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Payment and Settlement Systems Report 2019

2020. 3



BANK OF KOREA

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Payment and settlement refers to acts which discharge mutual obligations between economic entities arising from various economic activities through the use of payment instruments such as cash, payment cards, and funds transfers. To ensure that payment and settlement transactions that support economic activities are executed smoothly, payment and settlement systems, encompassing payment instruments, payment systems, and participating institutions, need to be managed and operated in a stable and efficient manner.

As a central bank, the Bank of Korea 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 intraday liquidity support to resolve settlement risks such as settlement delays. The BOK also conducts oversight of payment and settlement systems by monitoring and assessing the operating institutions and issuing recommendations for improvement.

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

It is hoped that this report will enable system participants and members of 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)-(4) (omitted)

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

BCBS	Basel Committee on Banking Supervision
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
CRCC	Cyber Resilience Coordination Centre
CSD	Central Securities Depository
DNS	Deferred Net Settlement
DLT	Distributed Ledger Technology
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
NFC	Near Field Communication
PFMI	Principles for Financial Market Infrastructures
PvP	Payment versus Payment
RTGS	Real-time Gross Settlement
SSS	Securities Settlement System
SWIFT	Society for Worldwide Interbank Financial Telecommunication
WGPMI	Working Group on Payments and Market Infrastructures

Executive Summary

[Oversight of Payment and Settlement Systems and Policy Responses]

1 The Bank of Korea (BOK) effectively carried out its role conducting oversight of payment and settlement systems by assessing financial market infrastructures, conducting joint examinations of participants, and working with international counterparts on cooperative oversight.

In 2019, the BOK conducted its regular assessments of systemically important payment and settlement systems (SIPSSs) operated by the Korea Exchange (settlement systems for the KOSPI, KOSDAQ and derivatives market) and the payment and settlement systems operated by the Korea Securities Depository (the OTC Bond Settlement System, Inter-Institutional Repo Settlement System and Institutional Stock Investors Settlement System). The assessments were based on the 「Principles for Financial Market Infrastructures (PFMI)」, 「Guidance on Cyber Resilience for Financial Market Infrastructures」, 「Resilience of Central Counterparties (CCPs): Further Guidance on the PFMI」, 「Recovery of Financial Market Infrastructures」 and other standards.

Both organizations were found to be mostly in compliance with the PFMI and other international standards. Nonetheless, the results also suggested that some improvements were needed with regard to liquidity risk and cyber risk in the case of the Korea Exchange (KRX), and with regard to credit risk and operational risk in the case of the Korea Securities Depository

(KSD). The two organizations plan to implement improvement actions, as per the recommendations of the BOK.

The BOK moreover conducted joint examinations of two banks and three financial investment companies to review the adequacy of payment and settlement activities by looking at the status of intraday liquidity management and whether a business continuity plan was in place and kept up-to-date. The examinations found that the recovery time objective (RTO) needed to be shortened, the management system for funds transfer-related operational risk required improvement, and the management of settlement liquidity needed to be strengthened. Appropriate recommendations for improvements were therefore issued to the institutions concerned.

The BOK continued with its efforts to improve the payment and settlement system oversight framework by enhancing the capability for oversight of cyber risks and by expanding the monitoring capacities of the BOK-Wire+. During 2019, the BOK was an active voice in cyber risk discussions at the BIS Cyber Resilience Coordination Centre (CRCC) and participated in cyber simulative exercises. Furthermore, to strengthen capabilities for monitoring and analyzing settlement risk indicators, a plan is in the works to expand the payment and settlement data warehouse that will be part of the next-generation BOK-Wire+.

The BOK also conducted joint international oversight of the CLS system and SWIFT with other central banks in other major economies. The CLS system provides payment-versus-payment (PvP) settlement services for multiple currencies, and SWIFT is the worldwide financial transactions information telecommunications system.

② The BOK strengthened its management of net settlement risks as part of a continuous policy effort to enhance the safety and efficiency of payment and settlement systems.

In August 2019, the BOK raised the collateral-to-net debit cap ratio for guaranteeing net settlements of its participants to 70%, from the previous 50%. This action implemented a plan proposed by the BOK in December 2018 to improve the net settlement risk management system by stepping up the management of credit risk arising from deferred net settlements. Going forward, the collateral-to-net debit cap ratio will be progressively raised to 100%.

Collateral-to-Net Debit Cap Ratio Increase Schedule

Aug. 1, 2019	Aug. 1, 2020	Aug. 1, 2021	Aug. 1, 2022
70	80	90	100

(%)

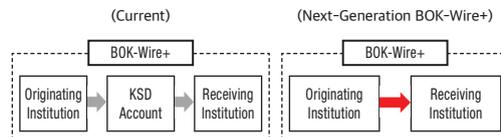
Source: Bank of Korea

The upward adjustment of the collateral-to-net debit cap ratio for guaranteeing net settlements was coupled with a measure to alleviate any resulting burden on banks. Collateral eligibility requirements were eased to include debentures issued by the Korea Development Bank (KDB), the Industrial Bank of Korea (IBK), and other bonds, in addition to existing government bonds and Monetary Stabilization Bonds. The BOK worked closely with net settlement participants to explore solutions that can reduce the strain that the increased collateral requirements may cause.

Meanwhile, the BOK is constructing the next-generation BOK-Wire+ for scheduled launch in the second half of 2020. The develop-

ment of the needed IT systems was completed in 2019. A new simplified method was also developed for the settlements of DvP transactions that are conducted through the real-time gross settlement (RTGS) on a transaction-by-transaction basis. Under this new methodology, settlement funds will be sent directly to transaction counterparties without transiting through a KSD account, and DvP securities transactions will be included among those subject to BOK-Wire+'s simultaneous multilateral settlement procedure. This change is expected to lessen the liquidity burden on participants, as well as increase the efficiency of DvP settlement.

Improvement of DvP Settlement Method for the Next-Generation BOK-Wire+



Source: Bank of Korea

③ The BOK supported innovation and the development of payment and settlement systems by conducting research into crypto-assets, central bank digital currency (CBDC), and distributed ledger technology (DLT), as well as implementing a joint project on bank account-based mobile deposit payment services.

The BOK conducted extensive research into crypto-assets, examining the potential impact of Facebook's Libra, and shared its findings across the industry and with academic experts. Meanwhile, to proactively respond to the international debate concerning CBDC, dedicated CBDC research units, including the Digital Currency Research Team and Section for CBDC Technology,

were established in February 2020.

The BOK continued with its research into the feasibility of applying DLT to payment and settlement systems. In 2019, the BOK followed up on its previous tests of large-value payment systems (2017) and retail payment systems (2018) with completion of a preliminary study into potential applications of DLT for DvP settlement, and commenced a mock test based on the results of this study. Moreover, the BOK organized a seminar on electronic finance in December 2019 where participants discussed the potentiality of DLT and possible directions for regulatory reform that may be required.

The Committee on Financial Informatization Promotion (CFIP), chaired by the senior deputy governor of the Bank of Korea, worked closely with participating financial institutions to ensure the smooth progress of the bank account-based mobile debit payment service project. In 2019, the CFIP launched a working group to decide on technical details, such as settlement standards and processes. After the completion of upgrades to participating financial institutions' IT systems, the mobile debit payment service was deployed in December 2019.

Furthermore, as the chair of the Working Group on Payments and Market Infrastructures (WGP-MI) of the Executives' Meeting of East Asia-Pacific Central Banks (EMEAP), the BOK led discussions among central banks from across the region about ways to improve cross-border payments. Meanwhile, as a member of the BIS Committee on Payments and Market Infrastructures (CPMI), the BOK actively participated in discussions about key CBDC issues and on strengthening the security of large-value settlement systems.

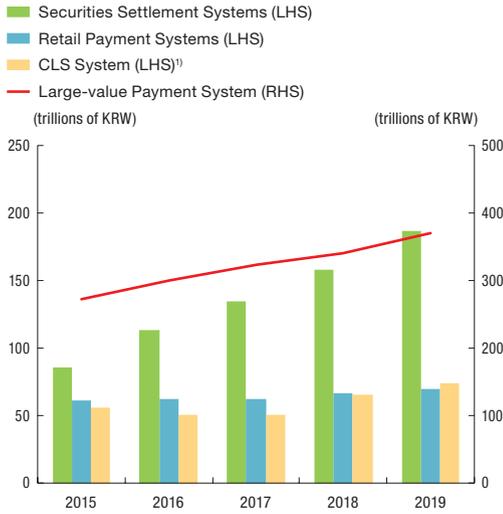
[Payment and Settlement Trends and Settlement Risk Management]

④ In 2019, the value of payments and settlements processed through the systems continued on an upward trend, driven mainly by securities settlements by financial institutions and electronic funds transfers by individuals and companies.

The daily average value of settlements passed through the securities settlement systems amounted to KRW 186.4 trillion, up 18.3% from a year earlier, on an increase in inter-institutional repo transaction. The daily average value of payments processed through the retail payment systems increased 3.7% from the previous year to KRW 69.4 trillion on the steadily rising volume and value of funds transfers via the Electronic Banking System, including internet banking. The daily average value of amounts settled through the CLS system totaled USD 74.3 billion, up 13.6% from a year earlier.

The daily value of settlements processed through BOK-Wire+, the final settler of inter-institutional transactions via securities, retail and foreign exchange settlement systems, amounted to KRW 369.9 trillion, up 8.6% from the previous year.

Value of Settlements by Major System (daily average)



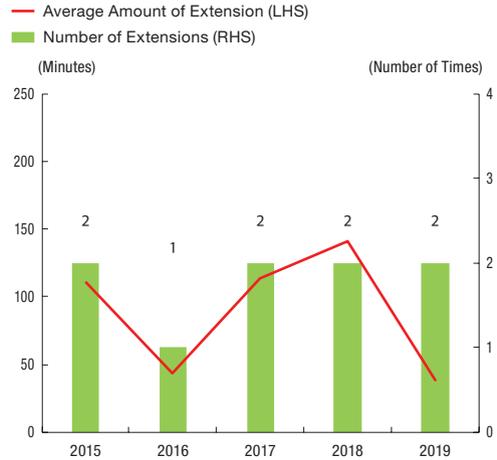
Note: 1) Billions of USD

Sources: Bank of Korea, KFTC, KRX, KSD

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

In 2019, final settlement services that BOK-Wire+ provides for funds transfers between participants, securities settlements, retail payments and CLS all operated smoothly. BOK-Wire+'s operating hours were extended twice, both times for repo transactions executed by the BOK for the purpose of liquidity management. The average length of extension was 38 minutes, considerably shorter than during the previous year (141 minutes).

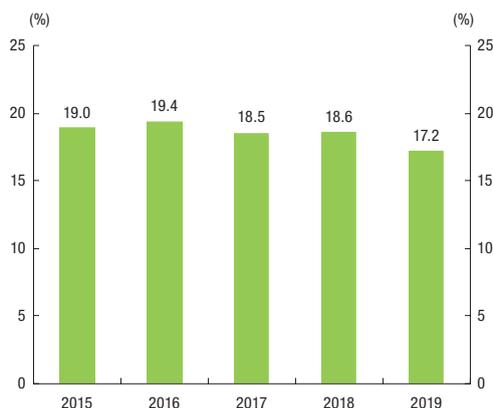
Extension of BOK-Wire+ Operating Hours



Source: Bank of Korea

The retail payment systems operated by the Korea Financial Telecommunications & Clearings Institute (KFTC) also functioned smoothly. The net debit cap utilization rate of net settlement participants exceeded the cautionary level (70%) 83 times, a decrease from a year earlier (87 times). The average maximum net debit cap utilization rate stood at 17.2%, also recording a decrease from the previous year (18.6%). The share of payment-versus-payment (PvP) transactions in total foreign exchange transactions rose to 76.4%, from 71.3% a year earlier.

Average Maximum Net Debit Cap Utilization Rate¹⁾



Note: 1) The average of the daily maximum net debit cap utilization rates of all participants.

Source: Bank of Korea

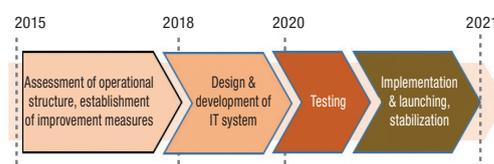
The securities settlement systems managed by the KRX and the KSD also operated smoothly. All transactions in the exchange-traded government bond market were settled by the deadline. In the Inter-institutional OTC Repo Settlement System, the share of free-of-payment (FoP) transactions, carrying a comparatively higher settlement risk due to the time lag between the delivery of securities and payment, fell to 5.7%, from the prior year's 6.7%.

[Future Policy Directions]

⑥ For greater safety and efficiency of payment and settlement systems, the BOK will continuously expand infrastructures and improve the regulatory and institutional framework.

The BOK will ensure that its next-generation BOK-Wire+ project will come to completion on time, for a planned deployment in the second half of 2020. The system will undergo an internal test during 2020, followed by a full-scale test with participants. Related regulations will also be appropriately amended to reflect new processes and procedures introduced by the next-generation system. Moreover, as part of an effort to facilitate the linkages between domestic and overseas settlement infrastructures, the BOK will actively work on the introduction of ISO 20022, the international electronic messaging standard, after collecting input from participants and once the global review of the project is completed.

Timeline for the Establishment of the Next-Generation BOK-Wire+



Source: Bank of Korea

To strengthen the management of credit risk arising from deferred net settlements, the BOK will progressively raise the collateral-to-net debit cap ratio for guaranteeing net settlements in successive steps, as planned. This will be coupled with a careful examination of available options for practically reducing the burden that the new collateral requirement for guaranteeing

net settlements may place on financial institutions. In tandem, the BOK will also continue its research into real-time gross settlement-based retail payment systems operated by central banks in the U.S. and other major countries to determine whether introducing such a system in Korea would be necessary or useful, analyzing their advantages and disadvantages.

The payment and settlement environment is continuously evolving, with payment services increasingly provided, in recent years, by fintech companies and other non-financial institutions. To ensure the safety of payment and settlement systems, all the while supporting innovation in this field, the BOK plans to review current rules for participation and explore improvement strategies.

7 The BOK will strengthen its payment and settlement system oversight framework by increasing cyber-risk response capabilities and establishing guidelines for the assessment of payment and settlement infrastructures.

The BOK will enhance its cyber risk response capabilities by stepping up oversight of operational risk in terms of IT, using its payment and settlement data warehouse, and through active cooperation with the BIS Cyber Resilience Coordination Centre (CRCC) and other domestic and international organizations.

Moreover, the BOK will establish assessment guidelines that have been adapted for the domestic payment and settlement environment, all the while closely reflecting the 「PFMI」, 「Resilience of Central Counterparties: Further Guidance on the PFMI」 and 「Recovery of Financial Market Infrastructures」. The new guidelines are

expected to increase transparency, effectiveness and the international conformity of assessment activities, and alleviate the work burden on assessed institutions, all resulting from the implementation of the recommendations for improvement issued by the BOK.

A plan is also in the works to update the oversight framework and revise payment and settlement statistics to reflect the recent increase in the participation of non-financial institutions in the payment service market. Improving the oversight framework is of particular importance for open settlement systems, like the open banking system, in which a substantial level of disparity exists between participating institutions in terms of risk management capabilities. Meanwhile, in light of the increasingly widespread use of various non-traditional electronic payment instruments, going forward payment instrument-related statistics will be further subdivided to include categories such as funding type and access channel.

8 The BOK will strengthen its effort to promote innovation and advances in payment and settlement systems with financial inclusion initiatives such as protecting the consumer's right to choose between payment instruments.

The BOK will proactively respond to rapidly-evolving developments surrounding the issue of CBDC through its newly-formed CBDC research units. A planned approach will be adopted for each phase of policy response development, from identification and formulation of policy tasks, through to legal, regulatory and technical research. A system will also be put into place to facilitate cooperation between CBDC units and other sections of the BOK with related

duties such as monetary policy, financial stability, international finance and currency issuance. In addition, the BOK will closely monitor the status of CBDC issues by the central banks of other major countries, and whether or not the Libra or other stablecoins are commercially launched, all while at the same time actively participating in related discussions across the international community, such as at the BIS.

The BOK will continue its research into DLT to determine whether the new technology can be applied to payment and settlement infrastructures. A mock test, currently underway, in which DLT is integrated into the settlement process for DvP transactions, is expected to come to a conclusion during 2020, yielding practical implications for its actual implementation.

These various initiatives to bring innovation to payment and settlement systems will be accompanied by efforts to protect the consumer's right to choose between payment instruments. In response to the recent decrease in the use of cash and to the reduction in the number of ATMs, ATM-related statistics will be further re-organized, and new measures to improve the public's access to cash will be developed and implemented through discussion with interested organizations. Meanwhile, to prevent innovation in payments and settlements from leaving behind those segments of the population that rely mainly on cash as a means of payment, the BOK plans to reinforce education about new emerging payment instruments.

Furthermore, the Committee on Financial Informatization Promotion (CFIP) is preparing a plan to support the broader use of bank account-based mobile debit payment services. By closely working together with participating

institutions, the CFIP will introduce near field communication (NFC) and other contactless payment instruments and expand the network of participating merchants. For the greater convenience of users, additional measures, such as depositing the changes into a bank account and raising the upper limit of deposits, are also planned.

⑨ The BOK will proactively respond to the assessment of implementation for international standards, participate in payment and settlement-related international discussions and strengthen cooperation with countries across the region.

The BOK will closely cooperate with relevant organizations to prepare for the forthcoming examination of implementation for payment and settlement-related international standards by the CPMI and the International Organization of Securities Commissions (IOSCO), scheduled to be conducted on 28 member countries. As part of this preparation, the BOK will review related domestic laws and regulations to determine whether the PFMI are appropriately reflected in them, and will participate in legal and regulatory amendment projects to introduce any needed changes.

The BOK intends to have a strong presence in the international debate concerning payment and settlement issues through active involvement in the activities of the BIS CPMI, and it will make use of the information obtained in the process in its own policymaking and in assisting with the oversight of payment and settlement systems, and while undertaking relevant research. Moreover, the BOK will ensure that Korea, as the chair country of the EMEAP Working Group on Payments and Market Infrastructures,

plays an expanding regional role in the field of payments and settlements. The BOK plans to lead discussions about key issues of interest for member countries, such as the cross-border linkage of payment and settlement infrastructures, CBDC, and increasing the efficiency of cross-border retail payment, all while at the same time laying the groundwork for regional policy cooperation.

I

Oversight and Policy Responses

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1. Oversight of Payment and Settlement Systems

Oversight of payment and settlement systems is a central bank function whereby the objectives of safety and efficiency are promoted by monitoring existing and planned systems, assessing them against these objectives and, where necessary, inducing change.¹⁾

The Bank of Korea (BOK) conducts oversight of payment and settlement systems pursuant to Article 81 of the Bank of Korea Act and its subordinate regulations. Its oversight activities involve monitoring payment and settlement systems, assessing their safety and efficiency and taking recommendations to the system operator regarding improvements to be made.

In addition to real-time monitoring, the BOK also conducts periodic reviews, on a daily, monthly or quarterly basis, of the operational status of payment and settlement system operators and the settlement values and risk management performance of system participants. When necessary in emergency situations, such as technical disruptions affecting payment and settlement system operators or

participants, the BOK may recommend the imposition of temporary restrictions on access to systems and extend the operating hours of BOK-Wire+.

The BOK conducts assessments of systemically important payment and settlement systems²⁾ on a biennial basis. In addition to biennial assessments, ad hoc assessments are also performed when an important change has occurred that affects the safety and efficiency of a system. Assessments of payment and settlement systems are carried out in accordance with the 「Principles for Financial Market Infrastructures (PFMI)」, issued in April 2012 jointly by the BIS Committee on Payments and Market Infrastructures (CPMI) and the International Organization of Securities Commissions (IOSCO), and international guidelines.³⁾ The BOK has adopted the PFMI as an assessment standard to ensure conformity to international standards, because the participants and stakeholders in Korea's payment and settlement systems are not limited to Korean entities. When a payment and settlement system fails to meet a required standard or needs improvement in terms of safety and efficiency, the BOK may issue improvement orders to its operator or supervisory authority.

1) "Central Bank Oversight of Payment and Settlement Systems" (BIS CPSS, May 2005)

2) For greater efficiency of oversight, the BOK classifies payment and settlement systems into "systemically important payment and settlement systems" (SIPSSs) and "other payment and settlement systems" according to the value and volume of transactions and potential impact on the financial system, to separately manage them. SIPSSs are systems whose disruption could send a shock across domestic and international financial systems, causing systemic disruptions. Ten systems are currently classified as SIPSSs, including BOK-Wire+: the Check Clearing System, the Interbank Funds Transfer System and the Electronic Banking System of the KFTC; the Institutional Bond Investors Settlement System and the Inter-institutional Repo Settlement System of the KSD; the KOSPI Market Settlement System and the KOSDAQ Market Settlement System of the KRX and the KSD; the Derivatives Market Settlement System of the KRX; and, the CLS System of the CLS Bank. "Other payment and settlement systems" include the Giro System and the CD/ATM System of the KFTC, the Foreign Currency Transfer System, the RMB Clearing System and the Institutional Stock Investors Settlement System.

3) Other CPMI-IOSCO guidelines include 「Guidance on Cyber Resilience for Financial Market Infrastructures」(June 2016), 「Resilience of Central Counterparties: Further Guidance on the PFMI」, and 「Recovery of Financial Market Infrastructures」(July 2017).

The BOK also conducts joint examinations of banks and financial investment companies with the Financial Supervisory Service (FSS) to review the status of settlement risk management and the adequacy of funds transfer processes that are in place.

Central banks maintain cooperative oversight of international systems that link the payment and settlement systems of various countries, such as the Continuous Linked Settlement (CLS) system and the Society for Worldwide Interbank Financial Telecommunication (SWIFT), through cooperative arrangements. As a participant in such arrangements, the BOK actively collaborates with peer central banks for the surveillance of these systems, sharing information about their operational status.

A. Regular Assessments of Domestic Payment and Settlement Systems

In 2019, the BOK conducted regular assessments of the securities settlement systems jointly operated by the Korea Exchange (KRX) and the Korea Securities Depository (KSD), which followed up on the previous year's regular assessments of BOK-Wire+ and the retail payment systems of the Korea Financial Telecommunications and Clearings Institute

(KFTC). These systems were assessed against the 「PFMI」, 「Guidance on Cyber Resilience for Financial Market Infrastructures」,⁴⁾ 「Resilience of Central Counterparties」⁵⁾; Further Guidance on the PFMI,⁶⁾ and 「Recovery of Financial Market Infrastructures」.⁷⁾ Recommendations were issued with regard to identified areas of improvement, which the two organizations plan to implement in due time.

Korea Exchange

The BOK conducted the assessment of the central counterparty (CCP) of exchange-traded securities and derivatives and OTC derivatives settlement systems operated by the Korea Exchange (KRX).⁸⁾ Although the assessment found that the KRX was mostly in compliance with the PFMI, some improvement was deemed necessary regarding the management of settlement risk, including liquidity risk and cyber risk.

The KRX is equipped with a rapid and well-defined response system, allowing it to effectively fulfill its role as a CCP that can manage the credit and liquidity risk in the event of a member's default. Its default waterfall is in conformity with international practices. With a liquidity plan and a recovery plan in place, the KRX also conducts crisis simulation

4) CPMI-IOSCO, June 2016.

5) A central counterparty (CCP) is also referred to as a central clearing house. CCPs reduce settlement liquidity requirements by netting offsetting transactions between multiple counterparties and guarantee the performance of settlement obligations, thereby taking on liquidity and counterparty credit risk of participants. Although a CCP maintains default resources (clearing members' initial margins, default funds, a portion of a CCP's capital set aside as settlement reserves) as the first line of defense against losses that may result from a member's default, losses in excess of the default resources can cause it to fail or lead to systemic risks. It is therefore important for CCPs to have a recovery plan in place to prevent such situations, which may include additional contributions to default funds or the return of some of the profits by members and increasing settlement reserves.

6) CPMI-IOSCO, July 2017.

7) CPMI-IOSCO, July 2017.

8) Exchange-traded securities (KOSPI, KOSDAQ), exchange-traded derivatives (stock, interest rate and currency futures and options) and OTC derivatives (Korean won IRS, U.S. dollar IRS).

exercises. Notwithstanding, the assessment found that some improvement was needed in regard to its foreign currency liquidity management and to its crisis simulation exercise.

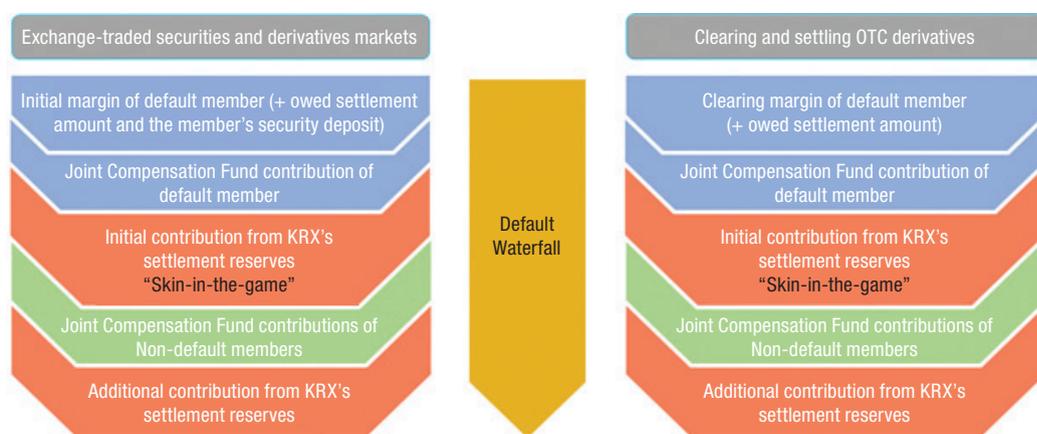
To help the KRX more effectively carry out its role as a CCP in relation to U.S. dollar IRS, the BOK recommended it set up a foreign currency liquidity management system by either maintaining a certain amount of its financial resources in foreign currency assets or entering into a committed credit agreement. Moreover, concerning the annual exercises conducted for the exchange and OTC markets to speedily respond to a member's default, the BOK recommended the inclusion of a scenario in which defaults occur simultaneously in the exchange and in OTC markets.

The KRX is making diverse efforts to ensure the safety and reliability of its business processes by operating a company-wide risk management system and by regularly reviewing key risk indicators. However, a recom-

mendation was issued to further strengthen its risk preparedness by modifying its organizational structure in such a way as to increase the independence of its CCP risk management unit. The BOK also recommended that the KRX introduce some improvements to its system for reviewing, identifying and managing operational risk by setting clear operational objectives.

At the KRX, data recovery procedures are in place to restore data that has been lost or destroyed due to a system interruption as a result of a technical disruption, disaster, or cyberattack, including a hacker attack. The assessment determined that some improvement was needed in regard to the verification of recovered data. The BOK recommended the participation of members in the verification of integrity of recovered transaction data so as to increase the objectivity and accuracy of the procedures, as well as the setting of clear and more specific recovery point objectives (RPOs)⁹ according to the type and relative

Figure I-1. CCP Default Waterfall



Source: KRX

9) A recovery point objective (RPO) is the maximum tolerable amount of data loss (point in time). Following the regular assessment in 2017, as per the BOK's recommendation, the KRX specified RPOs in its business continuity plan (BCP) in March 2019.

importance of each settlement system.

Korea Securities Depository

The BOK conducted assessments of three settlement systems operated by the Korea Securities Depository (KSD), including the OTC Bond Settlement System,¹⁰⁾ the Inter-institutional RP Settlement System and the Institutional Stock Investors Settlement System.¹¹⁾ While the assessment found that the KSD was mostly in compliance with the PFMI, some improvement was needed in the management of credit risk and operational risk.

Table 1-1. Assessed FMIs Operated by KSD

(2019, number of institutions, trillions of KRW)

	OTC Bonds ¹⁾	Inter-institutional Repos ²⁾	Institutional Stock Investors ³⁾
Settlement Participants	148	160	81
Indirect Participants	300	-	368
Total	448	160	449
Value of Settlements	2,596	40,195	165

Notes: 1) OTC Bond Settlement System, final settlement after continuous net settlement

2) Inter-institutional Repo Settlement System, bonds + ETFs

3) Institutional Stock Investors Settlement System, settlement between financial investment companies and institutional investors

Sources: Bank of Korea, KSD

When the KSD was assessed in its capacity as the CCP for the Institutional Stock Investors Settlement System, the assessment found

both its default resources for the absorption of potential losses and its default waterfall framework to be satisfactory. However, it was determined that the KSD was not sufficiently prepared for extreme situations, such as those caused by a financial crisis, in which simultaneous defaults by multiple members could result in losses in excess of available default resources and that situations of massive losses from disasters, cyberattacks or other events not related to defaults were overlooked in the recovery plan. The BOK accordingly recommended that its recovery plan be revised by consulting international standards so that a recovery would be able to take place in an orderly and efficient manner, even in the event of massive losses.

Being the nation's only security delivery and depository institution, if the KSD's settlement services are disrupted due to technical problems, this could have an unexpected negative impact on all linked FMIs, including BOK-Wire+ and the KRX. Although a company-wide internal control system is in place to manage such an operational risk, the BOK recommended that the KSD also anticipate and manage operational risk arising from external factors, such as mistakes by members, by increasing information sharing and coordination. Regarding its delivery versus payment (DvP) system, which is aimed at reducing settlement risk arising from the time gap between delivery and payment, the share

10) A bond settlement system for institutional transactions in government and municipal bonds, Monetary Stabilization Bonds, corporate bonds, CDs, CPs, electronic short-term bonds and foreign currency-denominated bonds.

11) A securities settlement system (SSS) fulfills four main functions: acting as the clearing central counterparty (CCP), delivering securities, acting as the central securities depository (CSD) and processing payments. The KSD serves as an SSS and as a CSD for the exchange-traded securities (KOSPI, KOSDAQ) settlement systems, the OTC Bond Settlement System and the Inter-institutional Repo Settlement System, while it serves as a CCP, an SSS and as a CSD for the Institutional Stock Investors Settlement System. The assessment of the exchange-traded securities settlement systems was conducted in conjunction with the regular assessment of the KRX, which serves as the CCP for this system.

of free-of-payment (FoP) deliveries was found to be high in some types of transactions. To more effectively manage operational risk associated with FoP deliveries, a recommendation was issued that the payment verification procedure for FoP transactions be improved and that measures be implemented to encourage the use of DvP transactions.

To enable a speedy recovery and the timely resumption of business processes in the aftermath of a major service outage, possibly caused by a system failure, a hacker attack or some other type of cyberattack, the KSD has a business continuity plan (BCP) in place and conducts simulation exercises with its members on a regular basis. However, the assessment determined that with some improvements, its cyber resilience could be further enhanced. In order to strengthen the capacity to respond to ever-evolving cyberattacks, it is necessary to develop and implement a comprehensive and targeted system for managing cyber risk. To this end, the BOK recommended improvements in the identification and management of risk factors arising from external service providers¹²⁾ and the participation of external service providers in cyberattack exercises. For greater accuracy of data recovery following a system disruption, it was also recommended to the KSD that it enter into data sharing agreements with its members and other third-party entities.

B. Improvement of the Oversight Framework

To improve the oversight framework for payment and settlement systems, the BOK strengthened its cyber risk oversight capabilities, while at the same time expanding its capacity for real-time monitoring of BOK-Wire+.

In 2019, the BOK participated in the BIS Cyber Resilience Coordination Centre (CRCC), established to support information sharing and cooperation between central banks, to discuss key cyber security issues and related trends. The BOK also took part in the Cyber Range Exercise¹³⁾(October 2019), a cyber simulative exercise conducted by the BIS, in a virtual environment that emulated real world environments. The exercise scenario simulates various forms of cyberattacks, including a hacker attack on payment and settlement systems for unauthorized withdrawals of funds, phishing emails spreading malicious code, and an infiltration attack, all occurring nationwide.

Meanwhile, to strengthen its payment and settlement system oversight function, the BOK is expanding the payment and settlement data warehouse as part of its next-generation BOK-Wire+ project. The payment and settlement data warehouse is expected to increase the efficiency of oversight activities by enabling early detection of various settlement risk factors and allowing for a speedy response to them.

12) Currently, security and maintenance services for the KSD's systems and networks, the operation of its disaster recovery center and the collection of cyber threat information are outsourced to external service providers.

13) The Cyber Range Exercise is a cyberattack and defense exercise conducted by the BIS in which a security firm launches a simulative cyber-attack on the systems of participating central banks, and their staff defends them against the attack.

C. Joint Examinations of Banks and Financial Investment Companies

Joint Examinations of Banks

8

In 2019, the BOK inspected two banks jointly with the FSS to review the status of payment and settlement-related activities. These examinations looked at their performance in intraday liquidity management and the management of foreign exchange, securities and net settlement risks, as well as business continuity plan (BCP) arrangements and compliance with relevant legal and regulatory guidelines.

Table 1-2. Joint Examinations of the Payment and Settlement Systems of Banks in 2019

Bank	Examination Period	Areas Subject to Examination
Citibank	Apr. 8 - 11 (4 business days)	<ul style="list-style-type: none"> Intraday liquidity management Foreign exchange, securities and net settlement risk management BCP arrangements
Shinhan Bank	Dec. 3 - 6 (4 business days)	<ul style="list-style-type: none"> Observance of regulations related to payment and settlement

Source: Bank of Korea

The examinations found that both banks effectively managed intraday liquidity by routinely monitoring the status of net settlements and reserve balances, and by having a funding plan in place to mitigate risk should there be a sudden liquidity crisis.

Notwithstanding, one recommendation was issued to shorten the recovery time objective (RTO) per the BCP, as well as another one to adhere to the guidelines for the reduction of BOK-Wire+ members' settlement liquidity requirements (in regard to the share of regular payment instructions and the share of foreign

exchange settlements made during the recommended input window).

Joint Examinations of Financial Investment Companies

In 2019, the BOK and the FSS conducted joint examinations of three financial investment companies, reviewing funds transfer activities and the management of liquidity related thereto.

Table 1-3. Joint Examinations of Financial Investment Companies in 2019

Company	Examination Period	Areas Subject to Examination
KTB Investment and Securities	Mar. 25 - Apr. 2 (7 business days)	<ul style="list-style-type: none"> Adequacy of execution of funds transfers Settlement liquidity management
KB Securities	Jun. 12 - 27 (12 business days)	
Shinhan Investment Corp	Oct. 31 - Nov. 15 (12 business days)	

Source: Bank of Korea

The examinations resulted in the recommendation that "identification of operational risk arising from funds transfer activities" be added as a self-assessment item and as a core indicator, and that related management procedures be put into place. A recommendation was also issued that the requirement of reporting to the BOK about information system disruptions and other emergency situations be incorporated into the three companies' internal bylaws.

The following dispositions related to the management of settlement liquidity were taken with regard to some of the examined financial investment companies. In order to better manage liquidity requirements to meet customer withdrawals, they were advised to

set a limit on the holdings of bonds included in repo-type CMAs, as well as to improve the monitoring system for the durations of bonds included in repo-type CMAs and cash equivalent assets by conducting a daily check, among other activities. Meanwhile, those financial investment companies found to be lacking in terms of stress testing and emergency funding plans to anticipate a liquidity crisis, were advised to revise their plan to make it more concrete and realistic. It was also recommended that the companies improve their investment rules for funds from notes payable issues and that they create more robust follow-up review procedures for securities lending and borrowing, and short selling.

D. International Cooperative Oversight

In 2019, the BOK participated in cooperative oversight arrangements for global payment and settlement infrastructures, such as the CLS system and SWIFT, alongside other central banks.

The CLS system provides payment versus payment (PvP) settlement services in multiple currencies, using large-value payment systems in major countries. The BOK is a member of the CLS Oversight Committee, chaired by the Federal Reserve Bank of New York, which has primary responsibility for oversight of the CLS system,¹⁴⁾ and it is composed of central banks

from CLS settlement currency countries, including the Bank of England. In 2019, in order to more effectively manage international operational risk, the CLS Oversight Committee strengthened its "three lines of defense" model¹⁵⁾ and decided to separately conduct internal and external oversights.

The BOK also carried out international cooperative oversight activities on the global interbank financial telecommunication network SWIFT.¹⁶⁾ In 2019, at the SWIFT Oversight Forum, composed of central banks from major countries, a discussion was held on the practical implementation of SWIFT's medium- and long-term strategy to enhance its Customer Security Programme. Meanwhile, SWIFT has strengthened its security standards and will be requiring user institutions to implement the new standards and mandating the independent substantiation of all self-attestations starting from 2020.

14) Oversight of the CLS system is conducted primarily by the central bank of the country where the CLS Group is headquartered, which then shares the results with other central banks.

15) The management of operational risk is divided into three independent lines of defense: a front-end business unit, a risk management unit, and an internal audit unit.

16) The Society for Worldwide Interbank Financial Telecommunication (SWIFT) is a cooperative society founded in 1973 by a group of European banks to send and receive messages related to international financial transactions between correspondent banks. In addition to being a messaging system, SWIFT also provides information intermediary services for securities transactions and international trade.

2. Enhancement of Payment and Settlement Systems

Changes Implemented in the Net Settlement Risk Management System

To bolster the management of credit risk arising from deferred net settlement,¹⁷⁾ in December 2018 the BOK decided on a series of changes to its net settlement risk management system to reflect related international standards. In 2019, following the previously announced implementation schedule, the ratio of collateral pledged to guarantee the net settlements relative to the net debit cap was raised from the previous 50% to 70%.

Table 1-4. Collateral-to-Net Debit Cap Ratio for Guaranteeing Net Settlements

(%)		
Aug. 1, 2002	Aug. 1, 2016	Aug. 1, 2019
30	50	70

Source: Bank of Korea

The increase in collateral requirements was coupled with measures to reduce the burden it may place on banks. In August 2019, the range of eligible collateral for guaranteeing net settlements was broadened to include debentures issued by the Korea Development Bank (KDB), the Industrial Bank of Korea (IBK) and other bonds, in addition to existing government bonds and Monetary Stabilization Bonds. This measure is expected to alleviate the col-

lateral burden on net settlement participants. Moreover, to encourage the use of linked settlement processes, launched in March 2016, in which large-value funds exceeding KRW 1 billion are settled in real time on a transaction-by-transaction basis by linking BOK-Wire+ and the Electronic Banking System, the BOK worked closely with relevant institutions by, for instance, organizing conferences with BOK-Wire+ participants. An increased use of linked settlements, as it decreases the volume and value of net-settled transactions, is expected to reduce the amount of collateral banks are required to pledge to the BOK.

Table 1-5. Scope of Securities Eligible for Use as Collateral for Guaranteeing Net Settlements

Before Change	After Change	Effective Date
· Bonds issued or guaranteed by the government · BOK Monetary Stabilization Bonds	No change	—
· KHF MBS (temporarily allowed until the end of 2018)	· KHF MBS (permanently allowed ¹⁾)	Dec. 20, 2018
	· KDB bonds, IBK bonds, and KEXIM bonds · Bonds temporarily designated by BOK governor in case of emergency	Aug. 1, 2019

Note: 1) The temporary designation of KHF MBS as eligible for use as collateral for BOK loans was terminated as scheduled at the end of 2018.

Source: Bank of Korea

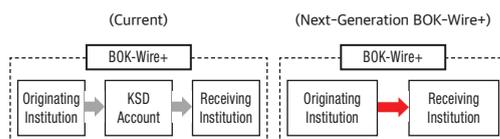
17) In the Korean retail payment network, transactions are settled on a deferred net settlement basis. In other words, intraday transactions are netted and then settled all at once on the following business day through the large-value settlement network. This settlement mechanism exposes banks with net settlement receivables to credit risk arising from the defaults of other clearing members. The PFMI requires an FMI to maintain sufficient collateral to cover 100% of its credit exposures. (Principle 4. Credit Risk: An FMI should effectively measure, monitor, and manage its credit exposures to participants and those arising from its payment, clearing, and settlement processes. An FMI should maintain sufficient financial resources to cover its credit exposure to each participant fully with a high degree of confidence. CPMI-IOSCO, 2012)

Improved DvP Settlement Method for the Next-generation BOK-Wire+

The BOK has undertaken a project to build a next-generation BOK-Wire+, to be launched in 2020, to proactively respond to the rapidly-evolving financial environment and to allow participants to transfer funds more conveniently. In 2019, the development of the required IT systems came to completion, and a new simplified method was designed for the DvP settlement process.

Currently, DvP transactions that are settled through real-time gross settlement (RTGS) on a transaction-by-transaction basis¹⁸⁾ transit through the KSD's bank account before being processed. As a result, these transactions cannot participate in the BOK-Wire+'s simultaneous multilateral settlement procedure for liquidity saving.¹⁹⁾ Given the accelerated growth trend in DvP transactions, it is expected that liquidity demand for settlements will increase. To alleviate the liquidity burden on BOK-Wire+ participants, and to raise the efficiency of DvP settlements, a new method was designed in which payments for DvP transactions that are settled via RTGS on a transaction-by-transaction basis are sent directly to transaction counterparties. As part of the next-generation BOK-Wire+, these transactions will be included among those settled through the BOK-Wire+'s simultaneous multilateral settlement procedure.

Figure 1-2. Improvement of DvP Settlement Method for the Next-Generation BOK-Wire+



Source: Bank of Korea

Key Measures Undertaken to Improve FMI

(Korea Securities Depository)

In September 2019, pursuant to the Act on Electronic Registration of Stocks, Bonds, Etc., the Korea Securities Depository (KSD) launched an electronic system for the registration of securities. Thanks to the cost savings from the decrease in the handling of paper securities, the KSD was able to lower fees on its securities agency, depository and settlement services.

Electronic securities dispense with the issuing of physical paper securities by registering information about the securities, including their ownership, in an electronic register held by an electronic registration organization (the KSD) and electronically handling all related processes, such as transferring their ownership, pledging them as collateral or exercising them. To date, listed and unlisted securities issued by close to 3,000 companies have been

18) Under this method, known as "DvP1," both securities and payments are settled through real-time gross settlement on a transaction-by-transaction basis. DvP1 is currently used for the settlement of institutional investors' OTC bond transactions (bonds, CDs, CPs, etc.), inter-institutional repo transactions and transactions in electronic short-term bonds.

19) Before the introduction of DvP, payments for securities were settled through the account the KSD held at a commercial bank. This procedure was directly incorporated without modification into DvP transactions at the time of its introduction (1999).

converted into electronic securities.²⁰⁾ The introduction of electronic securities is expected to result in substantial cost-cutting, as well as reduce the potential for forgery, tampering or illicit transactions.

(Korea Exchange)

The Korea Exchange (KRX) has set up a new mechanism to ensure the liquidity and safety of its default resources.²¹⁾ In August 2019, a review system for the management of collateral was put into place, and in December 2019 maximum allowed amounts of non-cash collateral (stocks and corporate bonds) were established based on the type of asset. Moreover, financial products eligible for the investment of default funds are now limited to bank deposits, government bonds and collective investment securities that have government bonds as underlying assets. For further safety, a haircut ratio is applied to all collateral, including the portion that is invested in government bonds, thus practicing conservative valuation. Margin rules were also changed so that securities issued by companies that are affiliated to settlement members are no longer accepted as margin deposits.

(Korea Financial Telecommunications and Clearings Institute)

In August 2019, the Korea Financial Telecommunications and Clearings Institute

(KFTC) rolled out a cloud-based web browser authentication service for bank and public websites. Users can now have their browsers authenticated using public keys without having to install any separate software. Public key certificates stored in the KFTC's dedicated cloud server allow users to access them from anywhere.

In October 2019, the KFTC piloted a blockchain-based mobile ID (decentralized ID) service. The mobile ID service is provided through a decentralized system through which ID data are dispersed among a number of institutions, rather than being stored at a single organization, with verification data also stored across several institutions. After the successful verification of identity, customers receive a decentralized ID from a financial institution or other trustworthy public organization, which can be used for identification purposes in contactless financial transactions from a mobile phone or other type of device.

20) While all listed securities have been converted to electronic securities on a mandatory basis, the conversion of non-listed securities is limited to only those for which an express request has been made by their issuers. As a result of this, investors currently holding paper securities need to visit an ownership transfer service provider to arrange for a transfer by book-keeping entry to their brokerage accounts.

21) Funds to cover losses arising from the default of a clearing member, comprising initial margin posted by members as collateral, the joint compensation funds and the KRX's own settlement reserves. In the event of a default, the initial margin and the joint compensation funds are the first assets to be consumed to cover losses.

3. Support for Innovation and Development

Launch of Mobile Debit Payment Service

The Committee on Financial Informatization Promotion (CFIP),²²⁾ chaired by the senior deputy governor of the Bank of Korea, worked closely with participating financial institutions²³⁾ to ensure a smooth progression to the bank account-based mobile debit payment service (mobile cash card service) adopted in July 2018.

This service uses a mobile cash card app to allow its users to pay for goods in stores, conduct ATM transactions, deposit loose change and withdraw cash at participating merchant sites. This service is expected to lead to meaningful structural changes in the Korean payment service market, which has been thus far been over reliant on credit card-based post-paid services, thereby contributing to a reduction in related social costs.

The CFIP operated a working group that decided on technical details of the service platform, such as settlement standards and processes, together with participating finan-

cial institutions. Participating financial institutions performed necessary upgrades to their IT systems in view of enabling cash card (i.e., bank debit card) services in a mobile environment.

Meanwhile, the KFTC developed a co-use mobile app for participating financial institutions with a link between its system and those of participating institutions. The stability of the co-use mobile app was tested starting in April 2019.

Following the completion of administrative formalities, including the service agreement, the app service made its debut starting with a small number of participating institutions. The full-fledged service is scheduled to be launched in the first half of 2020, once the necessary upgrades are completed on the IT systems of the remaining institutions.

Strengthening Research on Innovation in Payment and Settlement Systems

(Research on Crypto-assets and CBDCs)

The BOK monitored innovative payment and settlement technologies, such as crypto-assets, CBDCs and distributed ledger technology (DLT), while conducting active research

22) Formed in September 1984, initially called the Committee on Financial Computerization and originally chaired by the governor of the Bank of Korea, the CFIP spearheaded the establishment of major interbank shared networks, such as the CD/ATM System and the Interbank Funds Transfer System. In November 2009, it was restructured, now chaired by the senior deputy governor of the Bank of Korea, and given its current name. As of the end of 2019, 30 financial institutions and related organizations participate in the CFIP, which has under it the Working Committee, the Standardization Committee, the Safety Countermeasures Committee, the Working Group on Fintech & Financial Informatization, the Working Group on a Coinless Society, and the Working Group on Mobile Debit Payment Services.

23) Woori Bank, Shinhan Bank, Hana Bank, Nonghyup Bank, Suhyup Bank, the Industrial Bank of Korea, Korea Development Bank, Standard Chartered Bank Korea, Busan Bank, Daegu Bank, Gyeongnam Bank, Gwangju Bank, Jeonbuk Bank, Jeju Bank, and the National Agricultural Cooperative Federation.

into them. In particular, the BOK has closely followed Facebook's cryptocurrency, Libra, ever since plans for its issuance were first announced in June 2019. By conducting research into key characteristics of Libra, its potential impact and future development, and sharing the results with financial authorities, the BOK has stayed abreast of related developments. The BOK also led the effort to keep the Korean public informed about Libra and international trends in stablecoins in general, for example by releasing to the press in October 2019 highlights of the G7 report²⁴⁾ that contained the international community's assessment of and response to stablecoins.

In tandem, the BOK organized a total of 10 seminars on related topics, with industry professionals and academic experts invited as guest speakers, while actively engaging with market participants through various channels.

Meanwhile, to proactively respond to the issue of central bank digital currencies (CBDCs), increasingly at the forefront of international debate, dedicated CBDC research units, a digital currency research team and a section specializing in CBDC technology, were established in February 2020.

(Distributed Ledger Technology PoC, Etc.)

To gauge the applicability of distributed ledger

technology (DLT) to payment and settlement systems, the BOK has conducted a proof-of-concept (PoC) in several successive rounds.²⁵⁾ In 2019, ahead of the PoC, a preliminary study was performed to determine the optimal method of integrating DLT into the DvP securities settlement process. Based on the results of this study, the PoC kicked off in December that same year.

DvP is a securities transaction method devised to eliminate settlement risk by making the transfer of securities and funds take place simultaneously. In practice, however, DvP alone has proved ineffective in reducing the complexity of procedures, and it is often pointed out that it is a problematic aspect of the current securities settlement process.

As a solution to this problem, central banks from major countries are experimenting with the application of DLT to DvP securities transactions by conducting these PoCs.²⁶⁾ The results of these tests confirmed the many benefits of the application of DLT to DvP transactions, including simplified procedures and a shortened settlement time.

In December 2019, the BOK organized a seminar on the subject of "The DLT Ecosystem and the Future of Digital Finance." The seminar brought together officials from international organizations, including the World Bank, as

24) Following Facebook's announcement of a plan to issue its own cryptocurrency, Libra, the G7 jointly set up a working group on stablecoins with the BIS Committee on Payments and Market Infrastructures (CPMI) to investigate the impact of stablecoins and to discuss potential responses. In October 2019, the results of the G7 Working Group on Stablecoins were published as a report, which sets forth the G7's view that global stablecoins, such as Libra, should not be issued until various risks they pose are sufficiently addressed by establishing clear rules.

25) The PoC, as a mock test, was conducted for interbank funds transfers from September 2017 to January 2018 and for retail payment systems from September 2018 to December 2018.

26) Project Stella by the BOJ and the ECB, Project Ubin by the Monetary Authority of Singapore, and Project Jasper by the Bank of Canada (BOC).

well as researchers and financial industry experts, who exchanged ideas about the future development of the DLT ecosystem and potential directions for regulatory reform that may be required in order to clear the way for DLT.

(Payment and Settlement System Conference)

In October 2019, the BOK and the Korea Payment and Settlement Association jointly organized a conference on payment and settlement systems. At the conference, titled "Two Perspectives on the Future of Payments and Settlements: Openness and Harmony", academics, researchers and industry professionals came together to discuss payment services by fintech companies, issues related to the openness of payment and settlement systems, desirable directions of development in the payment and settlement field, and the role of central banks.

4. Participation in International Discussions and Cooperation

Involvement in International Consultative Bodies

As a member of the BIS Committee on Payments and Market Infrastructures (CPMI), the consultative body for international standards and cooperation in payments and settlements, the BOK has been involved in both research and discussions on related issues, and has actively cooperated with central banks from other major countries. In 2019, at the same time as participating in discussions about digital currencies and other key payment issues, the BOK also contributed to the international effort to enhance and modernize the security of large-value payment systems and to improve cross-border payments by working as a member of related CPMI working groups and taskforces.

Involvement in Regional Consultative Bodies

Since 2016, the BOK has served as the chair of the Working Group on Payments and Market Infrastructures (WGPMI), under the aegis of the Executives' Meeting of East Asia-Pacific Central Banks (EMEAP). The BOK's leadership during its first term as the Working Group chair was widely appreciated, and as the term drew to a close in 2018, the BOK was reelected to a second term²⁷⁾ by a unanimous vote from member countries. As

a second-term chair, the BOK has effectively served as a bridge between central banks worldwide and other EMEAP member countries by actively communicating about developments in global discussions on payments and settlements, led by the BIS and other international organizations, and by reflecting them in the working group agenda. Notably, when the increase in global remittances by migrant workers pushed the issue of improving the efficiency of cross-border payments to the forefront of international debate at the BIS, the BOK gathered information about the current status of cross-border payments between the 11 EMEAP economies and set up a regional taskforce.

The BOK also maintained an active presence in regional meetings such as the South East Asian Central Banks (SEACEN) Meeting of Directors of Payment and Settlement Systems, as well as in discussions on linking securities settlement systems across the region and fintech cooperation by the ASEAN+3 group.

Cooperation with Central Banks from Emerging Market Countries

The BOK is putting its experience in policymaking and implementation in the area of payments and settlements to use to assist central banks from emerging market countries by offering them advice on how to design payment and settlement systems and an oversight framework, and how to develop system infrastructure. In 2019, the BOK convened a council for bilateral cooperation on payments and settlements with central banks from

27) After the reelection of the chair of the Working Group on Payment and Market Infrastructures, the chair's term will be from August 2018 to August 2020.

countries including Laos, Cambodia and Turkey. Meanwhile, through a training program offered to central bank staff from Asia-Pacific countries, the BOK shared the Korean experience developing and operating its payment and settlement systems.

In November 2019, the BOK held a seminar with other major central banks to learn about cases of fast payment systems from guest experts from Sweden, Japan, Singapore, Hong Kong and Mexico. The participants also shared information about the mechanism of retail payment systems in their respective jurisdictions and how the RTGS services are provided by linking them with large-value payment systems at central banks, and discussed the role of central banks and their future tasks.

II

Payment and Settlement Trends and Settlement Risk Management

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1. Large-value Payment System

A. Settlement Trends

Korean Won Funds

In 2019, Korean won funds processed by BOK-Wire+, which provides the final settlement between financial institutions, jumped 8.6% from a year earlier to KRW 369.9 trillion in daily average value, on an increase in securities settlement fund transfers.¹⁾

Table II-1. Settlements Values through BOK-Wire+ by Type (daily average)

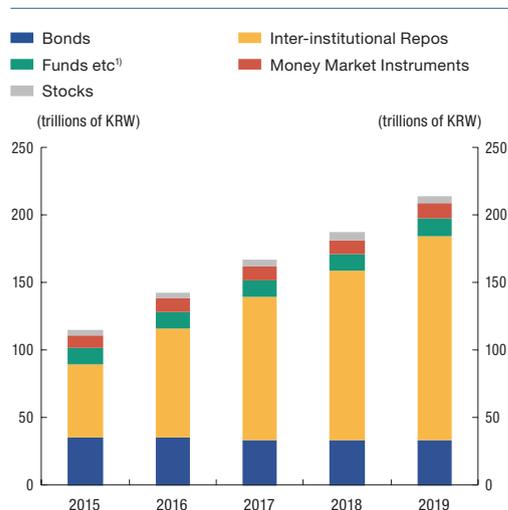
	(trillions of KRW, %)			
	2017	2018	2019	% change
Total of Korean won funds transfers	323.0	340.7	369.9	8.6
Transfers between participants	307.7	324.8	353.9	8.9
Call transaction funds	27.2	23.5	21.1	-10.5
Securities settlement funds	167.3	187.9	214.6	14.2
Foreign exchange settlement funds	19.3	15.9	14.6	-8.7
Customer payments ¹⁾	42.5	45.3	50.2	10.8
Net settlement funds ²⁾	16.9	18.1	18.1	0.3
Others	34.5	34.1	35.3	3.6
Transfers between participants and BOK ³⁾	15.3	15.9	16.1	1.0
Total of foreign currency-denominated funds transfers (billions of USD) ⁴⁾	0.5	0.7	0.7	-4.3

- Notes: 1) Large-value funds transfers made by individuals or companies to beneficiaries via BOK-Wire+
 2) Values of funds for which settlements between participants of retail payment systems are carried out on a deferred net settlement (DNS) basis.
 3) Including payments on government and public bond transactions, payments to and from the Treasury and BOK loans, etc.
 4) Including deposits and withdrawals

Source: Bank of Korea

By type of funds transfer, call transaction funds decreased substantially (-10.5%) year-on-year due to the dwindling demand for call funds, as financial institutions moved to meet the liquidity coverage ratio (LCR) and other capital requirements. On the other hand, securities settlement funds²⁾ jumped 14.2% from the previous year on a large increase in inter-institutional repos transactions. Inter-institutional repos transactions have been the main driver of growth in securities settlement funds in recent years. While there has been a steady increase in the use of repos by financial investment companies that had been restricted from participating in the call market, another contributing factor appears to be the sharp rise in leveraged investment using repos amid the expectations of a drop in interest rates.

Figure II-1. Securities Settlement Funds Processed by BOK-Wire+ (daily average)

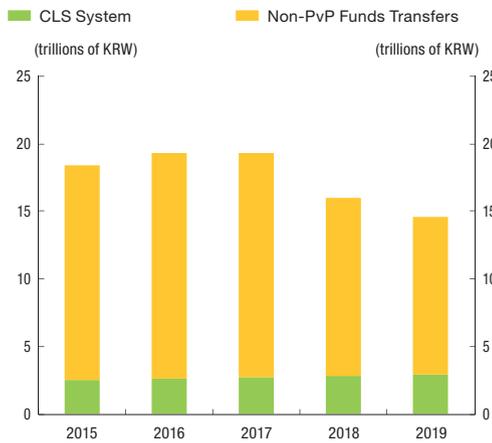


Note: 1) Collective investment securities under the Financial Investment Services and Capital Markets Act
 Source: Bank of Korea

1) In 2019, the volume of settlement transactions increased 11.0% from the previous year (17,962 payments), to a daily average of 19,939 payments.

The value of foreign exchange funds³⁾ showed a 8.7% year-on-year decrease, in line with the decline in non-PvP funds transfers through inter-bank correspondent banking network (-11.4%) and despite the 3.8% increase in fund transfer via the CLS System.

Figure II-2. Foreign Exchange Settlement Funds Transferred through BOK-Wire+¹⁾ (daily average)

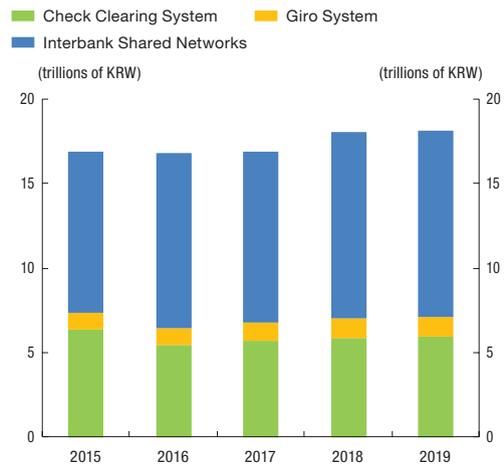


Note: 1) Net basis for CLS system, gross basis for non-PvP funds transfers

Source: Bank of Korea

The daily average value of net settlements among participants in BOK-Wire+ increased 0.3% year-on-year to KRW 18.1 trillion.

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



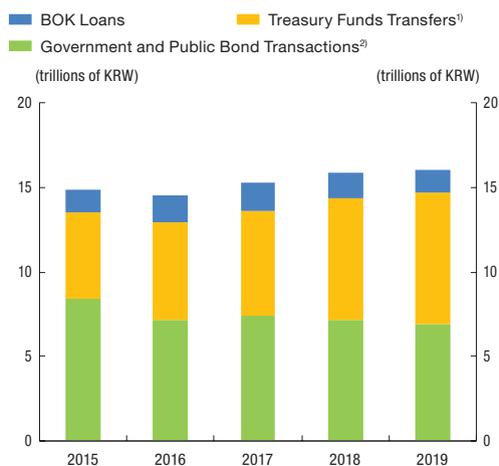
Source: Bank of Korea

Meanwhile, the daily average value of funds transferred between the BOK and BOK-Wire+ participants for transactions in government and public bonds, Treasury funds transfers, and loans from the BOK, increased 1.0% year-on-year to KRW 16.1 trillion. This is due mainly to Treasury funds transactions, which rose 7.7% from a year earlier.

2) In addition to transactions settled on a DvP basis, these also include incidental transactions, such as free-of-payment (FoP) and bond redemption transactions. Regarding redemptions of bank bonds, municipal bonds, and corporate bonds at maturity, KSD forwards the bond principal and interest redemption receipts for clearing, receives the sums of interest and principal on the maturity dates, and distributes the funds to individual investors through BOK-Wire+ and the Electronic Banking System.

3) Korean won funds transfers needed for foreign exchange settlements conducted through the correspondent banking networks and CLS System are processed by BOK-Wire+. In particular, the CLS System processes the payments for the currencies sold and the receipts for the currencies bought on a PvP basis based on connections between the payment system of CLS Bank International and the payment systems of the central banks issuing the currencies concerned with no time gap between the countries.

Figure II-4. Funds Transfers between the BOK and BOK-Wire+ Participants (daily average)



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

2) Issuances and redemptions of Government bonds and Monetary Stabilization Bonds, sales and purchases of repos, coupon, payments, etc.

Source: Bank of Korea

Foreign Currency Funds

The BOK provides foreign exchange banks with transfer, deposit, and withdrawal services for U.S. dollar and Japanese yen funds, all through BOK-Wire+ via foreign currency deposit accounts that were opened with the BOK by these banks to meet their foreign currency reserve requirements. In 2019, the total value of foreign currency funds transfers (including deposits and withdrawals) made through this system averaged USD 676.3 million per day, dropping that of the previous year by 4.3%. This drop is mainly due to the reduced foreign currency reserve requirements as a result of a decline in foreign currency-denominated deposits by Korean residents in 2019.

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

	(millions of USD, %)				
	2016	2017	2018	2019	% change
Transfers	0.8	0.1	0.3	0.2	-44.6
Deposits	243.8	258.2	347.0	333.0	-4.1
Withdrawals	275.8	272.7	359.5	343.2	-4.5
Total	520.3	530.9	706.8	676.3	-4.3

Source: Bank of Korea

B. Supply of Intraday Liquidity

To help BOK-Wire+ participants bridge temporary liquidity shortages and thereby ensure the smooth functioning of payments and settlements, the BOK offers facilities such as intraday overdrafts and intraday repos. In 2019, the value of intraday liquidity provided to BOK-Wire+ participants totaled KRW 3,050.2 billion in terms of daily average, up 23.2% from the previous year.

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

	(billions of KRW, %)			
	2017	2018	2019	% change
Intraday Overdrafts ¹⁾	318.2	328.5	432.1	31.5
Intraday Repos	2,055.9	2,147.9	2,618.1	21.9
Total	2,374.1	2,476.4	3,050.2	23.2

Note: 1) Based on average net intraday overdraft balances obtained after subtracting the balances of the deposit accounts used exclusively for settlement from the daily overdraft amounts

Source: Bank of Korea

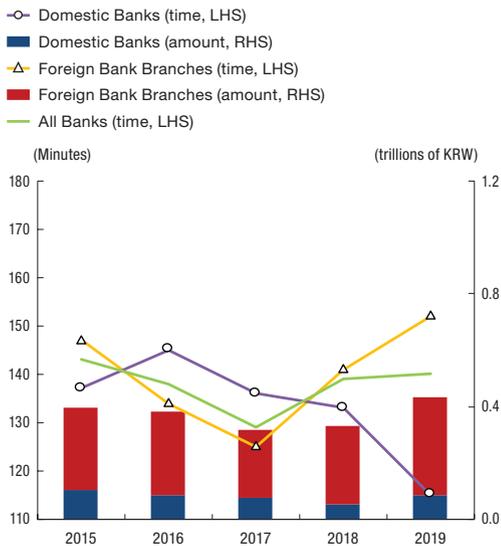
Intraday Overdrafts

An intraday overdraft is a loan extended to BOK-Wire+ participants experiencing a temporary liquidity shortage during business hours, on a real time basis, to ensure the smooth functioning of funds transfers

between financial institutions and those between companies that are mediated by them. In 2019, the daily average value of intraday overdrafts amounted to KRW 432.1 billion, representing a 31.5% increase over a year earlier. By type of bank, the value of intraday liquidity supplied to domestic banks and domestic branches of foreign banks totaled KRW 84.6 billion and KRW 347.5 billion, up KRW 30.7 billion and KRW 72.9 billion year-on-year, respectively.

The daily duration in which intraday overdrafts were outstanding averaged 140 minutes, roughly the same as during the previous year. By type of bank, the duration was 115 minutes for domestic banks, 18 minutes shorter than a year earlier, and 152 minutes for domestic branches of foreign banks, 11 minutes longer than a year earlier.

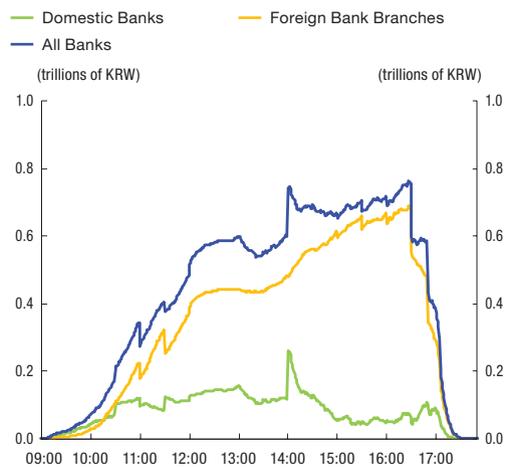
Figure II-5. Amounts¹⁾ and Durations of Net Intraday Overdraft Use (daily average)



Notes: 1) Based on average net intraday overdraft balances obtained after subtracting the balances of the deposit accounts used exclusively for settlement from the daily overdraft amounts
Source: Bank of Korea

The outstanding balance of banks' intraday overdrafts showed a continuous increase until 4 p.m., the time slot at which there is a high concentration of funds transfers, to reach a daily peak (KRW 762 billion) at around 4:30 p.m., and gradually declined thereafter. The daily peak in outstanding intraday overdrafts was higher than in the previous year (KRW 635.9 billion).

Figure II-6. Daily Net Intraday Overdraft Balances, by Time Slot¹⁾ (daily average)



Note: 1) Based on average net intraday overdraft balances obtained after subtracting the balances of the deposit accounts used exclusively for settlement from the daily overdraft amounts
Source: Bank of Korea

Intraday Repos

Since February 2012, the BOK has been supplying the KRX and financial investment companies with repos to cover their temporary settlement fund shortages, and has been encouraging the KRX and financial investment companies to conduct their funds settlements with each other through BOK-Wire+ at earlier times of the day, thereby alleviating the concentration of securities settlements at around the BOK-Wire+'s closing time. This

measure was implemented in accordance with Article 81.2 of the Bank of Korea Act, which prescribes the BOK's provision of support for financial institutions experiencing temporary settlement fund shortages. The value of intraday liquidity supplied through repo transactions rose by 21.9% year-on-year, recording a daily average of KRW 2,618.1 billion owing to the increase in exchange-traded bond transactions made by the KRX and financial investment companies.

Table II-4. Supply of Intraday Liquidity through Repo Transactions (daily average)

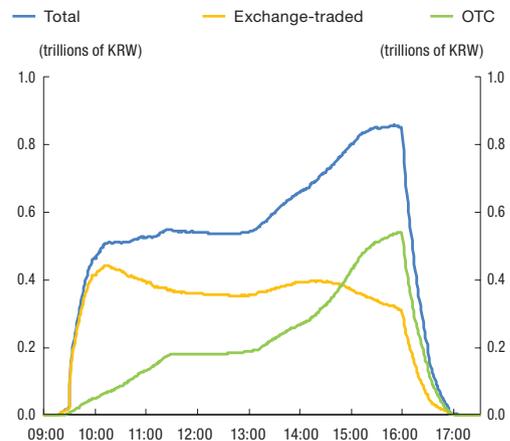
	2018			2019			% change
	Exchange-traded	OTC	Total	Exchange-traded	OTC	Total	
Korea Exchange	1,115.8	-	1,115.8	1,382.8	-	1,382.8	23.9
Financial Investment Companies	264.9	767.2	1,032.1	379.3	856.0	1,235.3	19.7
Total	1,380.8	767.2	2,147.9	1,762.1	856.0	2,618.1	21.9

Source: Bank of Korea

The balance of intraday liquidity provided through repos rose sharply at around 10 a.m., as more than half of all daily settlement obligations in the exchange-traded bond market are completed by 12 p.m. noon. The balance then remained stable until 1 p.m., when financial investment companies' use of intraday repo transactions began to steadily increase as a result of OTC bond settlements until 4 p.m., which is the closing time for intraday repo purchases by the BOK. After closing time, the balance declined rapidly, with the repurchases being completed. Meanwhile, the balance

of intraday liquidity supplied through repos recorded a daily high of KRW 857.1 billion at 3:50 p.m., which was six minutes later than in 2018, because the redemption of intraday repo transactions occurred slightly later⁴⁾ than in the previous year.

Figure II-7. Intraday Repo Balances, by Time Slot¹⁾ (daily average)



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

Source: Bank of Korea

C. Risk Management Status

The proportion of queued payment instructions⁵⁾ for settlement and the rate of maximum intraday overdraft cap utilization, both of which are monitored as indicators of the settlement liquidity of BOK-Wire+ participants, indicated that the operation of BOK-Wire+ remained stable. Compared to the previous year, while the rate of maximum intraday overdraft cap utilization increased slightly to 21.3% from 20.4%, The proportion of queued

4) The average redemption time of the intraday repos was 1:57 p.m., which is two minutes later than the previous year (1:55 p.m.).

5) The percentage share of funds transfer instructions that are temporarily placed in queue due to an insufficient balance in the payer's account, among the total number of transfer instructions submitted to BOK-Wire+.

payment instructions for settlement fell to 3.9% from 4.7%.

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

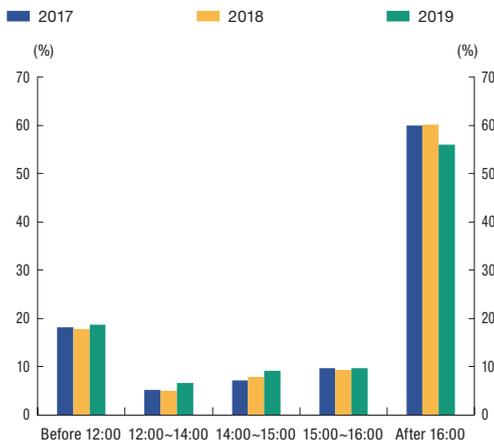
	2015	2016	2017	2018	2019
Proportion of payment instructions in queue for settlement ¹⁾	4.5	4.1	4.1	4.7	3.9
Maximum intraday overdraft cap utilization rate ²⁾	23.7	20.7	19.4	20.4	21.3

Notes: 1) Average proportion of amount of payment instructions in queue for settlement among the total amount of funds transfers (excluding payment instructions in queue for liquidity savings)
 2) Average ratio of the daily maximum intraday net overdraft amount to the intraday overdraft cap

Source: Bank of Korea

In 2019, the proportion of settlements, by value, carried out after 16:00, which is near the closing time of BOK-Wire+, fell from a year earlier (60.2%), to 56.0%.

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

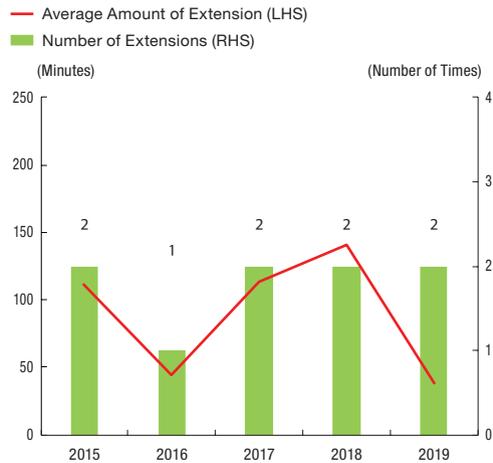


Note: 1) Settlement amount in each time slot / total settlement amount

Source: Bank of Korea

The closing time for the BOK-Wire+ was extended twice, similar to the two extensions in the previous year, and the extensions lasted an average of 38 minutes, significantly below that in the previous year (141 minutes). They both were to allow for repo transactions executed by the BOK to control liquidity after the closing time of the BOK-Wire+, and they took place in April and August 2019.

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



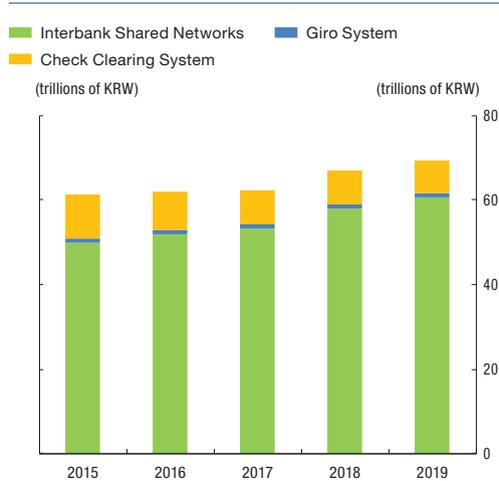
Source: Bank of Korea

2. Retail Payment Systems

A. Payment Trends

In 2019, the retail payment systems operated by the KFTC⁶⁾ processed a daily average of 24.6 million transactions, valued at KRW 69.4 trillion, showing increases of 7.6% and 3.7% year-on-year, respectively, as a result of the increase in funds transferred through the Interbank Shared Networks. Despite the decline in funds cleared via the Check Clearing System, the overall volume and value of transactions rose due to an increase in funds transferred through the Interbank Shared Networks that processes Internet banking transactions.

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



Source: KFTC

The daily average volume and value of funds transfers processed through the Interbank Shared Networks edged up 10.8% and 4.9% over the previous year to 20 million transactions and KRW 60.8 trillion, respectively. This was attributable to the rise in the volume and value of funds transferred via the Electronic Banking System, including Internet, mobile, and firm banking.

Table II-6. Amounts of Funds Transferred via Interbank Shared Networks, Check Clearing System and Giro System (daily average)

		(thousands of transactions, billions of KRW, %)			
		2017	2018	2019	% change
Volume	Interbank Shared Networks	16,206	18,046	20,001	10.8
	(Electronic Banking System)	10,289	12,178	14,236	16.9
	(Interbank Funds Transfer System)	333	319	295	-7.6
	(CD/ATM System)	1,796	1,700	1,548	-8.9
	Check Clearing System	421	329	252	-23.3
	(Cashier's Checks)	412	321	245	-23.6
	(Promissory Notes ¹⁾)	7	6	5	-16.2
	Giro System	4,675	4,437	4,301	-3.1
	(Credit Transfers)	943	873	798	-8.6
	(Direct Debits)	3,337	3,187	3,136	-1.6
(Direct Credit Transfers)	299	304	311	2.1	
Value	Interbank Shared Networks	53,146	57,925	60,755	4.9
	(Electronic Banking System)	46,933	51,793	54,823	5.8
	(Interbank Funds Transfer System)	4,822	4,793	4,679	-2.4
	(CD/ATM System)	923	892	818	-8.3
	Check Clearing System	8,220	8,002	7,661	-4.3
	(Cashier's Checks)	1,413	1,249	1,132	-9.4
	(Promissory Notes ¹⁾)	4,036	4,163	3,892	-6.5
	Giro System	1,009	1,024	1,030	0.7
	(Credit Transfers)	392	398	392	-1.5
	(Direct Debits)	368	372	380	1.9
(Direct Credit Transfers)	227	238	247	3.8	

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

Sources: Bank of Korea, KFTC

6) The value of retail payments processed refers to the value of funds transferred through the Interbank Shared Networks and Giro System as well as the value of checks and bills cleared through the Check Clearing System.

On the other hand, the daily average volume and value of checks and bills processed through the Check Clearing System fell by 23.3% and 4.3% year-on-year, respectively, to 252 thousand transactions valued at KRW 7.7 trillion, maintaining their downward trends. The volume and value of cashier's checks and promissory notes declined particularly sharply, as they are being rapidly replaced by KRW 50,000 denominated banknotes and electronic payment instruments.

The volume of transfers made through the Giro System fell to a daily average of 4.3 million transactions, which is 3.1% fewer than in the previous year. However, the daily average value of the transfers reached KRW 1.0 trillion, edging above that recorded in the previous year by 0.7%. The volume of funds transfers shrank, with a particularly noticeable decrease seen in credit transfers, due to the growing widespread use of firm banking and other alternative transfer services. On the other hand, the value of direct debits and direct credit transfers showed a moderate increase in the growth in funds transfers for payment of taxes and dues.

B. Risk Management Status

As the number of funds transfers between customers of financial institutions conducted through the retail payment systems is quite high and the value per transaction is quite small, only the net amounts among financial institutions are settled via BOK-Wire+ after

their debits and credits are offset. To facilitate this practice, participants set and manage net debit caps. As of the end of 2019, the sum of the net debit caps⁷⁾ set by retail payment system participants stood at KRW 47.3 trillion, showing a 3.5% increase from the end of 2018.

Table II-7. Net Debit Caps¹⁾, by Participant Type (year-end basis)

	(trillions of KRW, %)			
	2017	2018	2019	% change
Direct Participants	41.6	42.1	43.5	3.5
Indirect Participants	3.7	3.7	3.8	3.5
Financial Investment Companies	2.0	2.0	2.0	0.5
Others ²⁾	1.7	1.7	1.8	7.1
Total	45.3	45.7	47.3	3.5

Notes: 1) Ceiling on the unsettled net obligation that a retail payment system participant is allowed to incur (i.e., total amount of payment orders transmitted to other banks - total 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 2019, the daily average maximum utilization rate of net debit cap of institutions participating in net settlements decreased from a year earlier (18.6%) to 17.2%. The utilization rate exceeded the cautionary level (70%) 83 times, showing a reduction compared to the previous year (87 times). In 2019, there was no case of a suspended funds transfer due to the utilization rate exceeding 100%.

7) Net debit caps are set freely by participants and apply to payment instructions between participants of the Electronic Banking System and Interbank Funds Transfer System, which are processed in real time. Participants of the DNS system must deposit eligible securities with the BOK to guarantee settlement. For transactions requiring the use of a net debit cap, collateral equal to 70% of the cap must be put up, while for transactions that do not require such a cap, collateral equal to 70% of the average net clearing amount must be provided.

Table II-8. Status of Net Debit Cap Utilization

(% , number of instances)

	2015	2016	2017	2018	2019
Average maximum net debit cap utilization rate ¹⁾	19.0	19.4	18.5	18.6	17.2
Number of instances where net debit positions exceeded the cautionary level	62	51	71	87	83

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

Source: Bank of Korea

Meanwhile, to cover their net settlement exposure, participants are required to provide the BOK with collateral securities equivalent to a fixed percentage (collateral-to-net debit cap ratio) of their net debit caps. At the end of 2019, the total value of such collateral was KRW 37.1 trillion, having increased by KRW 10.9 trillion from the previous year (KRW 26.2 trillion).

Box II-1.

Usage Trends of Non-cash Payment Instruments

Checks and Bills

In 2019, the daily average volume and value of checks and bills cleared fell by 24.2% and 11.3% year-on-year, respectively, in line with the declining use of promissory notes and KRW 100,000-denominated cashier's checks. The use of cashier's checks cleared declined, owing to the growing use of KRW 50,000-denominated banknotes, and the transactions of promissory notes cleared fell as well, resulting from the expanded use of electronic payment instruments.

Checks and Bills¹⁾ (daily average)

(thousands of transactions, billions of KRW, %)

		2017	2018	2019	% change
Volume	Cashier's Checks	637	485	366	-24.6
	Preset Value	577	435	322	-25.9
	(KRW 100,000 denominated)	431	313	225	-28.2
	Non-preset Value	59	51	44	-13.3
	Promissory Notes, etc. ²⁾	16	15	13	-12.7
	Electronic Bills	8.7	8.5	7.7	-10.1
	Others ³⁾	2.5	2.1	1.9	-9.5
	Total	655	502	381	-24.2
Value	Cashier's Checks	1,926	1,658	1,455	-12.3
	Preset Value	189	152	119	-21.8
	(KRW 100,000 denominated)	43	31	22	-28.2
	Non-preset Value	1,737	1,506	1,336	-11.3
	Promissory Notes, etc. ²⁾	15,924	15,212	13,175	-13.4
	Electronic Bills	1,366	1,099	1,262	14.8
	Others ³⁾	2,770	2,590	2,637	1.8
	Total	20,620	19,461	17,267	-11.3

Notes: 1) Including checks and bills cleared via the Check Clearing System and presented directly at bank windows as well as electronic bills

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

3) Including postal money orders, receipts of principal and interest payments on securities, etc.

Source: KFTC

Account Transfers

In 2019 the daily average volume and value of account transfers between financial institutions, excluding those processed via BOK-Wire+, increased by 8.6% and 4.8%, respectively, from 2018. The volume and value of account transfers routed through the Electronic Banking System jumped significantly, by 16.9% and 5.8%, respectively, as a consequence of the growing use of electronic payment instruments, such as Internet banking (including mobile banking) and firm banking services.

Account Transfers¹⁾ (daily average)

(thousands of transactions, billions of KRW, %)

		2017	2018	2019	% change
Volume	Credit Transfers ¹⁾	13,128	14,816	16,652	12.4
	Electronic Banking System	10,289	12,178	14,236	16.9
	(Internet Banking ²⁽³⁾)	5,555	6,629	7,838	18.2
	(Firm Banking ²⁽⁴⁾)	3,645	4,424	5,418	22.5
	Interbank Funds Transfer System	333	319	295	-7.6
	Debit Transfers	7,010	6,932	6,958	0.4
	Total	20,138	21,749	23,610	8.6
Value	Credit Transfers ¹⁾	53,204	57,990	60,830	4.9
	Electronic Banking System	46,933	51,793	54,823	5.8
	(Internet Banking ²⁽³⁾)	22,366	24,002	25,125	4.7
	(Firm Banking ²⁽⁴⁾)	19,276	20,925	21,752	3.9
	Interbank Funds Transfer System	4,822	4,793	4,679	-2.4
	Debit Transfers	778	785	787	0.3
	Total	53,982	58,774	61,617	4.8

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

2) Based on funds transferred to other banks

3) Including transactions made via mobile devices

4) Corporate financial transactions system provided by financial institutions

Sources: Bank of Korea, KFTC

Payment Cards

In 2019, The daily average volume and value of payments made using payment cards was 65.1 million transactions valued at KRW 2.7 trillion, showing increases of 11.0% and 5.3%, respectively, from 2018.

During 2019, the daily average volume and value of payments made using credit cards increased by 12.4% and 5.0% year-on-year, respectively, driven mainly by the increased purchases of goods and services. Payments made via check cards continued to show an upward trend, re-

cording increases in their daily average volume and value of 8.2% and 6.2%, respectively, from the previous year, owing to the effects of the expansion of tax deduction benefits for the use of check cards and the provision of incidental services similar to those of credit cards. The daily average volume and value of payments made using prepaid cards jumped 28.0% and 18.8% year-on-year, respectively, lifted by, among others, the launch of the mobile debit payment service. The daily average volume and value of payments made using other payment cards, such as IC cash cards,¹⁾ soared by 292.3% and 74.2% year-on-year, respectively.

Payment Card Usage (daily average)

(thousands of transactions, billions of KRW, %)

		2017	2018	2019	% change
Volume	Credit Cards	32,782	36,197	40,693	12.4
	Purchases of Goods and Services	32,548	35,967	40,470	12.5
	Cash Advances	234	229	224	-2.4
	Check Cards	20,127	22,321	24,141	8.2
	Prepaid Cards	68	67	86	28.0
	Others ¹⁾	16.4	36.0	141.4	292.3
	Total	52,994	58,621	65,062	11.0
Value	Credit Cards	1,926	2,031	2,132	5.0
	Purchases of Goods and Services	1,760	1,862	1,967	5.7
	Cash Advances	166	169	165	-2.4
	Check Cards	466	502	532	6.2
	Prepaid Cards	2.1	2.1	2.5	18.8
	Others ¹⁾	1.1	1.4	2.4	74.2
	Total	2,395	2,536	2,670	5.3

Note: 1) IC cash cards and debit cards

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

1) They rose sharply as a large consumer goods company started to accept IC cash cards in 2018.

3. CLS System⁸⁾

A. Payment Trends

In 2019, the daily average value of foreign exchange settlements processed through the CLS System climbed 13.6% year-on-year to USD 74.3 billion, as foreign exchange transactions increased overall and as the CLS's share of total settlements by Korean branches of foreign banks grew significantly.

Table II-9. Value of Settlements through the CLS System¹⁾ (daily average)

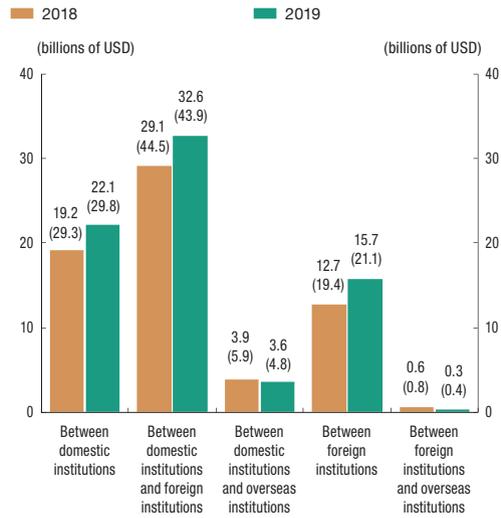
	(billions of USD, %)				
	2015	2016	2017	2018	2019
Value	55.7	50.4	50.7	65.4	74.3
% change	2.4	-9.5	0.7	29.0	13.6

Note: 1) Based on the sum of amounts reported by financial institutions in relation to foreign exchange spot, forward, and swap transactions (before multilateral payment netting)

Source: Bank of Korea

By counterparty type⁹⁾, transactions between domestic institutions and foreign institutions accounted for the largest share of 43.9% in total settlements processed through the CLS System, followed by those between domestic institutions (29.8%) and between foreign institutions (21.1%).

Figure II-11. Settlements Made through the CLS System, by Transaction Counterparty¹⁾²⁾ (daily average)



Notes: 1) Based on the sum of figures reported by financial institutions regarding foreign exchange spot, forward, and swap transactions

2) Figures in () indicate weights.

Source: Bank of Korea

As of the end of 2019, over 25,000 financial institutions in 18 countries participate in the CLS System, of which 43 are Korean institutions (17 domestic banks, 6 domestic financial investment companies, 19 foreign bank branches, one foreign financial investment company). In 2019, one of the foreign bank branches (Macquarie) ended its membership of the CLS System.

8) Foreign exchange settlements are processed through the interbank correspondent network, the CLS System operated by the CLS Bank and the domestic foreign currency transfer system. This report focuses on the PvP data of the CLS System, whose transaction volume and value can be clearly identified.

9) Transaction counterparties are divided into domestic institutions (domestic banks and financial investment companies), foreign institutions (Korean branches of foreign banks and investment companies) and overseas institutions.

Table II-10. Local Participants of the CLS System

(as of December 31, 2019)

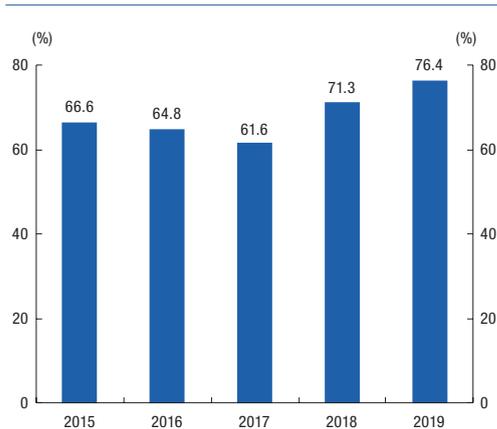
Classification		Participatory Institutions
Domestic	Banks (17)	Kookmin Bank, Nonghyup Bank, Gwangju Bank, Daegu Bank, KEB Hana Bank, Suhyup Bank, Export-Import Bank, Busan Bank, Gyeongnam Bank, Korea Development Bank, Industrial Bank of Korea, Woori Bank, Shinhan Bank, Jeju Bank, Standard Chartered Bank Korea, Citibank Korea
	Financial Investment Companies (6)	Samsung Securities, Mirae Asset Daewoo, NH Investment & Securities, Meritz Securities, Shinhan Investment
Foreign	Banks(19)	HSBC, BOA, BNP Paribas, SMBC, ING, Morgan Stanley, Credit Agricole, JPMorgan Chase, MUFG, Credit Suisse, Deutsche Bank, DBS, New York 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

B. Risk Management Status

Foreign exchange settlement risk arising from the time lag between the payment leg and the delivery leg tends to decrease with the increasing volume of PvP settlements. In 2019, the share of PvP settlements (76.4%) edged up 5.1%p over the previous year (71.3%), on an uptick in CLS settlements by domestic branches of foreign banks.

Figure II-12. Proportion of FX Settlements through the CLS System¹⁾²⁾ (daily average)



Notes: 1) Proportion of foreign exchange transactions settled through the CLS System among CLS-eligible foreign exchange transactions (spot, forward, and swap)

2) Transactions by domestic banks and foreign bank branches

Source: Bank of Korea

In the CLS System, multilateral payment netting is used to offset foreign exchange payables and receivables, thereby substantially reducing liquidity requirements. In 2019, the liquidity savings rate¹⁰⁾ for financial institutions reached 95.4%.

10) Settlement liquidity savings rate (%) = [1 - (net settlement value / gross settlement value)] × 100

4. Securities Settlement Systems

A. Settlement Trends

In 2019, the daily average value of securities settled via the systems operated by the KRX and KSD amounted to KRW 186.4 trillion, up 18.3% year-on-year. The daily average settlement value in the exchange markets reached KRW 2.5 trillion, increasing by 8.9% from the previous year. The daily average settlement value in the OTC markets recorded KRW 183.9 trillion, showing a rise of 18.4% over the previous year. This was attributed to the strong growth of settlement value in inter-institutional repos, which jumped by 21.2% over the preceding year.

Table II-11. Value of Settlements Made through Securities Settlement Systems (daily average)

		(billions of KRW, %)			
		2017	2018	2019	% change
Exchange-traded	Stocks	503	566	484	-14.6
	Bonds ¹⁾	1,472	1,608	1,898	18.0
	Derivatives	77	112	108	-3.4
	Subtotal	2,053	2,286	2,489	8.9
OTC	Stocks ²⁾	732	815	669	-18.0
	Bonds ³⁾	10,544	10,214	10,508	2.9
	Inter-institutional Repos	105,542	128,123	155,271	21.2
	Money Market Instruments ⁴⁾	8,928	9,086	10,061	10.7
	Collective Investment Securities ⁵⁾	6,759	7,027	7,357	4.7
	Derivatives ⁶⁾	18	30	45	50.1
	Subtotal	132,523	155,294	183,911	18.4
Total		134,575	157,581	186,400	18.3

Notes: 1) Value of settlements of government (including repos) and corporate bonds

2) Value of settlements between financial investment companies and institutional investors

3) Value of final settlement after netting of payables and receivables in chain settlement

4) Value of final settlement of certificates of deposit (CDs), commercial paper (CP), and electronic short-term bond transactions after netting of payables and receivables in chain settlement

5) Value including both subscription and redemption transactions of collective investment securities

6) Eligible IRS value settled through KRX after the beginning of the mandatory clearing of derivatives on Jun. 30, 2014

Sources: KSD, KRX

B. Risk Management Status

Settlement risk in the securities settlement systems refers to the risks associated with the failure to deliver securities and make payments within the set deadlines or to exchange securities and funds simultaneously. In 2019, the settlement risk of securities settlement systems was maintained at a low level, as the majority of participants mostly delivered and made payments for securities before the settlement deadlines, and the proportion of

free-of-payment (FoP) settlements¹¹⁾ remained relatively moderate.

In exchange-traded government bond markets, all securities and funds due were all completed before the penalty deadlines. The proportion of settlements made after the penalty deadlines in exchange-traded stock markets¹²⁾ and the institutional investors system for OTC stocks decreased from the previous year. As for the institutional investors system for OTC stocks, settlements made after the penalty deadlines were due to liquidity shortages among participants.

Table II-12. Proportions of Securities Settlement Completed after the Deadline

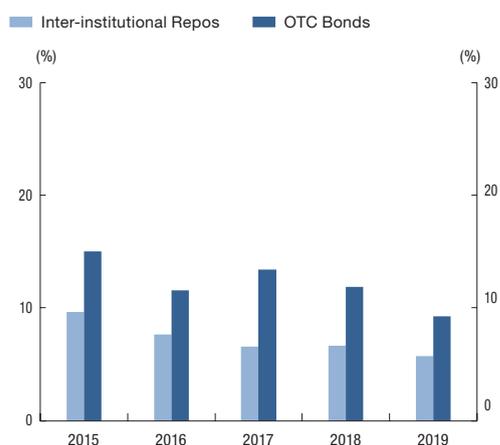
Type	Payment Deadline ¹⁾	Penalty Deadline ²⁾	2019 (%)		
			2017	2018	2019
Exchange-traded Stocks	16:00	16:00	0	0.025	0
Exchange-traded Government Bonds	16:00	17:00	0	0	0
Institutional Investors for OTC Stocks	16:50	16:50	0.009	0.14	0.024

Notes: 1) Settlement deadline under system operating rules
 2) Deadline after which penalty for settlement delay is imposed
 Source: Bank of Korea

The proportion of FoP in the inter-institutional repo settlement system dropped from 6.7% in 2018 to 5.7% in 2019 and the proportion of FoP in the OTC bonds settlement system declined from 11.9% in 2018 to 9.3% in 2019. Specifically, the proportions of FoP in OTC bonds, CDs, CP, and short-term electronic

bonds settled via the OTC bonds settlement system declined by 0.1%p, 1.3%p, 1.5%p, and 11.2%p, respectively, from the previous year.

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



Notes: 1) Proportion of settlement value not made through BOK-Wire+ (DvP) among the total settlement value
 2) OTC bonds include bonds, CDs, CPs and electronic short-term bonds (based on final settlement after chain netting)
 Source: KSD

11) Settlement risk is relatively higher with free-of-payment (FoP) settlements, in which there is a time gap between the payment and delivery of securities, than with DvP settlements.

12) Transactions of exchange-traded securities (stocks, government bonds, other bonds and repos) are settled through the KOSPI and KOSDAQ Market Settlement Systems jointly operated by the KRX (clearing institution) and the KSD (settlement institution), while transactions of OTC stocks are cleared and settled through the Institutional Stock Investors Settlement System operated by the KSD.

III

Future Policy Directions

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4. Active Participation in International Discussions and Continuing Efforts for Cooperation	45

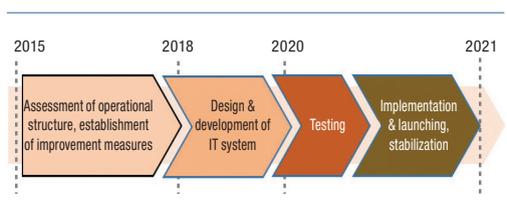
1. Expanding and Enhancing the Stability of Payment and Settlement Infrastructures

Building and Operating the Next-generation BOK-Wire+

The BOK has been building the next-generation BOK-Wire+ since 2015 with the aim of putting the system into operation in the second half of 2020. In the lead-up to its launch, the BOK will conduct comprehensive testing of the system with BOK-Wire+ participants. Related regulations will also be appropriately amended to reflect new processes and procedures introduced by the system.

After its operation, the BOK plans to stabilize the new system through continuous checks and improvements. The status of participants' transition to the new system will also be closely monitored, with guidance provided to help them make the most of its various features.

Figure III-1. Timeline for the Establishment of the Next-Generation BOK-Wire+



Source: Bank of Korea

Meanwhile, the BOK is currently reviewing matters related to the introduction of ISO 20022,¹⁾ an international electronic messaging standard, to lay the foundation for cross-border linkages among payment systems. In 2019, the BOK conducted a consultation that analyzed current BOK-Wire+ messages and provided a strategy for the introduction of the standard and expected benefits. Based on insights gained from the consultation, the BOK will conduct a comprehensive analysis of the impact of introducing the standard on participants, and cases of introducing such systems in other major countries, and take concrete steps toward the adoption of ISO 20022 after collecting opinions from BOK-Wire+ participants.

Enhancing Management of Net Settlement Risk

The Electronic Banking System and other retail payment systems process funds transfers around the clock, in real time, thereby delivering a high standard of service in terms of customer convenience. However, net obligations in retail payment systems, resulting from banks' customer transactions, are settled on the following business day, by 11 a.m., which exposes participants with settlement receivables to credit risk.

A number of measures are in place to manage such risks associated with deferred net settlement, including requiring participants in retail payment systems to establish a net debit cap for themselves, pledge collateral securi-

1) International standard on electronic message formats in the field of banking, securities, and other financial services, developed by the International Organization for Standardization (ISO). This standard provides methods for the development and registration of standardized messages so that standard message formats are used across financial industries, thus facilitating efficient international financial transactions.

ties to guarantee settlements, and collectively shoulder any settlement shortfall. In 2016 and 2019, the collateral-to-net debit cap ratio for guaranteeing net settlements was successively increased (30% → 50% → 70%) to bring it up-to-date with the international standard, the PFMI. The collateral-to-net debit cap ratio is scheduled to rise in 2020 and thereafter, until it reaches 100%.

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

	(%)		
	Aug. 1, 2020.	Aug. 1, 2021	Aug. 1, 2022
	80	90	100

Source: Bank of Korea

In tandem, the BOK will be examining a variety of options to ease the burden that the new net settlement collateral requirement will place on financial institutions.

Introducing Real-time Gross Settlement in Retail Payment Systems

Recently, in jurisdictions such as the U.S., Mexico, Australia, Hong Kong, Sweden and other places in Europe, a new settlement method has been adopted for retail payment systems, in which final settlements between financial institutions take place in real time, on a transaction-by-transaction basis (real-time gross settlement). Also, a growing number of central banks are setting up a fast payment system that is directly managed and operated by them. The BOK will carefully follow related developments in the U.S. and elsewhere and analyze the advantages and disadvantages of a real-time gross settlement system, to determine whether such a system would be needed in Korea.

Amending Rules for Participation in Payment and Settlement Systems

Recent innovations in fintech have caused a rapid change in the payment services market. There has been a steady increase in both the use of payment services provided by fintech companies and other non-financial institutions, and in the number of non-financial institutions providing payment services. This has led to a call for opening up payment and settlement systems -- whose use has so far been reserved to financial institutions -- to non-financial institutions, such as fintech companies.

In light of such changes in the payment services environment, the BOK has started to review current rules on participation in payment and settlement systems, to introduce appropriate amendments. Payment and settlement systems are the backbone of a financial system, providing an efficient settlement of obligations arising from financial transactions and business activities between economic entities. Safety and efficiency must therefore be the two guiding considerations in establishing rules for participation in payment and settlement systems. The rules must, furthermore, be in line with the general principle of "same business, same risk, same rules." As the BOK continues to support innovation in payment and settlement systems, it will also engage in sustained efforts to guarantee their safety by improving their rules of participation.

2. Strengthening Oversight Framework for Payment and Settlement Systems

Strengthening the Oversight of Operational Risk in Information Technology

As the reliance of payment and settlement systems on information technology grows stronger, there is a pressing need for robust management of operational risk arising from information systems. In recognition of this need, the BOK plans to strengthen its oversight of operational risk associated with information technology.

A plan is currently in the works to set up a framework to monitor system issues at participating institutions in real time, which will be based on the next-generation BOK-Wire+, scheduled to begin operation in the second half of 2020. BOK-Wire+ participants will be required to report any technical difficulties they encounter without delay via the payment systems, and the reported details will be saved onto a database, to build a comprehensive system incident history and to assist in the analysis of operational risk. The plan also includes the sharing of the results of the operational risk analyses to make participants to implement their own measures to prevent future system incidents.

Increasing Cyber Risk Response Capabilities

To enhance its oversight capabilities for information technology, the BOK will tighten cooperation with relevant domestic and foreign

organizations. For a coordinated response to cyber risk and the sharing of related experiences with other central banks, the BOK will continue to participate in the BIS Cyber Resilience Coordination Centre (CRCC). The BOK will take part in cyber simulative exercises organized by the BIS to improve its cyber risk response capabilities and use this experience in the assessment and inspection of the response framework of domestic payment and settlement system operators.

Establishment of Financial Market Infrastructures Assessment Guidelines

The BOK will be establishing assessment guidelines for systemically important settlement systems that are suitable for the domestic payment and settlement environment, while being closely aligned with the requirements under the PFMI and the two further guidance documents, 「Resilience of Central Counterparties: Further Guidance on the PFMI」 and 「Recovery of Financial Market Infrastructures」, currently in use for regular assessments.

At the same time as fleshing out the basic principles laid out in the PFMI, these assessment guidelines will take into comprehensive consideration the special characteristics of the domestic financial market systems and infrastructures. In developing these guidelines, based on the 24 principles and 113 key considerations under the PFMI, as well as items outlined in the recently-published "further guidance" documents, existing regulations and guidelines in other countries will also be consulted.

The guidelines developed in that manner,

when applied to practice, are expected to increase the transparency, utility and international conformity of the assessment process. They are furthermore expected to reduce the work burden on assessed institutions associated with the implementation of international standards or with improvement actions recommended by the BOK.

Updating the Oversight Framework

The recent increase in the participation of non-financial institutions in the payment service market has had a positive effect on convenience for financial consumers, as well as contributing to a reduction in settlement costs. For example, with the launch of the open banking system by the KFTC in December 2019, fintech companies that satisfy certain eligibility requirements can now access customer bank account information without having to enter into an agreement with each bank. This has provided fintech companies with the ability to offer payment services that are innovative as well as cost-efficient. At the same time, this has added to the growing complexity and diversity of payment services and settlement mechanisms. As more companies can access bank customer information, it also raises concerns about the transfer of risk among service providers, and information leaks.

To keep up-to-date with the evolving environment, the BOK plans to continuously add new oversight tools, while also enhancing its assessment methods. A comprehensive oversight framework is especially important for an open payment and settlement system, such as the open banking system, in which there exists a high level of disparity in risk manage-

ment capabilities among the participants.

Reorganization of Payment and Settlement Statistics

The BOK plans to reorganize its payment and settlement statistics at the same time as stepping up the monitoring of potential risk factors. The reorganization of statistics will have a particular focus on retail payments, a field that has seen much innovation over recent years.

The utilization of contactless electronic payment instruments has rapidly increased, with the use of mobile payment means also steadily gaining in volume. In order to capture such changes, payment instrument-related statistics will be subdivided according to the type of funding (prepaid, debit) and access channel (online, offline). For greater ease in cross-country comparison and for the sake of international convergence, the new organization of statistics will also reflect the new payment and settlement statistics by the BIS CPMI, as reorganized in November 2019.

3. Facilitating Innovation and Development of Payment and Settlement Systems

Support for Promotion of Mobile Cash Card Service Use

To help increase the use of the bank account-based debit payment service, the Committee on Financial Informatization Promotion (CFIP) plans to provide sustained support for promotion of the mobile cash card service use. Going forward, the CFIP will work together with financial institutions to introduce NFC and other contactless payment instruments for broader usability of the service, while also increasing the number of merchants who accept the card.

In tandem, as a value-added service, the BOK plans to enable users of the mobile cash card service to deposit the change through the card when they buy goods in cash or with a gift certificate at participating merchant stores. This service is aimed at reducing the inconvenience of carrying cash and the social costs associated with its circulation and management. The service will start once all necessary preparations are completed, including the development of IT systems for participating merchants, in the second half of 2020. To promote the utilization of the mobile cash card service, the BOK will undertake measures to increase its convenience, such as raising the deposit limit²⁾ in cooperation with Financial

Supervisory Service (FSS) and expanding the pool of participating merchants.³⁾

Operation of Dedicated CBDC Units and Strengthening Research

The BOK intends to proactively respond to rapidly-evolving developments surrounding CBDCs by conducting in-depth research into the issue through its dedicated CBDC units -- a digital currency research team and a section for CBDC technology -- newly established in February 2020. Research into policy tasks, and regulatory and technical research, will be performed under a comprehensive stage-by-stage plan, according to a clear timeline. For greater efficiency of research, a cooperation system will also be put into place with other sections of the BOK with related duties, like monetary policy, financial stability, international finance or currency issuance.

Moreover, the BOK will closely monitor the progress of any issuance of CBDCs at central banks in other major countries, and actively review the status of commercialization of stablecoins, such as Libra. The BOK plans to actively participate in related discussions at the BIS and across the international community at large,⁴⁾ while continuing to cooperate with relevant institutions.

Meanwhile, to ensure the quality of CBDC-related research, the BOK will be bringing on-board external specialists with expertise in the field, at the same time as seeking to expand

2) The current limit, set to KRW 10,000 per deposit with a daily deposit limit of over KRW 100,000, needs to be raised to KRW 50,000, which is the value of the highest denomination bill.

3) Cash back on debit card purchases, currently available only at some participating CU franchises and at Emart 24 stores, needs to be offered at more stores, including all convenience stores and large discount retailers.

4) The BIS Committee on Payments and Market Infrastructures (CPMI), the Financial Stability Board (FSB), the EMEAP Working Group on Payments and Market Infrastructures (WGPMI), etc.

cooperation with academics and market professionals.

Distributed Ledger Technology Research for Application in Payment and Settlement Infrastructures

The BOK plans to bring its PoC (proof-of-concept) to simulate delivery-versus-payment (DvP) securities settlement on distributed ledger technology (DLT) platforms, initiated in 2019, to completion during 2020, which will help it to derive implications from all of the above. The goal of the test is to determine whether DvP settlements can be safely processed in an environment where securities and funds are managed through two separate DLT-based ledgers. The test will also compare the DLT environment with the current centralized system in terms of settlement processing performance, resilience and scalability, at the same time as analyzing how the new environment will affect the liquidity requirement and settlement time of transaction parties.

In tandem, the BOK will be carefully monitoring research activities on DLT and its use by central banks in other major countries and at international organizations, and in the payment and settlement field in Korea and abroad, to keep up-to-date with its status of diffusion.

Protection of Consumers' Right to Choose between Payment Instruments

In light of the steady decline in the number of

bank branches and ATMs in recent years, the BOK will engage in an effort to ensure that this does not cause any inconvenience in the use of cash. The goal is to guarantee access to cash, particularly for the elderly and for low-income consumers, who are more likely to be reliant on cash than the rest of the population, and in rural and remote areas that have fewer ATMs than in urban areas.

To be able to more accurately assess ATM networks that are available across the country, the BOK plans to reorganize ATM statistics published by the CFIP. In addition to the total number of ATMs, the statistics will have additional items such as number of units by town and city, and number of units accessible to people with disabilities.⁵⁾ This will be followed by the development of comprehensive measures to improve the public's access to cash and their implementation in cooperation with the FSS and financial institutions.

The BOK will also undertake measures to assist those segments of the population that are left behind by innovations in payment and settlement technology. The results of a recent survey revealed the possibility that consumers who rely mainly on cash as a payment instrument could be excluded or even suffer from technological innovations, suggesting the need to mitigate the digital divide through an exercise in public relations and economic education for the general public. The BOK plans to step up its public relations efforts about the new trend of emerging electronic payment instruments utilizing the BOK-run public educational program.

5) To identify areas with excessively high or low numbers of ATMs, the data needs to be collected by geographic area (province, city, county, etc.).

4. Active Participation in International Discussions and Continuing Efforts for Cooperation

Proactively Responding to the Implementation Monitoring of PFMI and Other International Standards

The CPMI and the IOSCO are currently monitoring the implementation of the PFMI, published in April 2012, in 28 member countries, to follow up on it with additional guidelines, if necessary.

To monitor the status of implementing the PFMI, the CPMI-IOSCO has established and is operating its Implementation Monitoring Standing Group (IMSG).⁶⁾ To ensure consistency in the implementation of the PFMI across member countries and to thereby eliminate incentives for regulatory arbitrage. The IMSG's monitoring is conducted at three levels, as described below:

Table III-2. PFMI Implementation Monitoring Levels

Level	Description
Level 1	Assessment of whether a jurisdiction has completed the process of adopting the legislation and other policies that will enable it to implement the PFMI
Level 2	Assessment of whether the content of legislation, regulations and/or policies is complete and consistent with the PFMI
Level 3	Assessment of whether there is consistency in the outcomes of implementation of the PFMI

Source: CPMI-IOSCO

The BOK has long represented Korea at the CPMI-IOSCO Steering Group (SG) and the IMSG. Going forward, the BOK will continue to play an active role in discussions on the establishment of payment and settlement-related international standards and guidelines and the monitoring of the implementation status of the PFMI, to ensure that the Korean voice is heard, and that its interests are being accommodated concerning issues of importance. The BOK intends to engage in policy efforts to increase the conformity of domestic FMIs with international standards, including carrying out pre-assessments of systemically important payment and settlement systems.

The level 2 PFMI monitoring scheduled to be performed on Korean financial market infrastructures in 2025 is of great importance in many respects. Not only will its results be published at the websites of international organizations, such as the BIS and the IOSCO, but they are also likely to have an important impact on the confidence in Korean financial market infrastructures. A thorough preparation ahead of the monitoring is therefore crucial. In cooperation with relevant financial authorities, including the Financial Services Commission (FSC) and the Financial Supervisory Service (FSS), the BOK will be conducting a pre-monitoring to assess whether key FMIs are fully consistent with PFMI standards. If necessary for compliance, the BOK will participate in regulatory or legislative amendment projects and share information with stakeholder institutions.

6) Composed of the staff of central banks and supervisory authorities of various countries, including the BOK, and the staff of the secretariats of the CPMI and the IOSCO.

Closer International Cooperation

As a member of the international standard setter CPMI, the BOK is an active participant in international discussions in the payment and settlement field. The BOK will be using the latest information obtained from its international involvement to enhance the development and implementation process for Korean payment and settlement policies, as well as the oversight, research and analysis of payment and settlement systems and their improvement efforts.

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In 2019, the G20 selected "cross-border payment services" as one of its priorities and requested a report on the subject from the CPMI and the FSB. The CPMI therefore plans to conduct research into the status of cross-border payment services in various regions around the world and to explore concrete ways to improve them.

The CPMI is also currently planning to conduct an analysis of the impact of digital innovations such as CBDCs and DLT on the payment and settlement process and discuss responses. A particular focus will be placed on the regulatory approach toward stablecoins, such as Libra, on which it intends to jointly deliberate with the FSB on a sustained basis. The CPMI will also carry on with discussions about CBDCs to anticipate their future issuance.

Meanwhile to reduce foreign exchange settlement risks,⁷⁾ the CPMI will make joint efforts with the BCBS to encourage banks to

more carefully manage related risks and will encourage central banks and supervisory authorities to strengthen their risk management system. The CPMI will also continue with the financial inclusion initiative it has been carrying out with the World Bank and other international organizations.

The BOK, currently serving as the chair of the EMEAP Working Group on Payments and Market Infrastructures, envisages to have Korea play an expanded regional role in the payment and settlement field, and further improve the operations of the Working Group. By maintaining in-depth discussions on issues of interest for member countries across the Asia-Pacific, such as the cross-border linkage of payment and settlement infrastructures, CBDCs and improving the efficiency of the cross-border retail payment process, the BOK will work to consolidate the foundation of regional policy cooperation. In addition, the BOK will also continue to serve as a bridge between advanced nations participating in the CPMI and regional countries to promote cooperation and solidarity between them. Finally, the BOK will carry on with its efforts to share the Korean experience in payment and settlement policy-making and the development of related infrastructures with central banks in emerging market countries.

7) The risk that one party to a foreign exchange transaction will pay the currency it sold, but not receive the currency it bought, arising from the time gap between the two payment processes.

Annex

1. Payment and Settlement Systems Designated by the BOK as Subject to Settlement Finality	49
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1. Payment and Settlement Systems Designated by the BOK as Subject to Settlement Finality

a. Payment and settlement systems subject to settlement finality, as designated by the governor of the BOK after consultation with the FSC under Articles 120 (1) and 336 of the Debtor Rehabilitation and Bankruptcy Act

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

Note: 1) Limited to transactions denominated in KRW and USD

b. Clearing and settlement systems operated by entities that perform clearing and settlement tasks for securities and derivatives transactions pursuant to the Financial Investment Services and Capital Markets Act or other statutes and by other entities designated by Presidential Decree, in accordance with Articles 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. Volume of Settlements, by Payment System

(daily average, thousands of transactions, %)

	2016	2017	2018	2019	% change
BOK-Wire+	15.3	16.5	18.0	19.9	11.0
Retail Payment Systems	20,659	21,301	22,812	24,554	7.6
Check Clearing System	524	421	329	252	-23.3
Giro System	5,060	4,675	4,437	4,301	-3.1
Interbank Shared Networks	15,075	16,206	18,046	20,001	10.8
(Electronic Banking System)	9,164	10,289	12,178	14,236	16.9
(Interbank Funds Transfer System)	354	333	319	295	-7.6
(CD/ATM System)	1,883	1,796	1,700	1,548	-8.9
(CMS System)	3,563	3,691	3,764	3,839	2.0
(Regional Bank Shared System)	0.4	0.5	0.5	0.5	-7.9
(E-commerce Payment System)	111	95	84	81	-3.1
(EFT/POS System)	0.4	0.3	0.1	0.1	-27.2

B. Value of Settlements, by Payment System

(daily average, billions of KRW, %)

	2016	2017	2018	2019	% change
BOK-Wire+	299,780	323,048	340,716	369,920	8.6
Retail Payment Systems	61,858	62,375	66,950	69,446	3.7
Check Clearing System	9,075	8,220	8,002	7,661	-4.3
Giro System	991	1,009	1,024	1,030	0.7
Interbank Shared Networks	51,792	53,146	57,925	60,755	4.9
(Electronic Banking System)	45,621	46,933	51,793	54,823	5.8
(Interbank Funds Transfer System)	4,794	4,822	4,793	4,679	-2.4
(CD/ATM System)	932	923	892	818	-8.3
(CMS System)	423	443	421	414	-1.7
(Regional Bank Shared System)	8.2	10.4	10.6	8.3	-21.9
(E-commerce Payment System)	15	15	14	13	-6.7
(EFT/POS System)	0.0	0.0	0.0	0.0	-39.3

C. Payments Made through BOK-Wire+

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

		2016	2017	2018	2019	% change
Volume	Funds Transfers Between Participants	14,297	15,449	16,890	18,811	11.4
	Call Settlement Funds	715	680	564	468	-17.1
	(Call Transaction System)	714	680	564	467	-17.1
	(General Funds Transfers)	1	0	0	0	-18.0
	Securities Settlement Funds	9,598	10,709	12,143	13,967	15.0
	(DvP System)	8,477	9,539	10,970	12,804	16.7
	(Non-DvP Funds Transfers)	1,121	1,170	1,173	1,163	-0.9
	Foreign Exchange Settlement Funds	797	743	689	594	-13.8
	(CLS System)	34	36	42	40	-5.3
	(Non-PvP Funds Transfers)	763	707	647	554	-14.3
	Institutional Customer Settlement Funds	1,856	2,150	2,398	2,668	11.3
	(Beneficiary-designated Funds Transfers)	735	806	870	887	2.0
	(General Funds Transfers)	553	676	705	787	11.6
	(Linked Settlements)	568	667	822	993	20.8
	Net Settlement Funds	247	245	244	241	-1.2
	Others	1,084	922	852	874	2.5
	Funds Transfers Between BOK and Participants	1,051	1,072	1,072	1,128	5.2
Treasury Funds Transfers ¹⁾	982	1,002	1,002	1,058	5.6	
BOK Loans and Discounts	26	24	24	23	-2.9	
Government and Public Bond Transactions ²⁾	43	45	46	47	1.7	
Total Funds Transfers in Korean Won	15,347	16,521	17,962	19,939	11.0	
Total Funds Transfers in Foreign Currency ³⁾	6.0	7.4	7.3	7.2	-2.2	
Value	Funds Transfers Between Participants	285,231	307,712	324,805	353,856	8.9
	Call Settlement Funds	27,689	27,234	23,531	21,070	-10.5
	(Call Transaction System)	27,619	27,212	23,517	21,062	-10.4
	(General Funds Transfers)	70	22	14	9	-36.1
	Securities Settlements	143,155	167,283	187,890	214,591	14.2
	(DvP System)	105,440	124,494	145,906	174,533	19.6
	(Non-DvP Funds Transfers)	37,715	42,788	41,984	40,058	-4.6
	Foreign Exchange Settlement Funds	19,314	19,334	15,943	14,561	-8.7
	(CLS System)	2,653	2,761	2,827	2,935	3.8
	(Non-PvP Funds Transfers)	16,661	16,573	13,116	11,625	-11.4
	Institutional Customer Settlement Funds	37,073	42,514	45,329	50,228	10.8
	(Beneficiary-designated Funds Transfers)	13,230	14,037	14,374	14,177	-1.4
	(General Funds Transfers)	18,445	21,442	22,459	26,173	16.5
	(Linked Settlements)	5,397	7,036	8,496	9,879	16.3
	Net Settlement Funds	16,829	16,861	18,056	18,112	0.3
	Others	41,169	34,487	34,056	35,295	3.6
	Funds Transfers Between BOK and Participants	14,550	15,335	15,911	16,064	1.0
Treasury Funds Transfers ¹⁾	5,778	6,257	7,239	7,797	7.7	
BOK Loans and Discounts	1,599	1,708	1,536	1,377	-10.3	
Government and Public Bond Transactions ²⁾	7,172	7,370	7,137	6,890	-3.5	
Total Funds Transfers in Korean Won	299,780	323,048	340,716	369,920	8.6	
Total Funds Transfers in Foreign Currency (in millions of USD) ³⁾	520	531	707	676	-4.3	

Notes: 1) Limited to transactions made through BOK-Wire+ (management and recovery of surplus funds and national tax payments)

2) Issuance 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. Volume and Value of Payments, by Payment Instrument

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

		2016	2017	2018	2019	% change
Volume	Checks and Bills	813	655	502	381	-24.2
	Cleared via Check Clearing System	524	421	329	252	-23.3
	Presented Directly at Issuer's Window	280	226	165	121	-26.7
	Electronic Bills	8.5	8.7	8.5	7.7	-10.1
	Account Transfers ¹⁾	19,348	20,138	21,749	23,610	8.6
	Payment Cards	46,697	52,994	58,621	65,062	11.0
	Credit Cards	29,136	32,782	36,197	40,693	12.4
	(Purchases)	28,885	32,548	35,967	40,470	12.5
	(Cash Advances)	251	234	229	224	-2.4
	Check Cards	17,474	20,127	22,321	24,141	8.2
	Prepaid Cards	76	68	67	86	28.0
	Debit Cards	0.4	0.3	0.1	0.1	-27.1
	IC Cash Cards ²⁾	10.9	16.1	35.9	141.3	293.3
	e-Money	10	6	3	1	-65.3
Value	Checks and Bills	21,604	20,620	19,461	17,267	-11.3
	Cleared via Check Clearing System	9,075	8,220	8,002	7,661	-4.3
	Presented Directly at Issuer's Window	11,318	11,035	10,359	8,344	-19.5
	Electronic Bills	1,211	1,366	1,099	1,262	14.8
	Account Transfers ¹⁾	52,606	53,982	58,774	61,617	4.8
	Payment Cards	2,273	2,395	2,536	2,670	5.3
	Credit Cards	1,846	1,926	2,031	2,132	5.0
	(Purchases)	1,677	1,760	1,862	1,967	5.7
	(Cash Advances)	169	166	169	165	-2.4
	Check Cards	424	466	502	532	6.2
	Prepaid Cards	2.2	2.1	2.1	2.5	18.8
	Debit Cards	0.0	0.0	0.0	0.0	-39.3
	IC Cash Cards ²⁾	0.9	1.1	1.4	2.4	75.9
	e-Money	0.0	0.0	0.0	0.0	-54.3

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

2) A kind of debit card launched in November 2012

E. Usage of Electronic Banking

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

		2016	2017	2018	2019 ⁵⁾	% change ⁶⁾	
Internet Banking ¹⁾	Number of Subscribers ²⁾³⁾	122,538	135,047	146,559	156,829	7.0	
	(Individuals)	114,755	126,593	137,382	147,019	7.0	
	(Corporations)	7,783	8,453	9,177	9,811	6.9	
	Volume of Use	86,844	94,924	118,808	149,427	25.8	
	Value of Use	42,052.7	43,111.7	47,550.2	47,807.8	0.5	
Mobile Banking ⁴⁾	Number of Subscribers ²⁾³⁾	78,362	89,738	104,734	118,626	13.3	
	(Smartphone-based)	74,675	89,738	104,734	118,626	13.3	
	Volume of Use	52,948	58,664	74,919	93,062	24.2	
	(Smartphone-based)	52,931	58,664	74,919	93,062	24.2	
	Value of Use	3,126.6	4,051.8	5,343.6	6,172.5	15.5	
(Smartphone-based)	3,126.5	4,051.8	5,343.6	6,172.5	15.5		
e-Money	Volume of Issuance ³⁾	17,735	18,326	17,360	17,410	0.3	
	Value of Use	0.02	0.01	0.01	0.00	-48.7	
Electronic Bills	Issuance	Volume	7.7	7.5	7.0	6.5	-7.2
		Value	2,104.1	2,281.5	1,955.0	1,857.4	-5.0
	Discounts	Volume	1.7	1.7	1.5	1.2	-14.3
		Value	80.7	80.6	71.9	62.3	-13.4

Notes: 1) Including mobile banking. Some figures were revised upon receipt of revised figures from sources

2) Including overlapping subscribers at 18 domestic banks (including two internet-only banks) and Korea Post

3) Year-end basis

4) As IC chip- and VM-based mobile banking were terminated in September 2016 and December 2015, respectively, these figures include smartphone-based mobile banking service since 2017. Figures were revised upon receipt of revised figures from source.

5) The volume and value of use is for the first, second, and third quarters of 2019. However, the number of Internet banking subscribers and number of e-Money issuances are as of the end of the third quarter of 2019.

6) % change over the previous year

F. Usage of Easy Electronic Payment Services

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

		2017	2018	2019 ³⁾	% change ⁴⁾
Easy Payment Service ¹⁾²⁾	Volume of Use	2,087	3,840	5,665	47.5
	(ICT)	448	706	1,068	51.2
	(Retail & Manufacturing)	1,639	3,134	4,597	46.7
	Value of Use	65.3	120.9	165.6	37.0
	(ICT)	15.3	24.3	34.4	41.9
	(Retail & Manufacturing)	50.0	96.6	131.2	35.8
Easy Transfer Service ¹⁾	Volume of Use	695	1,406	2,319	64.9
	(Electronic Financial Business Operators)	647	1,328	2,188	64.7
	(Financial Institutions)	47	78	131	68.0
	Value of Use	35.5	104.6	217.7	108.2
	(Electronic Financial Business Operators)	32.7	98.2	203.4	107.1
	(Financial Institutions)	2.8	6.3	14.3	125.4

Notes: 1) Compilation of statistics began in 2016 and some figures were revised upon receipt of revised figures from sources.

2) Including only credit card and check card-based easy payment services provided by electronic financial business operators (excluding account transfers and phone bill payment)

3) Covers the period from January to September 2019.

4) % change over the previous year

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