Bank of Japan Review

2009-E-4

BOJ-NET Funds Transfers after the Implementation of Phase 1 of the Next-Generation RTGS Project

Payment and Settlement Systems Department

July 2009

In October 2008, the Bank of Japan launched Phase 1 of the Next-Generation RTGS (RTGS-XG) project. While the financial conditions in Japan remained tight during the first six months following the implementation, the enhanced BOJ-NET functioned seamlessly, facilitating the smooth flow of payments among financial institutions. Analysis of the BOJ-NET payment pattern after the start of Phase 1 finds that the average settlement time shifted to earlier in the day by one hour, while the aggregate liquidity requirement was reduced by 2 trillion yen. This indicates that the objective of the project, that is, enhancing both the safety and efficiency of large-value payments, has been successfully achieved for Phase 1.

I. Background

The accounts that financial institutions hold with the Bank are used for making large-value interbank payments. The types of payments settled in those accounts include payments on call loans and other money market transactions, the cash legs of Japanese government bond (JGB) and other securities transactions, net positions arising from private-sector deferred net settlement (DNS) systems, and transactions relating to the Bank's open market operations. Those payments, totaling 121 trillion yen daily, are processed by the funds transfer system in the Bank of Japan Financial Network System (BOJ-NET).

In January 2001, the BOJ-NET was converted from a DNS system to a pure real-time gross settlement (RTGS) system. RTGS systems eliminate systemic risk associated with DNS, while at the same time requiring relatively larger amounts of liquidity. Increased liquidity costs could potentially lead to "gridlock" with multiple participants holding back their payments until they receive payments from others, which could prevent participants from fully exploiting the benefits of RTGS.

The Bank's RTGS-XG project aims to bring new levels of safety and efficiency to large-value payments in Japan by allowing participants to economize on the use of liquidity while maintaining the risk reduction benefits of RTGS. The project consists of two pillars: (1) introducing liquidity-saving features into the BOJ-NET (see Box 1); and (2) shifting large-value payments that were previously processed by private-sector DNS systems, namely, the Foreign Exchange Yen Clearing System (FXYCS) and the Zengin System, to settlement on an RTGS basis in the BOJ-NET with liquidity-saving features.[1] Providing real-time final settlement during the day for large-value payments is consistent with the international best practice for systemically important payment systems.

The changes are being implemented in two phases, with the introduction of liquidity-saving features into the BOJ-NET and the shift of payments routed from the FXYCS (hereafter FXYCS payments) to RTGS taking place in Phase 1 and the shift of large-value payments in the Zengin System to RTGS taking place in Phase 2. Phase 1 was successfully implemented on October 14, 2008. While the "go live" of Phase 1 took place amid the global financial market turmoil following the failure of Lehman Brothers in September 2008, both the participating financial institutions and the Bank achieved a smooth changeover.

This edition of the Bank of Japan Review provides a quantitative analysis of payment activity in the BOJ-NET during the first six months after Phase 1 implementation and assesses the impact of the project on the safety and efficiency of large-value payments in Japan.

II. Payment Activity

A. Settlement value and volume

The new liquidity-saving features are provided on a new type of account that participants hold with the Bank, namely the "Queuing and Offsetting Account" (Q/O account). By the end of March 2009, about 300 BOJ-NET participants, accounting for 80 percent of online participants, opened Q/O accounts.

As shown in Chart 1, in the first six months following the implementation of Phase 1, the average daily volume of payments processed by the system almost doubled compared with the same period of the previous year. This is primarily due to the fact that FXYCS payments, most of which previously settled in the FXYCS's DNS mode, are now directly routed to the BOJ-NET for settlement on an RTGS basis. The value of payments settled, however, did not show a significant change reflecting a decline in the value of money market transactions, which tend to be large in terms of value per transaction (see Section II.D). According to market guidelines, payments on call loans and other money market transactions (hereafter money market payments),[3] as well as payments routed from the FXYCS,[4] are in principle settled on Q/O accounts. In the first six months, on average, 5,500 money market payments worth 33 trillion yen and 27,900 FXYCS payments worth 15 trillion yen were settled on Q/O accounts.

Chart 1: Average daily volume and value of payments processed by the BOJ-NET

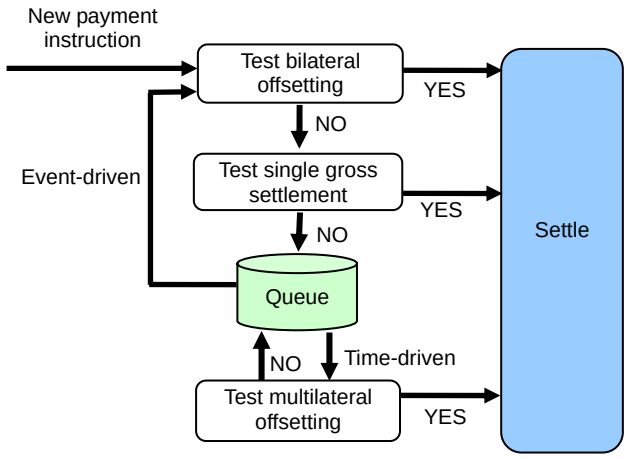
Account type	Payment type	Volume (thousands)	Value (trillion yen)
Home account	Corporate bond DVP, CLS, market operations, etc.	10.3	28.4
SPDC[2] account	JGB DVP	10.8	46.4
Q/O account	Money market	5.5	33.3
	FXYCS	27.9	15.2
Total (year-on-year percentage change)		54.5 (+90%)	123.3 (+2%)

Note: Daily average for the period from October 14, 2008, to March 31, 2009. Charts below use data for the same period unless noted otherwise.
Source: Bank of Japan.

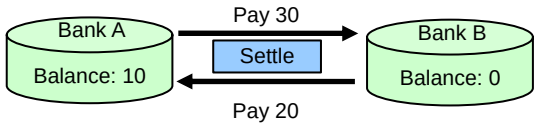
Box 1: Liquidity-saving features

The liquidity-saving features in the new BOJ-NET consist of centralized queuing and offsetting mechanisms. "Queuing" allows payment instructions to be held pending within the system if a participant sends a payment instruction but does not have sufficient funds to complete the transaction. Previously in the BOJ-NET, such payment instructions were rejected by the system. "Offsetting" mechanism searches among the newly entered and queued payment instructions for a set of instructions that can be settled when taking into account incoming funds as a source of liquidity, and settles the selected instructions simultaneously. The bilateral offsetting algorithm searches for a pair of offsetting instructions when certain events occur, including when a new payment instruction enters a system or when there is a change in Q/O account balances. The multilateral offsetting algorithm attempts to find a group of offsetting transactions from all queued instructions at four fixed times each day.

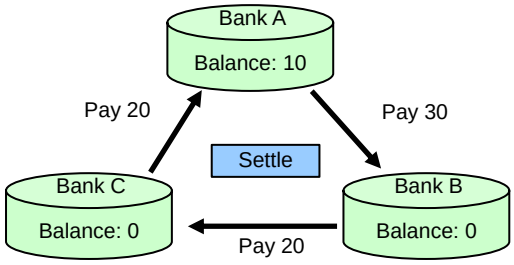
Box Chart 1-1: Settlement process for Q/O accounts



Box Chart 1-2: Example of bilateral offsetting



Box Chart 1-3: Example of multilateral offsetting



B. Settlement timing

Intraday settlement timing is a key indicator of the level of safety in payment systems. This section first describes the intraday distribution of payments in Q/O accounts and the changes in average settlement times during the first six months. It then makes a comparison of the payment pattern before and after the start of Phase 1.

1. Intraday distribution of payments

The dark solid line in Chart 2-1 shows that the settlement of money market payments is concentrated between 9:00 and 10:00, immediately after the opening of the system. At 9:10, the value and volume of money market payments queued (dark dotted line) peaks with 3.2 trillion yen and 280 transactions, respectively, and falls sharply as the payments are settled. At 10:00, there are only 10 transactions worth 0.2 trillion yen left in the queue. Such a payment pattern for money market payments suggests that participants using Q/O accounts are strictly following the market guidelines for trading and settlement of money market transactions. In preparation for the start of Phase 1, market participants reviewed the guidelines and confirmed that call loans should continue to be returned no later than 10:00.

The light solid line indicates that the settlement of FXYCS payments is concentrated between 10:00 and 11:00 in value terms and between 9:00 and 10:00 in volume terms. The value of FXYCS payments in the queue (light dotted line) maintains a peak of 1 trillion yen from shortly before 10:00 to 10:30, and declines after 10:30 to 0.3 trillion yen at 11:00. Volume peak occurs between 9:00 to 10:00 with more than 1,000 payments on the queue, most of which are released by 11:00. Such distribution of payment flows can be attributed to the throughput guidelines in the FXYCS, which require participants to send and settle 65 percent of the daily volume and 55 percent of the daily value by 11:00. FXYCS payments tend to remain on the queue for a longer period of time compared with money market payments, as they are relatively less time critical (Chart 2-2).

The intraday profile of payment flows for Q/O accounts indicates that participants prioritize payments based on time criticality and control their payment submission pattern to meet the relevant industry guidelines. From 9:00 to 10:00, participants place priority on making repayment of call loans, while also sending FXYCS payments, particularly those of relatively smaller value. Large-value FXYCS payments are usually submitted after 10:00 and before the deadlines set in the throughput guidelines at 11:00.

2. Average settlement time

Throughout the first six months following the start of Phase 1, the BOJ-NET achieved smooth settlement without significant delays in payment flows. This was also the case for high-value days, which usually fall on the last business day of each month.

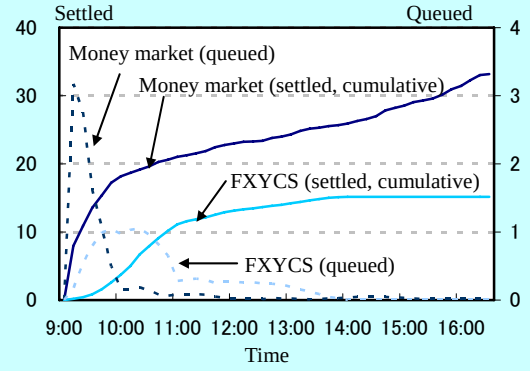
Chart 3 plots for each day the value of payments settled on Q/O accounts and the value-weighted average settlement time.[5] The average settlement time serves as a measure of the level of safety in payment systems, with an earlier average settlement time indicating a reduction in intraday settlement exposure.

During the six months from October 2008, the average settlement time remained constant around 11:00 regardless of the total value of payments settled.

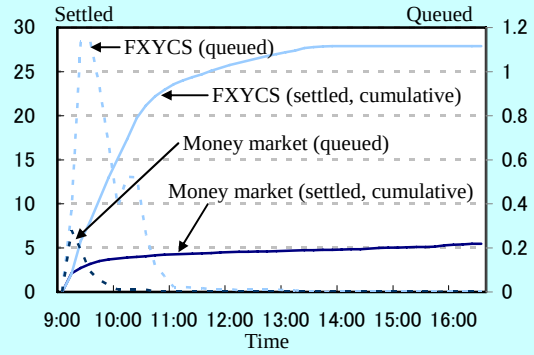
Chart 2: Intraday distribution of payments in Q/O accounts

2-1 Value and volume of payments settled and queued

Value (trillion yen)



Volume (thousands)



Note: Solid lines show the cumulative value and volume of payments settled (left-hand scale). Dotted lines show the outstanding value and volume of payments placed in the queue (right-hand scale).

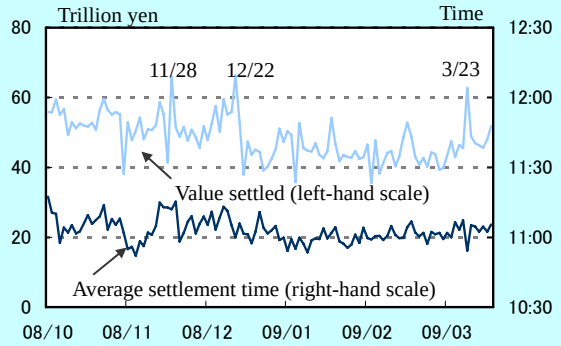
2-2 Average time in queue (minutes)

	Unweighted average	Value-weighted average
Money market	1:25	3:18
FXYCS	2:15	8:14

Source: Bank of Japan.

Delay in settlement was not observed even on the three days where payments were particularly concentrated, namely, on November 28, 2008 (last business day of the month) and on December 22, 2008 and March 23, 2009 (high-value days for JGB settlement). This indicates that participants observe the market guidelines on high-value days as well.

Chart 3: Daily settlement value and average settlement time



Source: Bank of Japan.

3. Changes in payment pattern

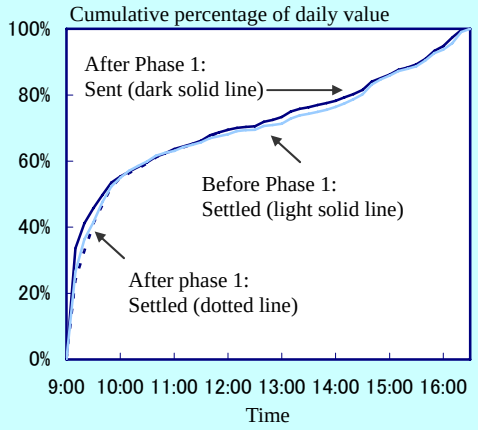
Charts 4-1 and 4-2 compare the intraday pattern of payment submission and settlement in Q/O accounts before and after the implementation of Phase 1. The timing of submitting money market payments at the start of the day has become slightly earlier, while the timing of settlement has not changed, indicating that participants continue to prepare sufficient liquidity to comply with the market guidelines (Chart 4-1).[6]

In contrast, the timing of submission and settlement of FXYCS payments shifted significantly to earlier in the day (Chart 4-2). The change in submission time is likely associated with the elimination of the sender net debit cap, which existed in the system's DNS mode but was lifted as the FXYCS moved to full RTGS with the start of Phase 1. The cap was designed to control the maximum level of exposure that a participant can pose to the system by placing a limit on the value of net outgoing payments that a participant can send to the system. The removal of the cap has allowed participants to send payments that were previously subject to cap constraints earlier in the day.[7]

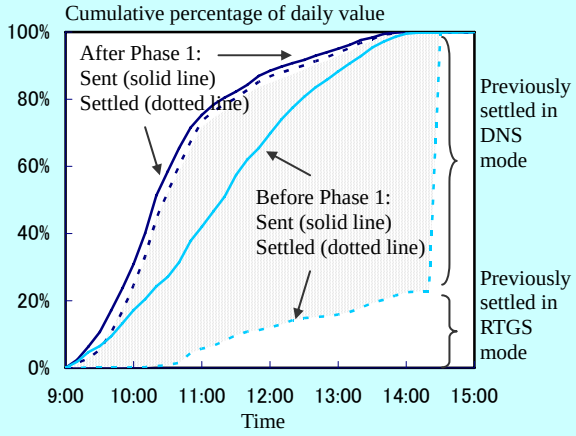
Of course, earlier submission of payment instructions does not necessarily result in earlier settlement. If liquidity is not recycled efficiently within the system, payments may be queued for an exceptionally long period, causing delay in the overall payment flows. In the case of FXYCS payments, participants' compliance with the throughput guidelines and their effective liquidity management

Chart 4: Changes in intraday pattern of payment submission and settlement

4-1 Money market payments



4-2 FXYCS payments



4-3 Average time of payment submission and settlement (hh:mm)

	Before Phase 1		After Phase 1	
	Sent	Settled	Sent	Settled
Money market	11:11	11:11	11:09	11:12
FXYCS	11:19	13:54	10.34	10:42

Notes:
1. Figures for the period before the start of Phase 1 are calculated using data from October 17, 2007, to March 31, 2008.
2. Before Phase 1, all money market payments settled on an RTGS basis without the queuing mechanism. For those payments, the cumulative percentage of payments submitted is identical to the percentage of payments settled. Also, before Phase 1, around 20 percent of FXYCS payments settled in the system's RTGS mode, and around 80 percent in the DNS mode. For those payments, the cumulative percentage of payments submitted equals the percentage of payments settled at 14:30, when the settlement takes place in the DNS mode.

Source: Bank of Japan.

using the liquidity-saving features (see Section II.C) have contributed to the improvement in settlement timing.

As shown by the shaded area in Chart 4-2, earlier submission (solid line) and settlement (dotted line) of FXYCS payments, largely driven by the shift of FXYCS payments to RTGS, has resulted in a significant reduction in intraday settlement exposure, thereby enhancing the safety of large-value payments in Japan as intended by the RTGS-XG project.

C. Liquidity efficiency

As noted, RTGS systems require a relatively large amount of liquidity in comparison with DNS systems, while eliminating risk associated with DNS. An excessively high liquidity cost can induce participants to deliberately delay outgoing payments in order to take advantage of incoming payments as a source of liquidity, potentially leading to a "gridlock" in the system. This section evaluates the efficiency of the new system by analyzing the level of liquidity transfer to Q/O accounts and the use of liquidity-saving features.

1. Liquidity transfer to Q/O accounts

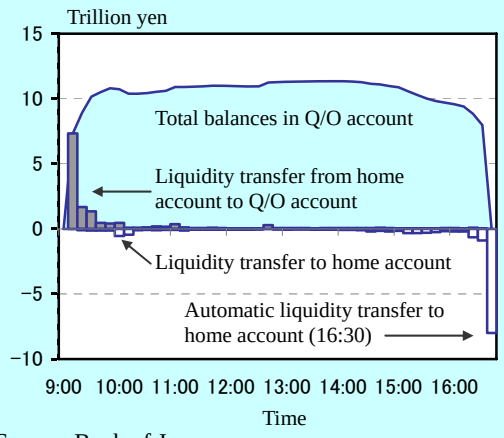
As a rule, participants cannot incur intraday overdrafts or maintain overnight balances in Q/O accounts. Each participant therefore needs to transfer the necessary amount of liquidity to its Q/O account, which is funded either by holding a positive balance in or incurring intraday overdrafts in the home account.

The average intraday inflows and outflows of liquidity to and from Q/O accounts are illustrated in Chart 5. Participants transfer around 7 trillion yen to their Q/O accounts immediately after the opening of the system and transfer an additional 4 trillion yen by 10:00, the deadline for the repayment of call loans. This indicates that participants monitor their payment flows and actively control their liquidity levels as they try to meet the money market guidelines for the level of initial balances and the repayment of call loans.

The value of liquidity transferred to Q/O accounts is limited after 10:00. This pattern likely suggests that subsequent payments, including FXYCS payments, which are concentrated between 10:00 and 11:00, are sufficiently funded by the liquidity posted earlier for money market payments. In other words, the fact that settlement of both money market and FXYCS payments is made on the same account, in combination with the effect of liquidity-saving features, has eased the liquidity requirements for achieving smooth settlement throughout the day.

In the first six months, the average peak value of the aggregate balances in Q/O accounts was approximately 12 trillion yen. Those balances were used to settle payments totaling 50 trillion yen, meaning that on average liquidity was recycled among participants four times.

Chart 5: The level of liquidity in Q/O accounts

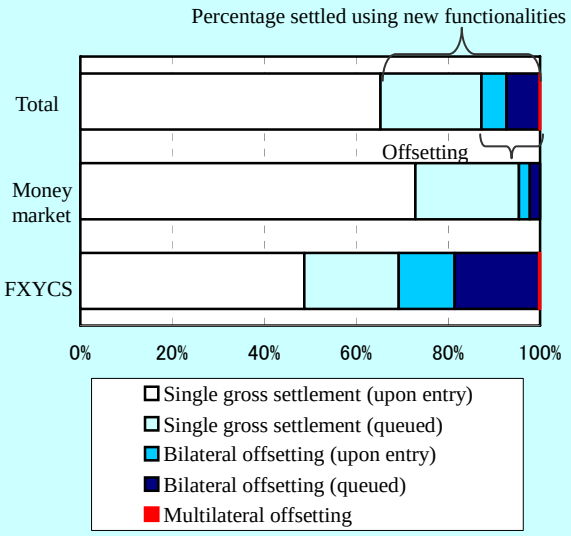


Source: Bank of Japan.

2. Use of liquidity-saving features

As shown by the shaded areas in Chart 6, the newly introduced queuing and offsetting mechanisms were used for around 35 percent of the daily value settled in Q/O accounts. Roughly 15 percent of the daily value was offset against incoming payments, implying that the aggregate liquidity requirement under the new system is lower compared with that under a pure RTGS system without liquidity-saving features.

Chart 6: Shares of daily value by settlement method



Source: Bank of Japan.

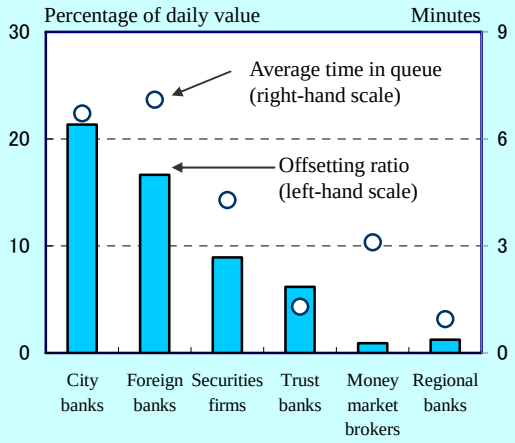
By transaction type, liquidity-saving features are used more frequently for FXYCS payments. There may be a higher chance for the system to find pairs of bilaterally offsetting payments for FXYCS payments because they are queued relatively longer, as seen in Chart 2, and also because of the smaller number of

participants in the FXYCS (around 30 banks, or approximately 10 percent of the total number of participants with Q/O accounts).

3. Use of liquidity-saving features by type of institution

Chart 7 compares the extent to which different types of institutions benefit from the liquidity-saving features. City banks and foreign banks, which are the major participants in the FXYCS, tend to have their payments placed in the queue for a longer period of time and settle a higher proportion of their payments using the offsetting mechanism. This implies that those institutions are managing their payment flows by making effective use of both functionalities. Securities firms and money market brokers tend to have their payments queued for a long time relative to the level of offsetting achieved, indicating that they primarily make use of the queuing mechanism. Regional banks, in contrast, tend to inject a large amount of liquidity in their Q/O accounts relative to the amount of their outgoing payments, and accordingly make little use of queuing and offsetting mechanisms. For those banks, there may be some room to take further advantage of the new functionalities.

Chart 7: Use of liquidity-saving features by type of institution



Notes:
1. "Offsetting ratio" is the percentage of outgoing payments settled by using either bilateral or multilateral offsetting facility.
2. "Average time in queue" is the value-weighted average of the time during which outgoing payments were placed in the queue.

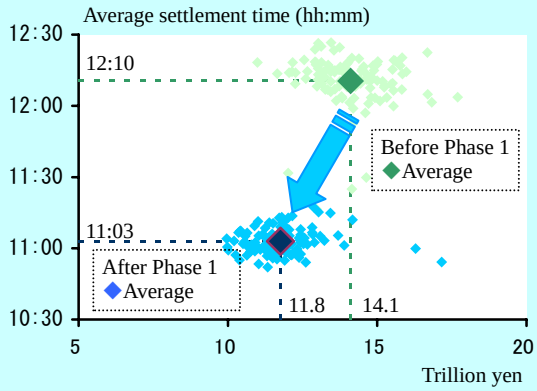
Source: Bank of Japan.

D. Conclusion

This section brings together the observations above and evaluates the extent to which the objective of the RTGS-XG project, that is, enhancement of both safety and efficiency of large-value payments, is achieved.

Chart 8 plots the average settlement time and the amount of liquidity required for settlement before and after the implementation of Phase 1. Average settlement time, an indicator of the level of safety, improved by one hour from shortly after 12:00 to 11:00. This primarily reflects the shift of FXYCS payments, which were previously settled on a DNS basis at 14:30, to RTGS.

Chart 8: Average settlement time and liquidity needed for settlement



Notes:
1. Figures for the period before Phase 1 are calculated using data from October 15, 2007, to March 31, 2008.
2. Average settlement time and liquidity needed for settlement for the period before Phase 1 are calculated based on actual transaction data. Before Phase 1, all money market payments and around 20% of FXYCS payments were settled on an RTGS basis, and around 80% of FXYCS payments were settled on a DNS basis.

Source: Bank of Japan.

Efficiency of the system can be measured using the value of aggregate liquidity required for settlement. Before the implementation of Phase 1, a total of 14 trillion yen (calculated as the total of peak debit position of each participant) was used to settle money market and FXYCS payments. After the start of Phase 1, the value was reduced to around 12 trillion yen (calculated as the peak value of Q/O account balances).[8] While it is difficult to directly compare the two figures due to the differences in the way liquidity is measured,[9] based on the above calculation, the amount of liquidity saved is estimated to be approximately 2 trillion yen.

Taken together, it can be concluded that the implementation of Phase 1 has enhanced both the safety and efficiency of payments through the BOJ-NET.

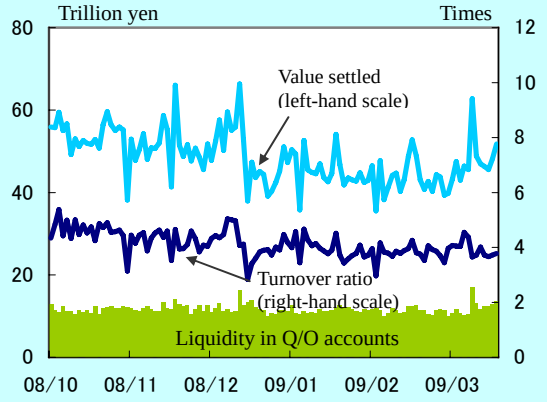
During the first six months, however, participants did not show strong intentions to further improve their liquidity efficiency by making active use of the new liquidity-saving features. As shown in Chart 9, the value of liquidity transferred to Q/O accounts has

remained largely constant throughout the period. At the same time, the value of transactions settled in Q/O accounts has declined significantly, reflecting the heightened awareness of counterparty risk among market participants in light of strained financial conditions.[10] As a result, the turnover ratio of liquidity in Q/O accounts has fallen slightly.

The tendency to maintain sufficient liquidity implies that participants were taking a relatively conservative approach in funding their payments in light of the tight financial conditions. The provision of ample liquidity by the Bank during this period has likely contributed to meeting such increased liquidity demands.

It is expected that participants will use the new functionalities effectively in light of the future changes in financial conditions.

Chart 9: Daily settlement value and liquidity transferred to Q/O accounts



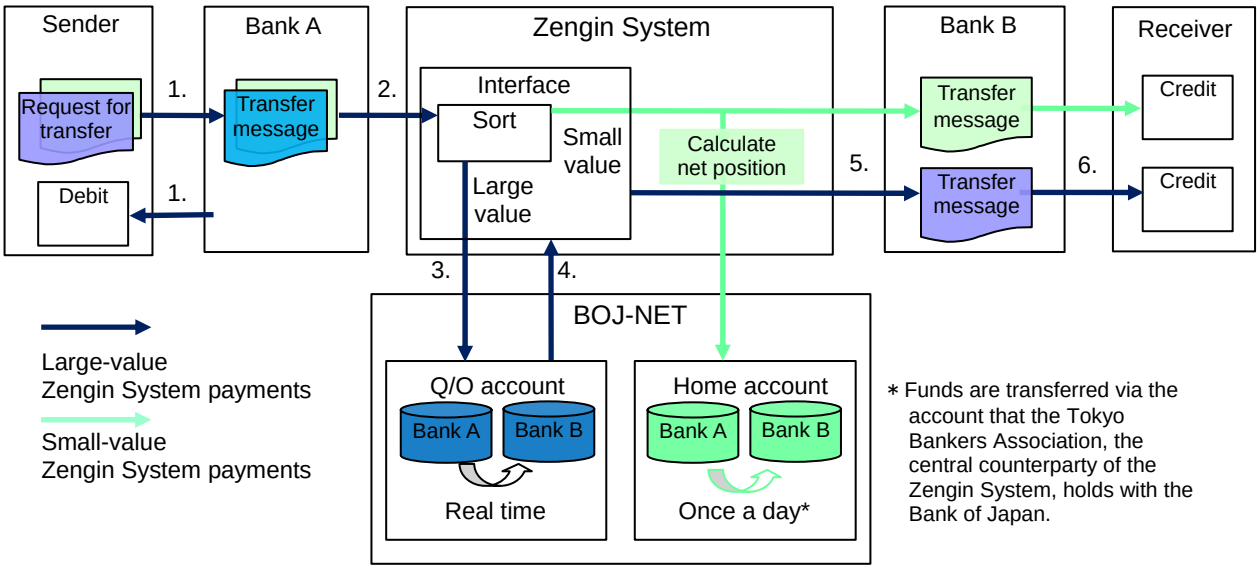
Note: The turnover ratio is calculated by dividing the value of payments settled in Q/O accounts by the peak value of liquidity in Q/O accounts.
Source: Bank of Japan.

Box 2: Phase 2 of the RTGS-XG project

With the implementation of Phase 2 of the RTGS-XG project, large-value retail payments processed in the Zengin System will be routed to the BOJ-NET via a newly constructed interface connecting the two systems and will settle on an RTGS basis on Q/O accounts. For the purpose of the project, a payment in the Zengin System is considered "large-value" if it is equal to or larger than 100 million yen.

In March 2009, large-value payments accounted for only 0.2 percent of the payments processed in the Zengin System in terms of volume but accounted for around 70 percent in terms of value. Those payments, which currently settle at 16:15 on a DNS basis, will become final in the course of the day, resulting in a significant shift in the settlement timing to earlier in the day. It is expected that the combination of the reduction of intraday exposure and the use of liquidity-saving features will enhance the level of safety and efficiency achieved for large-value Zengin System payments, as was the case for FXYCS payments.

Box Chart 2-1: Settlement process for Zengin System payments after Phase 2 implementation



1. The Sender instructs its Bank A to make a payment to the Receiver at Bank B. Bank A debits the Sender's account.
2. Bank A sends a transfer message to the Zengin System.
3. The Zengin System identifies a "large-value" payment and routes the interbank settlement information to the BOJ-NET.
4. The Bank of Japan debits Bank A's Q/O account and credits Bank B's Q/O account.
5. The Zengin System sends the full transfer message to Bank B.
6. Bank B credits the Receiver's account.

III. Next steps

The quantitative analysis of the payment activity in BOJ-NET during the first six months of Phase 1 indicates that the measures taken under the RTGS-XG project has reduced the aggregate liquidity requirement while maintaining the risk reduction benefits of RTGS, thereby achieving, for Phase 1, the objective of enhancing both safety and efficiency of large-value payments. As noted, at the moment, there is little sign that participants are attempting to further improve their liquidity efficiency by making active use of the new liquidity-saving features. The Bank will continue to monitor payment activity by participants as financial conditions evolve and work to further enhance the safety and efficiency of the payment systems in Japan.

The implementation of Phase 2 of the project is scheduled for November 2011 (see Box 2). The Bank will move forward with the project in close coordination with relevant parties, as was the case with Phase 1. The Bank will also work to ensure that smooth settlement is achieved following possible changes in BOJ-NET payment flows under Phase 2.

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[1] For a more detailed description of the Bank's RTGS-XG project, see Bank of Japan, *Japan's Next-Generation RTGS*, 2006.

[2] SPDC refers to the account for simultaneous processing of DVP and collateralization (SPDC). Used for the settlement of the cash legs of JGB transactions, the SPDC facility allows the receiver of JGBs to pledge the incoming securities as collateral for intraday overdrafts, while using the overdrafts to pay for those incoming securities.

[3] The market guidelines developed by the Study Group for Activation of Short-Term Money Markets state that market transactions would in principle be, and other transactions would preferably be, settled on Q/O accounts. Payments on market transactions include those on call loans (uncollateralized, collateralized, and intraday), transactions of negotiable certificates of deposit (NCDs), the cash legs of dematerialized commercial paper, corporate bond and other bond transactions (those that are not settled on a delivery-versus-payment [DVP] basis), margins for repurchase agreements, the cash legs of pair-off netting transactions, and premiums arising from over-the-counter securities option transactions.

[4] The rules governing FXYCS state that all FXYCS payments other than CLS pay-ins and pay-outs would be settled on Q/O accounts.

[5] To calculate the average settlement time, the settlement time for each payment instruction is multiplied by the value of the payment, the sum of which is then divided by the aggregate value of payments settled. For example, if there were two payments, one totaling 10 billion yen that settled at 9:00 and another totaling 50 billion yen that settled at 10:00, the average settlement time would be 9:50.

[6] For a description of the intraday pattern of money market payments prior to the start of Phase 1, see Kei Imakubo and Hidetsugu Chida, "BOJ-NET Funds Transfers after the End of the Quantitative Monetary Easing Policy," Bank of Japan Review Series 2006-E-5, 2006.

[7] For a description of the intraday pattern of FXYCS payments prior to the start of Phase 1, see Akiko Kobayashi, Yasuho Hama, and Kei Imakubo, "Payment Flows for Settlement of Foreign Exchange Trades: Japan's Experience since 2002," Bank of Japan Review Series 2007-E-4, 2007.

[8] With the start of Phase 1, the DNS mode was eliminated in FXYCS. As a result, for FXYCS participants, various costs associated with risk management in DNS mode, including the cost of posting collateral (800 billion yen) with the Tokyo Bankers Association, was also reduced.

[9] The value of aggregate liquidity required before the start of Phase 1 is a theoretical value calculated using actual data for payment value and submission timing. It represents the minimum value of liquidity needed to settle money market transactions in pure RTGS and FXYCS payments in either the RTGS or DNS mode. The value of aggregate liquidity after the start of Phase 1 is calculated based on the actual value of funds that participants transferred to their Q/O accounts.

[10] For a summary of developments in the money market during the same period, see Bank of Japan, "Financial Markets Report," 2009.

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