Retail payment systems, on the other hand, are used to process funds transfers by individuals and businesses, which tend to be small-value transactions occurring in high volumes. Notwithstanding, the boundaries between large-value and retail payment systems are becoming increasingly vague as in some countries like Mexico and Switzerland, an integrated RTGS system handling both large and small-value payments has been introduced.

Figure III-1. Payment Value in the Electronic Banking System (daily average)



Source: Bank of Korea

To prepare for potential cross-border interlinkings of payment and settlement systems and to reduce credit risk in domestic systems, the BOK will be developing a plan to implement an RTGS-based fast payment system. The BOK will closely monitor developments related to the introduction of fast payment systems in other countries²⁾ and international discussions on the cross-border interlinking of payment systems, while also increasing external communication regarding its plans and progress in the implementation of an RTGS-based fast payment system.

Introduction of the International Financial Messaging Standard ISO 20022

Financial institutions conduct fund transfers in connection with a securities or foreign ex-

change transaction etc. by sending and receiving payment messages through payment and settlement systems. Payment and settlement systems most often use their own proprietary messaging formats that are designed for the types of transactions they handle and are adapted for their specific payment environment.³⁾ This is also the case with BOK-Wire+, which uses a proprietary messaging format that is customized for payments in Korean won between domestic financial institutions.

However, as advances in globalization have caused a rapid expansion in the volume of cross-border payments, it has become increasingly necessary to improve the international interoperability of payment systems' messaging formats. This is because when two payment systems using two different messaging formats send and receive messages to and from each other for cross-border payments, these messages need to be converted into a format that is readable by the other system. The process of message conversion can often lead to data truncation and require additional manual work by staff, resulting in inefficiency.

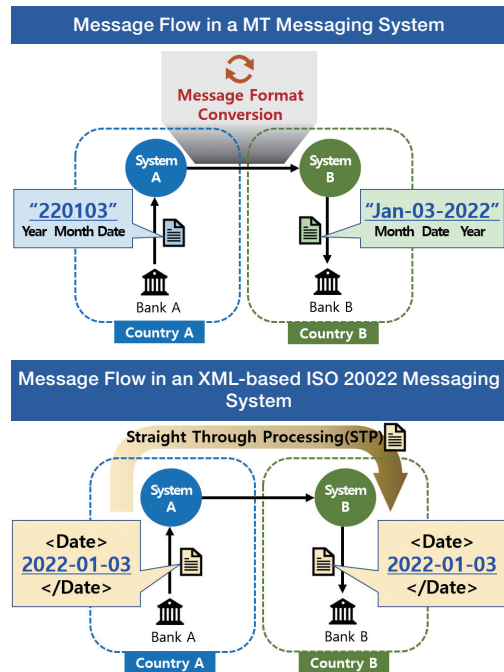
Accordingly, in 2020, a task force composed of international organizations including the BIS and the FSB, elected to adopt a harmonized ISO 20022 version for message formats as a cooperative task for enhancing cross-border payments.⁴⁾ ISO 20022 is a global message standard for communications across financial sectors, including payment and settlement,

2) The BOK conducted case studies on some countries where an RTSG-based fast payment system is already in place or in the process of implementation (the Eurozone, USA, Australia, Sweden, Hong Kong, Hungary and Brazil) and published the results as a book in August 2021.

3) In some developing countries (e.g. Ghana, Bangladesh, etc.), the SWIFT messaging format, which is optimized for international financial transactions, was adopted from the outset, at the time when their payment and settlement systems were first established.

securities transactions, and foreign exchange, etc. As the adoption of ISO 20022 increases the international interoperability of financial messages, it can also enable straight through processing (STP),⁵ in other words, the end-to-end automation of the processing of financial transactions from the sender to the recipient, which dramatically enhances the efficiency of processing international transactions. Moreover, unlike conventional text-based messages, ISO 20022 message format is based on XML,⁶ a markup language allowing easy expansion and extraction of data in a message. As this makes it possible to include more information about senders and recipients of funds in a financial message, this format enables financial institutions to respond more effectively to tightening global regulations, including anti-money laundering regulations.

Figure III-2. Comparison of Messaging Formats (example)



Source: Bank of Korea

In many countries, active efforts are currently underway toward the adoption of ISO 20022. In 23 of the 26 member countries of the BIS's CPMI, except for Korea, Turkey, and Mexico, all have either already migrated to ISO 20022 or are in the process of migration. According

4) In "Enhancing cross-border payments: Stage 3 roadmap," published in October 2020, the BIS and the FSB selected "adopting a harmonized ISO 20022 version for message formats" as one of the core tasks ("building blocks"). This building block includes "development of country-level plans for the adoption of global ISO 20022 standards for cross border payments" as one of its action plans.

5) Under this method, when a customer places a payment order (with the required information, including amount, name, account number, and address of the recipient) with their bank, the funds transfer is automatically processed without any further intervention from the receiving bank or the recipient. This makes STP vastly more efficient than the conventional funds transfer process.

6) XML, the abbreviation for extensible mark-up language, is a programming language that declares what constitutes a markup in a document through the use of tags placed before and after each data item (i.e., <name> Kim </name>). Conventional text messages that are currently in use contain only text-type message values, and the meaning is determined based on the order of the values and the number of digits. For this reason, it is difficult to include additional transaction information in these message formats. With an XML-type message, on the other hand, new data (i. e., invoice numbers) can easily be attached by simply adding another tag (The BOK currently uses conventional text message format).

to a study conducted by SWIFT,⁷⁾ by 2025, ISO 20022 messages are expected to account for 87% of the total amount of settlement value in large-value payment systems worldwide and 53% of the payment value in retail systems. ISO 20022 is also the standard used for the cross-border linking of payment systems, a global initiative rapidly gaining traction recently.⁸⁾

Table III-1. Adoption of ISO 20022 in Many Economies¹⁾²⁾

| | Large-value Payment Systems | Retail Payment Systems |
|------------------------|---|--|
| Adopted | India (2014) Japan (2015) China (2015) Switzerland (2016) | Japan (2011) Sweden (2012) Switzerland (2016) Eurozone (2018)3) Australia (2018) Hong Kong (2018) Brazil (2020) Saudi Arabia (2021) Indonesia (2021) Argentina (2021) |
| Planned | Singapore (2022) Eurozone (2022)3) Canada (2022) South Africa (2022) USA (2023) UK (2023) Hong Kong (2023) Indonesia (2023) Russia (2023) Australia (2024) | USA (2023) |
| Not Adopted or Planned | Republic of Korea, Mexico, Turkey | |

Notes: 1) Based on BIS-CPMI member countries (26 countries).

2) Figures inside () are the planned years of migration.

3) Germany, France, Italy, the Netherlands, Belgium, and Spain.

Source: Bank of Korea

In Korea, the option of introducing ISO 20022 in BOK-Wire+ is currently under consideration by the BOK. In 2019, as a preparatory step, gap analysis was performed with the help of external consultants. In 2021, a survey of BOK-Wire+ participants was conducted to gather their views about migration to ISO 20022, while research was carried out on ISO 20022 migration strategies in other countries. Going forward, the BOK will develop a detailed plan to introduce ISO 20022 that contains the specific scope and method of migration in consultation with BOK-Wire+ participants, and also actively take part in discussions around BIS and other international organizations.

Enhancing the Safety of the Open Banking System

The recent surge in the volume of settlements made on the Open Banking System has commensurately increased its impact on the overall payment and settlement systems. To strengthen the safety of the Open Banking System, the BOK plans to designate it as a system subject to settlement finality and as a systemically important payment and settlement system (SIPs), while also taking steps for the improvement of its business process and policy participation.

7) As the ISO 20022 registration authority, SWIFT plays a leading role in practical standardization efforts, for example, by storing and managing all the elements generated during the development of an ISO 20022 message (messaging format, elements, business models, etc.) in order to prevent redundant messages.

8) ISO 20022 has either been adopted or is planned to be adopted in payment system interlinking projects including the cross-border interlinkage of Singapore's PayNow and Thailand's PromptPay (the first project in the world to link two fast payment systems), the cross-border interlinkage of Switzerland's euroSIC and the ECB's TARGET2/STEP2, the Nexus platform of the BIS Innovation Hub (Singapore), Deutsche Bundesbank's Amplus platform, and the P27 Nordic Payment Platform, etc.

(Settlement Finality)

In 2022, the BOK plans to designate the Open Banking System as a system subject to settlement finality. Its bylaws will be appropriately amended so that the system meets the eligibility requirements⁹⁾ for settlement finality under the Enforcement Decree of the Debtor Rehabilitation and Bankruptcy Act. Moreover, the system architecture will be modified so that the net obligations of its participants, which were previously calculated by combining them with obligations accrued in other systems within the Electronic Banking System, can be calculated separately. The procedure for the designation of the Open Banking System as a system subject to settlement finality will be completed after consultation with the Financial Services Commission as required under the Debtor Rehabilitation and Bankruptcy Act¹⁰⁾¹¹⁾.

Table III-2. Payment and Settlement Systems Designated for Settlement Finality

| Operator | System |
|--------------------------------------|---------------------------------|
| BOK | BOK-Wire+ |
| KFTC | Electronic Banking System |
| | Interbank Funds Transfer System |
| | CD/ATM System |
| | Check Clearing System |
| | Giro system |
| Cash Management Service (CMS) System | |
| CLS Bank | CLS system |

Source: Bank of Korea

(Designation as a Systemically Important Payment and Settlement Systems)

During 2022, the Open Banking System will be designated as a systemically important payment and settlement systems through approval by the Monetary Policy Board. As a system designated as a SIPSs is biennially assessed by the BOK and receives recommendations for necessary improvements, this is expected to help enhance the safety and efficiency of the Open Banking System.

9) Eligibility requirements for a system to be designated for settlement finality under Article 6 of the Enforcement Decree of the Debtor Rehabilitation and Bankruptcy Act are as follows: ① A payment and settlement system in which the default of one or more participants can trigger a chain of defaults among other participants and whose volume of settlements and method for processing funds transfers are such that the lack of settlement finality can have seriously disruptive consequences on the normal operation of broader financial markets; ② a system with operating rules that provide for necessary matters related to settlement finality, including the time frame in which a payment becomes final and can no longer be canceled; ③ a system in which Korean won transfers between participants are carried out using funds in their Korean won current accounts with the BOK or other settlement assets that are free of credit or liquidity risk; and ④ a system satisfying other requirements deemed necessary by the Governor of the Bank of Korea in order to limit settlement risk and ensure the stability of payment and settlement systems.

10) Article 120 of the Debtor Rehabilitation and Bankruptcy Act requires the BOK to consult with the Financial Services Commission when designating a system for settlement finality.

11) In November 2021, a plan to designate the Open Banking System as a system subject to settlement finality was submitted for discussion by an advisory group composed of government officials, members of academia, and financial experts. The consensus among the members of the advisory group was that given the systemic importance of the Open Banking System, its designation was desirable and necessary.

(Improvement of Participation Policy)

The policy for participation in the Open Banking System will be amended to permit its access by fintech companies that are properly licensed and authorized for payment services in accordance with the principle of “same business, same risks, same rules.” This is expected to reduce the risk posed to the safety and confidence of the Open Banking System, which is accessible by companies that are not appropriately regulated by related laws.

(Improvement of Business Processes)

A plan is also in progress to enhance the business processes of the Open Banking System. Currently, in the Open Banking System, when a customer requests a funds transfer through the mobile banking system of Bank A to send funds from an external account held at Bank B to a customer of Bank C (a third-party transfer), such a transfer is handled through a two-tier process of pulling funds from one bank and then pushing them to another (B→A→C). This overly complicated way of processing funds transfers is liable to increase operational risk for all banks involved. Therefore, it was decided that the system design will be revised to simplify the process into a single-tier process (B→C).

2. Facilitating Innovation and Development of Payment and Settlement Systems

Follow-up CBDC Simulation Research and Creation of a Strong Technical and Institutional Basis

As part of its response to the rapid digitalization of the economy, the BOK will step up research on technical and institutional requirements of a CBDC system ahead of any potential introduction of a CBDC.

To build a solid technical foundation for a CBDC system, the BOK plans to devote sufficient time to trials and testing by conducting extensive follow-up simulation research from various angles. After the completion of the phase 2 of the simulation at the end of June 2022, the scope of simulation will be extended to include tests involving external participants such as financial institutions. By linking with trial systems of financial institutions, the CBDC simulation system will test stable payments and funds transfers between users.

Meanwhile, a growing variety of CBDC architectures and system designs are being proposed internationally. Therefore, keeping its focus on the comprehensive assessment of the current simulation results, CBDC research will narrow in on those system architectures and designs that are most likely to be applied to actual CBDC systems and their enabling technologies. A CBDC architecture and design that are best adapted to Korea's financial and economic environment need to be identified.

The scope of the CBDC research will also include a careful analysis of the impacts of the CBDC on the broader financial and economic environment, including the financial industry and monetary policy. The results of this analysis, which will help the BOK anticipate and respond to the impacts a CBDC could have on the macroeconomy and the financial system if and when a CBDC is ever introduced, will be actively reflected in the design of the CBDC model.

Increasing CBDC-related Communication and Continuous Cooperation

The final decision to introduce a CBDC must not only be preceded by a thorough examination of all relevant technical and institutional considerations, but also by the development of social consensus. As the CBDC project moves along, the BOK will actively share its progress with the Korean public to help improve their understanding of the CBDC.

At the same time as releasing a report on the results of CBDC research so far completed during the second half of 2022, the BOK plans to hold conferences and briefings on payment and settlement systems as part of an effort to increase external communication. This will be coupled with a close monitoring of the latest research and development trends through information exchange and cooperation with central banks worldwide and international organizations. The BOK also intends to actively participate in international discussions on the interlinking of national payment systems since the CBDC can potentially be used for cross-border payments.

Sustained Efforts for Enhancement of the Access and Usability of ATM Systems

To prevent any aspect of the widespread use of digital payment solutions leading to a shrinkage of the ATM network, the BOK plans to work with the financial sector to continuously enhance access and usability of ATM systems.

The Committee on Financial Informatization Promotion (CFIP) will be discussing with banks about an interbank arrangement for cooperative operations of ATMs based on the ATM database created in November 2021. This arrangement, allowing banks to share information about their ATM operating strategies with other banks, can help reduce redundant or excessive investment in related projects and any sudden closure of ATM access locations. The CFIP will, moreover, explore ways to encourage banks to operate more ATMs in rural and other underserved areas, such as a tiered schedule for ATM fees paid and received between them.¹²⁾ Also on the agenda is examining the possibility of introducing a new type of ATM jointly operated by the banking sector.¹³⁾

In addition, to alleviate the burden associated with operating additional ATM locations on the banking sector at the same time as enhancing the ease and convenience of access to cash for the public, the BOK plans to pro-

mote the use of ATM alternatives such as cash withdrawals from stores.¹⁴⁾

12) When a customer uses an out-of-network ATM operated by another bank, the customer's bank pays a fee to the ATM operating bank. A tiered fee schedule in which ATM operators charge higher than normal fees for the use of ATMs in underserved areas should give banks incentives to operate more ATMs in these areas.

13) The multi-bank ATMs in pilot operation by Kookmin, Shinhan, Woori, and Hana Banks (begun in August 2020) have shown a number of drawbacks, including the inability to update passbooks and the unavailability of bank-specific services provided by proprietary ATMs operated by individual banks.

14) A cash withdrawal service offered to retail customers in which an amount is added to the purchase price of goods paid by a debit card and the customer receives this amount in cash (up to KRW 100,000 per transaction and per day). This service is currently available at the CU and Emart24 convenience stores.

3. Strengthening Oversight of Payment and Settlement Systems

Strengthening Oversight in Anticipation of Changes in the Payment and Settlement Environment

As digital transformation gains pace in the financial industry, the influence of big tech companies has increased commensurately.

Big tech companies provide payment services to their customers most often by linking with existing service providers such as banks and card companies. Because of this, there is a strong potential for risks associated with payment services by big tech companies spilling over to the providers of interlinked service. Furthermore, it is also possible that the financial platforms of big tech companies will evolve in the future into independent systems, completely disconnected from payment and settlement systems. Another major concern is that as big tech companies' proprietary technologies and network effects further boost their market power, this could lead to problems such as price discrimination, entry barriers, and data privacy breaches.

There is currently a growing consensus among international organizations, including the BIS, that central banks need to conduct an in-depth analysis of the risks associated

with payment services by big tech companies, and strengthen their oversight with respect to these services.

To enhance the safety and efficiency of payment and settlement systems and to ensure the safety of emerging payment service platforms, the BOK will decide on an oversight approach for payment services by big tech firms by referring to cases from the BIS and other international organizations and central banks. Concretely, the BOK will examine issues such as the methodology of assessing risks associated with payment services by big tech companies, the designation of their payment platforms as systems subject to oversight, and conducting examinations on these payment platforms, jointly with the FSS.

Meanwhile, policy tools available to the BOK under the current Bank of Korea Act¹⁵⁾ are limited to proactively respond to rapid changes in the payment and settlement environment. Bills to amend the Bank of Korea Act are currently pending in the National Assembly.¹⁶⁾ To allow the BOK to more efficiently carry out its oversight of payment and settlement systems, these bills seek to introduce clarity to its roles and responsibilities and grant greater oversight power to it. To help ensure that these amendment initiatives lead to the desired outcome of providing a legal basis necessary for it to proactively respond to potential risks stemming from changes in the payment and settlement environment, the BOK plans to take an

15) Article 81 of the Bank of Korea Act confers upon the BOK the right to demand information from the operators of payment and settlement systems and the right to request them to improve their operating standards and the right to demand information from the participants in BOK-Wire+, but not the tools to enforce their compliance with its demands.

16) Two amendment bills, introduced by National Assembly representative Yang kyung-sook (in November 2020) and National Assembly representative Kim Ju-young (in February 2021), respectively, are currently pending.

active part in related legislative discussions.

Table III-3. Key Amendments Proposed to the Bank of Korea Act

| | Amendment Bill by Yang Kyung-sook | Amendment Bill by Kim Ju-young |
|---|--|---|
| Power to Make Standards and to Issue Directions | <ul style="list-style-type: none"> • Power to make standards and power to issue directions to be complied with by operators of payment systems and of securities settlement systems | <ul style="list-style-type: none"> • Power to make risk management standards and power to issue directions to be complied with by operators of payment systems |
| Oversight Tools | <ul style="list-style-type: none"> • Power to obtain information¹⁾ • Power to ask for a joint examination with a supervisory authority | <ul style="list-style-type: none"> • Power to obtain information²⁾ • Power to conduct examinations and on-site inspections |
| | — | <ul style="list-style-type: none"> • Power to recommend to the operators that they take enforcement action³⁾ |
| Duty to Report to National Assembly | — | <ul style="list-style-type: none"> • Duty to report to National Assembly |

Notes: 1) Applying to operators and participants of payment systems or securities settlement systems.
 2) Applying to operators of payment systems or securities settlement systems and participants of BOK-Wire+. (same as under the current law)
 3) Disciplinary actions with respect to staff compliance failures, e.g., refusal, obstruction or avoidance of directions, requests for information, inspections, etc. without justifiable reasons.

Source: Bank of Korea

Strengthening Assessment of Payment and Settlement Systems to Enhance the Response Capacity to IT Operation Risk

The rise in the outsourcing of IT service, re-

sulting in greater reliance on external service provides, together with deregulation of separating internal and external networks during the COVID pandemic in order to facilitate work-from-home arrangements, has increased the vulnerability of payment and settlement systems to hacking attacks, as well as substantially their overall cyber security risk. This has made strengthening their response capacity to IT operational risk more critical than ever. The BOK therefore decided to develop and improve its assessments of cyber resilience¹⁷⁾ and cyber risks of the domestic payment and settlement systems.

In 2021, the CPMI-IOSCO carried out cyber resilience assessments on 37 payment and settlement systems in 28 countries with respect to their operational risk management in the IT area. The assessments were in-depth evaluations focused on specific areas¹⁸⁾ of “Guidance on Cyber Resilience for Financial Market Infrastructures.”¹⁹⁾ These assessments were moreover combined with the evaluation to address cyber risk arising from the increased remote working arrangements. Meanwhile, through its participation in the Cyber Resilience Assessment Team under the CPMI-IOSCO, the BOK has gained privileged knowledge of assessment items and techniques, as well as implementation efforts regarding diverse FMI’s cyber resilience. The knowledge thus gained will be put to constructive use in the BOK’s assessment work on domestic pay-

17) Cyber resilience, which refers to the ability to rapidly respond to security incidents caused by hacking and other types of cyberattacks to minimize disruptions and damage (system outages and errors, data breaches, etc.), has gained further importance since the pandemic, amid the widespread use of work-from-home arrangements.

18) The assessments were focused on 85 assessment items in three areas including governance, testing, and learning & evolving.

19) This guidance sets forth 60 assessment items across eight areas including governance, identification, protection, detection, response and recovery, testing, situational awareness, and learning & evolving.

ment and settlement systems.

The BOK has also joined the Cyber Security Working Group operated under the BIS Innovation Hub for the sharing of cyber risk-related status and experiences. The working group is currently conducting research into the latest security and monitoring technologies to prevent cyber security incidents within the work-from-home environment. The BOK plans to actively apply the results of this research to its assessments of cyber risk among domestic payment and settlement systems.

Annex

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1. Payment and Settlement Systems Designated for Settlement Finality

a. Payment and settlement systems subject to settlement finality, as designated by the Governor of the BOK in consultation with the FSC pursuant to Article 120(1) and 336 of the Debtor Rehabilitation and Bankruptcy Act

| Operator | System | Operating Rules | Effective Date and Time |
|----------|--------------------------------------|---|-------------------------|
| BOK | BOK-Wire+ | Regulations, Working Regulations, and Sub-regulations for the Operation and Management of Payment and Settlement Systems | Aug. 21, 2006, 09:30 |
| KFTC | Electronic Banking System | Regulations and Working Rules of the Electronic Banking System | Aug. 21, 2006, 07:00 |
| | Interbank Funds Transfer System | Regulations and Working Rules of the Interbank Funds Transfer System | Aug. 21, 2006, 09:30 |
| | CD/ATM System | Regulations and Working Rules of the CD/ATM Systems | Aug. 21, 2006, 07:00 |
| | Checks Clearing System | Regulations on Check Clearing, Regulations on Real-time Information Sharing on Cashier's Checks, Regulations on Electronic Bills, Regulations on Local LC Bills Clearing ¹⁾ , Regulations and Working Rules on Information Sharing on Business Purchase Loan Bills, Special Regulations on Check Clearing during Emergency and Disasters | Jan. 10, 2014, 00:00 |
| | Giro System | Regulations and Working Rules of the Giro System | |
| | Cash Management Service (CMS) System | Regulations and Working Rules of the Cash Management Service (CMS) System | |
| CLS Bank | CLS System | CLS Bank International Rules, Settlement Member Agreement | Aug. 21, 2006, 09:30 |

Note: 1) Limited to KRW and USD-denominated LC.

b. Clearing and settlement systems operated by entities providing clearing and settlement services for securities and derivatives transactions pursuant to the Financial Investment Services and Capital Markets Act or another law and other entities designated by the Presidential Decree (as referenced to in Article 120(2) and 336 of the Debtor Rehabilitation and Bankruptcy Act).

Clearing and settlement systems operated by the KRX and the KSD.

2. Statistics

A. Settlement Volume by Payment System

(daily average, thousands of transactions, %)

| | 2018 | 2019 | 2020 | 2021 | % change |
|-------------------------------------|--------|--------|--------|--------|----------|
| BOK-Wire+ | 18.0 | 19.9 | 20.8 | 22.2 | 6.7 |
| Retail Payment Systems | 22,812 | 25,505 | 27,878 | 32,614 | 17.0 |
| Checks Clearing System | 329 | 252 | 200 | 175 | -12.7 |
| Giro System | 4,437 | 4,301 | 4,193 | 4,120 | -1.7 |
| Interbank Shared Networks | 18,046 | 20,951 | 23,485 | 28,319 | 20.6 |
| (Electronic Banking System) | 12,178 | 14,236 | 16,114 | 19,041 | 18.2 |
| (Interbank Funds Transfer System) | 319 | 295 | 273 | 254 | -6.8 |
| (CD/ATM System) | 1,700 | 1,548 | 1,226 | 1,064 | -13.2 |
| (CMS System) | 3,764 | 3,839 | 3,798 | 3,913 | 3.0 |
| (Regional Bank Shared System) | 0.5 | 0.5 | 0.4 | 0.3 | -16.1 |
| (E-commerce Payment System) | 84 | 81 | 108 | 138 | 28.4 |
| (EFT/POS System) | 0.1 | 0.1 | 0.1 | 0.0 | -23.3 |
| (Open Banking System) ¹⁾ | - | 950 | 1,966 | 3,908 | 98.8 |

Note: 1) Based on data starting from December 2019

B. Settlement Value by Payment System

(daily average, billions of KRW, %)

| | 2018 | 2019 | 2020 | 2021 | % change |
|-------------------------------------|---------|---------|---------|---------|----------|
| BOK-Wire+ | 340,716 | 369,920 | 423,552 | 488,491 | 15.3 |
| Retail Payment Systems | 66,950 | 69,608 | 80,201 | 94,338 | 17.6 |
| Checks Clearing System | 8,002 | 7,661 | 7,254 | 7,039 | -3.0 |
| Giro System | 1,024 | 1,030 | 1,042 | 1,098 | 5.4 |
| Interbank Shared Networks | 57,925 | 60,917 | 71,906 | 86,201 | 19.9 |
| (Electronic Banking System) | 51,793 | 54,823 | 65,261 | 78,757 | 20.7 |
| (Interbank Funds Transfer System) | 4,793 | 4,679 | 5,191 | 5,504 | 6.0 |
| (CD/ATM System) | 892 | 818 | 722 | 655 | -9.3 |
| (CMS System) | 421 | 414 | 401 | 409 | 2.1 |
| (Regional Bank Shared System) | 10.6 | 8.3 | 5.7 | 4.8 | -14.8 |
| (E-commerce Payment System) | 14 | 13 | 15 | 18 | 25.2 |
| (EFT/POS System) | 0.0 | 0.0 | 0.0 | 0.0 | -20.6 |
| (Open Banking System) ¹⁾ | - | 162 | 310 | 853 | 174.9 |

Note: 1) Based on data starting from December 2019

C. Payments Made through BOK-Wire+

(daily average, number of transactions, billions of KRW, %)

| | 2018 | 2019 | 2020 | 2021 | % change | |
|---|--|---------|---------|---------|----------|-------|
| Volume | Funds Transfers Between Participants | 16,890 | 18,811 | 19,647 | 21,027 | 7.0 |
| | Call Settlement Funds | 564 | 468 | 387 | 342 | -11.7 |
| | (Call Transaction System) | 564 | 467 | 387 | 342 | -11.7 |
| | (General Funds Transfers) | 0 | 0 | 0 | 0 | -31.4 |
| | Securities Settlement Funds | 12,143 | 13,967 | 14,828 | 15,989 | 7.8 |
| | (DvP System) | 10,970 | 12,804 | 13,688 | 14,828 | 8.3 |
| | (Non-DvP Funds Transfers) | 1,173 | 1,163 | 1,140 | 1,161 | 1.9 |
| | Foreign Exchange Settlement Funds | 689 | 594 | 549 | 514 | -6.4 |
| | (CLS System) | 42 | 40 | 39 | 39 | -1.0 |
| | (Non-PvP Funds Transfers) | 647 | 554 | 510 | 475 | -6.8 |
| | Institutional Customer Settlement Funds | 2,398 | 2,668 | 2,769 | 2,978 | 7.5 |
| | (Beneficiary-designated Funds Transfers) | 870 | 887 | 916 | 957 | 4.5 |
| | (General Funds Transfers) | 705 | 787 | 736 | 731 | -0.7 |
| | (Linked Settlement) | 822 | 993 | 1,117 | 1,290 | 15.5 |
| | Net Settlement Funds | 244 | 241 | 239 | 237 | -0.9 |
| | Other | 852 | 874 | 875 | 967 | 10.5 |
| Funds Transfers Between BOK and Participants | 1,072 | 1,128 | 1,159 | 1,179 | 1.8 | |
| Treasury Funds Transfers ¹⁾ | 1,002 | 1,058 | 1,088 | 1,101 | 1.2 | |
| BOK Loans and Discounts | 24 | 23 | 23 | 26 | 11.4 | |
| Government and Public Bond Transactions ²⁾ | 46 | 47 | 47 | 52 | 11.4 | |
| Total Funds Transfers in Korean Won | 17,962 | 19,939 | 20,806 | 22,206 | 6.7 | |
| Total Funds Transfers in Foreign Currency ³⁾ | 7.3 | 7.2 | 7.3 | 7.2 | -0.9 | |
| Value | Funds Transfers Between Participants | 324,805 | 353,856 | 405,009 | 465,366 | 14.9 |
| | Call Settlement Funds | 23,531 | 21,070 | 21,579 | 20,603 | -4.5 |
| | (Call Transaction System) | 23,517 | 21,062 | 21,575 | 20,596 | -4.5 |
| | (General Funds Transfers) | 14 | 9 | 3 | 6 | 84.7 |
| | Securities Settlement Funds | 187,890 | 214,591 | 236,056 | 257,375 | 9.0 |
| | (DvP System) | 145,906 | 174,533 | 190,348 | 205,992 | 8.2 |
| | (Non-DvP Funds Transfers) | 41,984 | 40,058 | 45,708 | 51,382 | 12.4 |
| | Foreign Exchange Settlement Funds | 15,943 | 14,561 | 14,831 | 14,464 | -2.5 |
| | (CLS System) | 2,827 | 2,935 | 3,326 | 3,131 | -5.9 |
| | (Non-PvP Funds Transfers) | 13,116 | 11,625 | 11,505 | 11,333 | -1.5 |
| | Institutional Customer Settlement Funds | 45,329 | 50,228 | 63,162 | 73,602 | 16.5 |
| | (Beneficiary-designated Funds Transfers) | 14,374 | 14,177 | 14,894 | 17,746 | 19.1 |
| | (General Funds Transfers) | 22,459 | 26,173 | 35,841 | 40,701 | 13.6 |
| | (Linked Settlement) | 8,496 | 9,879 | 12,427 | 15,155 | 22 |
| | Net Settlement Funds | 18,056 | 18,112 | 22,451 | 25,889 | 15.3 |
| | Other | 34,056 | 35,295 | 46,930 | 73,435 | 56.5 |
| Funds Transfers Between BOK and Participants | 15,911 | 16,064 | 18,543 | 23,124 | 24.7 | |
| Treasury Funds Transfers ¹⁾ | 7,239 | 7,797 | 7,808 | 9,493 | 21.6 | |
| BOK Loans and Discounts | 1,536 | 1,377 | 2,252 | 3,463 | 53.8 | |
| Government and Public Bond Transactions ²⁾ | 7,137 | 6,890 | 8,484 | 10,168 | 19.9 | |
| Total Funds Transfers in Korean Won | 340,716 | 369,920 | 423,552 | 488,491 | 15.3 | |
| Total Funds Transfers in Foreign Currency (in millions of USD) ³⁾ | 707 | 676 | 1,002 | 1,128 | 12.6 | |

Notes: 1) Based only on transactions processed through BOK-Wire+ (investment of surplus funds, sales and redemption of investment assets, national tax payments).

2) Issue and redemption of government bonds and MSBs, and government and public bond sales transactions(including repurchase agreements) by the BOK

3) Including deposits and withdrawals.

D. Payment Volume and Value by Payment Instrument

(daily average, thousands of transactions, billions of KRW, %)

| | | 2018 | 2019 | 2020 | 2021 | % change |
|-----------------------------|---------------------------------------|--------|--------|--------|--------|----------|
| Volume | Checks and Bills | 502 | 381 | 308 | 271 | -11.9 |
| | Cleared via Check Clearing System | 329 | 252 | 200 | 175 | -12.7 |
| | Presented Directly at Issuer's Window | 165 | 121 | 100 | 89 | -10.8 |
| | Electronic Bills | 8.5 | 7.7 | 7.0 | 6.5 | -6.5 |
| | Account Transfers ¹⁾ | 21,749 | 24,560 | 27,156 | 31,967 | 17.7 |
| | Payment Cards | 58,621 | 65,053 | 63,273 | 66,900 | 5.7 |
| | Credit Cards | 36,197 | 40,685 | 39,211 | 42,044 | 7.2 |
| | (Purchases) | 35,967 | 40,462 | 39,034 | 41,882 | 7.3 |
| | (Cash Advances) | 229 | 223 | 177 | 162 | -8.6 |
| | Check Cards | 22,321 | 24,141 | 23,187 | 24,163 | 4.2 |
| | Prepaid Cards | 67 | 86 | 734 | 504 | -31.3 |
| | Debit Cards | 0.1 | 0.1 | 0.1 | 0.0 | -23.3 |
| IC Cash Cards ²⁾ | 35.9 | 141.3 | 141.8 | 189.5 | 33.7 | |
| e-Money | 3.0 | 1.0 | 0.5 | 0.1 | -75.8 | |
| Value | Checks and Bills | 19,461 | 17,267 | 18,240 | 18,900 | 3.6 |
| | Cleared via Check Clearing System | 8,002 | 7,661 | 7,254 | 7,039 | -3.0 |
| | Presented Directly at Issuer's Window | 10,359 | 8,344 | 8,703 | 7,975 | -8.4 |
| | Electronic Bills | 1,099 | 1,262 | 2,283 | 3,886 | 70.2 |
| | Account Transfers ¹⁾ | 58,774 | 61,779 | 72,801 | 87,152 | 19.7 |
| | Payment Cards | 2,536 | 2,669 | 2,669 | 2,909 | 9.0 |
| | Credit Cards | 2,031 | 2,131 | 2,109 | 2,312 | 9.6 |
| | (Purchases) | 1,862 | 1,967 | 1,960 | 2,160 | 10.2 |
| | (Cash Advances) | 169 | 165 | 149 | 152 | 2.0 |
| | Check Cards | 502 | 532 | 540 | 581 | 7.6 |
| | Prepaid Cards | 2.1 | 2.5 | 17.0 | 12.6 | -25.8 |
| | Debit Cards | 0.0 | 0.0 | 0.0 | 0.0 | -20.6 |
| IC Cash Cards ²⁾ | 1.4 | 2.4 | 2.3 | 2.8 | 24.6 | |
| e-Money | 0.0 | 0.0 | 0.0 | 0.0 | -90.0 | |

Notes: 1) Excluding account transfers via BOK-Wire+.

2) A kind of debit card launched in November 2021.

E. Usage of Electronic Banking

(daily average, thousands of persons, transactions and sheets, billions of KRW, %)

| | | 2018 | 2019 | 2020 | 2021 | % change | |
|--------------------------------|---------------------------------------|---------|---------|---------|---------|----------|-------|
| Internet Banking ¹⁾ | Number of Subscribers ²⁾³⁾ | 146,559 | 163,914 | 174,392 | 190,859 | 9.4 | |
| | (Individuals) | 137,382 | 153,904 | 163,576 | 178,942 | 9.4 | |
| | (Corporations) | 9,177 | 10,010 | 10,816 | 11,917 | 10.2 | |
| | Volume of Use | 10,240 | 12,721 | 14,680 | 17,321 | 18.0 | |
| | Value of Use | 47,488 | 48,814 | 58,997 | 70,554 | 19.6 | |
| Mobile Banking | Number of Subscribers ²⁾³⁾ | 104,734 | 121,976 | 135,080 | 153,369 | 13.5 | |
| | Volume of Use | 6,909 | 9,507 | 11,684 | 14,363 | 22.9 | |
| | Value of Use | 5,282 | 6,394 | 9,415 | 12,858 | 36.6 | |
| e-Money | Volume of Issuance ³⁾ | 17,360 | 17,495 | 16,122 | 16,251 | 0.8 | |
| | Value of Use | 0.01 | 0.00 | 0.00 | 0.00 | 0.0 | |
| Electronic Bills | Issuance | Volume | 7.0 | 6.4 | 5.8 | 5.4 | -6.9 |
| | | Value | 1,955 | 2,017 | 3,591 | 5,754 | 60.2 |
| | Discounts | Volume | 1.5 | 1.3 | 1.0 | 0.8 | -20.0 |
| | | Value | 71.9 | 62.5 | 49.0 | 46.0 | -6.1 |

Notes: 1) Including mobile banking. Some figures were revised to reflect corrections reported by source organizations.

2) Based on the customers of 19 domestic banks (including three internet-only banks) and Korea Post (postal banking). The total may include double-counting of customers subscribed to more than one bank's services.

3) End-of-year basis.

F. Usage of Easy Payment Services

(daily average, thousands of transactions, billions of KRW, %)

| | | 2018 | 2019 | 2020 | 2021 | % change |
|--------------------------------------|--|-------|--------|--------|--------|----------|
| Easy Payment Service ¹⁾²⁾ | Volume of Use | 6,573 | 10,073 | 14,539 | 19,812 | 36.3 |
| | Electronic Financial Service Providers | 2,567 | 4,244 | 7,475 | 11,237 | 50.3 |
| | (Credit Cards ³⁾) | 1,406 | 2,197 | 3,789 | 5,626 | 48.5 |
| | (Prepayment Means) | 996 | 1,770 | 3,250 | 4,964 | 52.7 |
| | (Account Transfers) | 165 | 278 | 435 | 648 | 49.0 |
| | Mobile Device Manufacturers | 2,494 | 3,858 | 4,476 | 5,542 | 23.8 |
| | Financial Institutions | 1,512 | 1,971 | 2,588 | 3,032 | 17.2 |
| | Value of Use | 223 | 317 | 449 | 607 | 35.2 |
| | Electronic Financial Service Providers | 77.9 | 119.9 | 205.2 | 301.4 | 46.9 |
| | (Credit Cards ³⁾) | 60.7 | 85.5 | 135.3 | 194.0 | 43.4 |
| | (Prepayment Means) | 10.2 | 24.5 | 56.8 | 88.5 | 55.8 |
| (Account Transfers) | 6.9 | 9.9 | 13.1 | 18.9 | 44.3 | |
| Mobile Device Manufacturers | 60.9 | 89.9 | 107.0 | 137.6 | 28.6 | |
| Financial Institutions | 84.1 | 107.3 | 136.9 | 167.6 | 22.4 | |
| Easy Transfer Service | Volume of Use | 1,406 | 2,485 | 3,258 | 4,333 | 33.0 |
| | Electronic Financial Service Providers | 1,328 | 2,343 | 3,062 | 3,998 | 30.2 |
| | Financial Institutions | 78.2 | 142.2 | 196.3 | 334.4 | 70.4 |
| | Value of Use | 105 | 235 | 357 | 505 | 41.5 |
| | Electronic Financial Service Providers | 98.2 | 218.4 | 329.3 | 472.3 | 43.4 |
| | Financial Institutions | 6.3 | 16.2 | 27.3 | 32.2 | 17.9 |

Notes: 1) To more accurately determine the volume of use, the lists of institutions and payment instruments were expanded by retroactively adjusting all-time series back to 2016 when related statistics were first recorded.

2) Some figures were revised to reflect corrections reported by source organizations.

3) Including check cards.

Payment and Settlement Systems Report 2021

Publisher Rhee, Chang Yong
Editor Lee, Jongryeol
Published by Bank of Korea
67 Sejong-daero, Jung-gu, Seoul, 04514, Republic of Korea
www.bok.or.kr
Published on July 15, 2022
Printed by Jeil Printech Co., Ltd.

This report is an English translation of the Korean original published on April 14, 2022 and it is posted on the web-site of the Bank of Korea (<http://www.bok.or.kr/eng> > Financial Stability > Annual Report on the Payment and Settlement Systems)
In case of any inconsistency, the original version in Korean will prevail.
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