

Real-Time Gross Settlement (RTGS) in Japan: An Evaluation of the First Six Months

S U M M A R Y

1. On the first business day of January 2001, the Bank of Japan introduced the new RTGS system, making real-time gross settlement (RTGS) the only mode for its settlement system for funds and Japanese government securities (JGSs) and abolishing designated-time net settlement.

As a preliminary to the changeover to the RTGS system, the Bank sought public comment on specific issues relating to the scheme in 1996, and then began the necessary preparations including system development. In this process, the Bank received significant cooperation from market participants with regard to changes that would need to be made in computer systems and market practices, especially those in trade and settlement, to accommodate to the RTGS system.

2. Since the start of the RTGS system, the Bank's settlement system (the BOJ-NET) has been operating stably, and funds and JGS settlement between financial institutions has taken place smoothly. Financial institutions and private clearing systems have also accommodated to the new settlement method smoothly.

Examining the daily volume of transactions settled through the BOJ-NET under the RTGS system in comparison with designated-time net settlement, for funds settlement, i.e., funds transfers via current accounts at the Bank (BOJ accounts), the total value of transactions has fallen sharply. The main reason for this is that the changeover to the RTGS system has made financial institutions more aware of the risks and costs involved in settlement, leading them to review market practices for transactions such as call money transactions. For JGS settlement, the total value of transactions settled has remained more or less unchanged since the start of the RTGS system, but the number of transactions has increased substantially. This is because the new market practices require market participants to set an upper limit of 5 billion yen on the size of trades for smooth settlement.

Examination of the way funds and JGS settlement are processed in the course of the

day shows that a regular pattern has emerged. Settlement takes place at a fast pace starting early in the morning trading session, given the Bank's introduction of an intraday overdraft facility to provide liquidity throughout the day, and new market practices that facilitate smooth settlement.

3. RTGS is a settlement mode that limits the direct effect of the inability to pay of one financial institution, in the event that the institution becomes unable to transfer either funds or JGSs for any reason, to the immediate counterparties of that institution. The changeover to the RTGS system was aimed at reducing the systemic risk¹ inherent in designated-time net settlement.

Following the introduction of the RTGS system, funds and JGSs are transferred and settled on a transaction-by-transaction basis, i.e., "gross" basis, unlike in designated-time net settlement where each participant's net position (the sum of the value of all the payments it has received at a particular point of time less the sum of the value of payments it has made) was calculated and settled. In designated-time net settlement, each payment was interrelated with other payments settled at the same settlement time through the netting process, but in RTGS each payment is settled individually. As a result, the systemic risk has been significantly reduced. In addition, since the changeover to real-time settlement, settlement of most transactions at the Bank is completed early in the day. The earlier timing of settlement has also contributed to the reduction of systemic risk by significantly reducing the amount outstanding of transactions remaining unsettled on the settlement day.

4. These developments show that the Bank's changeover to the RTGS system for funds and JGS settlement has taken place smoothly, successfully reducing systemic risk as planned. It constitutes a substantial improvement in the stability of Japan's financial infrastructure. The changeover to the RTGS system is an important factor contributing to more active trading in Japan's financial markets.

It is worth noting, however, that innovation in information technology has been going forward at a remarkable pace in recent years, and that the

1. The risk of systemic disruptions posed to financial institutions, and ultimately to the entire financial system, through a chain of settlement failures or delays in settlement.

specific nature of services demanded of the settlement system continues to change. The challenges that the Bank will continue to face will be how best to incorporate technological innovations in the BOJ-NET to further enhance the safety and efficiency of the system for its participants.

The Bank of Japan will continue to make unceasing efforts to improve the safety and efficiency of the BOJ-NET and Japan's payment and settlement system as a whole in close cooperation with market participants and the operators of private clearing systems.

I. Background and Aims of the Changeover to the RTGS System

Over six months have passed since the Bank of Japan introduced the new RTGS system, making real-time gross settlement (RTGS) the only mode for its settlement system for funds and Japanese government securities (JGSs) and abolishing designated-time net settlement.

The changeover to the RTGS system has had two main effects. The first is the change from designated-time settlement to real-time settlement. Instructions transmitted to the Bank from institutions that have current accounts (BOJ accounts) at the Bank (hereafter account holders) such as banks, securities companies, and other institutions are now executed immediately upon receipt, instead of accumulating until certain settlement times. The other major change is from net settlement to gross settlement. For the settlement of funds and JGSs at the Bank, the whole (gross) value of transactions is debited from or credited to the BOJ account of each account holder for each transaction, instead of the net amount of a number of transactions being debited or credited for each account holder.

The changeover to the RTGS system has been implemented in various countries around the world over the past decade, reflecting changes in the financial environment and innovation in information technology. The aim of the change has been the reduction of systemic risk.

Settlement involves various risks: (1) credit risk relating to principal, which is the risk of loss of the whole value of a transaction when a counterparty does not meet its obligation; (2) replacement cost risk, which is the risk of incurring the additional cost of replacing funds or securities in a transaction at current market prices when a counterparty to an outstanding transaction for completion at a future date fails to perform on the settlement date; and (3) liquidity risk, which is the risk that a financial

institution's expected liquidity position may be affected to the extent that it becomes unable to meet its own obligation to a third party. Furthermore, a settlement failure in any given transaction can spread quickly beyond the original counterparties to affect other parties through the interrelation of trades and settlement, ultimately disrupting the nation's entire payment and settlement system. This is referred to as systemic risk.

In 1996, to reduce the systemic risk inherent in settlement between financial institutions, the Bank put forward a proposal for changing its settlement system to the RTGS system. The Bank sought public comment and then began development of the system, finally introducing the RTGS system in January 2001. In the development process, the Bank received significant cooperation from market participants with regard to the changes that would need to be made in computer systems and market practices to accommodate to the RTGS system.

II. Trends in Settlement since the Introduction of the RTGS System

A. Operation of the BOJ-NET

The Bank of Japan Financial Network System (BOJ-NET) is the Bank's on-line system for processing the settlement of funds and JGSs between financial institutions. Among the many transactions that the Bank handles each day, some still take place using paper instruments such as checks and transfer requests, but over 99 percent of transfer instructions are now transmitted and executed online using the BOJ-NET.

To realize the changeover to the RTGS system, it was necessary to develop a system capable of processing the vast majority of transfers through the BOJ-NET on an RTGS basis. This required development of various facilities necessary for the RTGS system, such as an intraday overdraft facility and simultaneous processing of DVP and

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collateralization (SPDC).² System development for these facilities was completed by the end of 2000. Also, to reduce the operational burden on financial institutions participating in the BOJ-NET, such as banks and securities companies, the Bank decided to expand the availability of CPU-to-CPU connections³ to a wider range of services simultaneously with the changeover to the RTGS system.

The RTGS system began operation on January 4, 2001, and has operated smoothly without major disruptions. With regard to the operating hours of the BOJ-NET in the six months since the start of the RTGS system, the deadline for entering instructions was extended on only two occasions (both by 30 minutes), both times owing to extension of operating hours at private clearing systems. Participating financial institutions have gradually familiarized themselves with the new settlement mode, and the time taken for DVP settlement of JGS transactions has been shortened each month (Chart 1).

B. Funds Settlement

1. Developments in the daily volume of transactions

a. Value of transactions

Since the changeover to the RTGS system, the total value of transactions settled through BOJ accounts has fallen sharply, from a daily average of 143 trillion yen in 2000 to 81 trillion yen in the first six months of 2001. When these transactions are classified into payments for JGS transactions on a DVP basis (“DVP payments”), and payments for other transactions (“payments other than DVP payments”), the fall in the total value was largely due to a decrease in the latter (Chart 2).

The value of payments other than DVP payments settled through BOJ accounts decreased

significantly as the value of call money transactions settled fell by more than 50 percent due to the review of market practices discussed below. This development reflects market participants’ heightened awareness of the risks and costs associated with settlement, and can be described as another positive effect of the changeover to the RTGS system.

(i) Changes in the settlement method for unsecured call money transactions

Settlement of unsecured call money transactions had traditionally been conducted through current accounts held by *tanshi* companies at the Bank, i.e., by transferring funds first to *tanshi* companies’ accounts, then distributing the funds to lenders or borrowers.⁴ Following the decision on the changeover to the RTGS system, however, there was a growing awareness among market participants that it would be inappropriate from a risk management perspective to maintain this settlement method, and it was changed so that settlement is conducted directly between lenders and borrowers.

(ii) Changes in the settlement method for secured call money transactions

In the past, the vast majority of secured call money transactions were conducted by *tanshi* companies trading on their own account, but since the changeover to the RTGS system, *tanshi* companies have begun to handle such transactions on a broking basis. As a result, since the start of the RTGS system, about one-third of call money transactions have been settled directly between lenders and borrowers, without using the accounts of *tanshi* companies.

(iii) Introduction of open-end transactions⁵

In the past, overnight transactions formed the overwhelming majority of transactions in Japan’s call money market, and as a consequence vast sums of money needed to be settled every day. In an RTGS system, however, such vast sums would mean

2. SPDC is a mechanism through which a financial institution buying JGSs can post to the Bank the JGSs it receives from the seller as collateral for an intraday overdraft, and use the funds from the overdraft to pay the seller for the JGSs it purchases at the same time. It eases the burden on financial institutions of fund-raising to pay for JGSs. Delivery versus payment (DVP) is a mechanism through which the delivery of securities occurs only if the corresponding transfer of funds occurs, eliminating the risk that the seller delivers JGSs but does not receive payment, and vice versa.

3. A CPU-to-CPU connection is a direct link between the computer systems of a participating financial institution and the Bank. The Bank had previously made CPU-to-CPU connections available only for processing payment messages for the Foreign Exchange Yen Clearing System (FEYCS), but with the changeover to the RTGS system, the Bank decided to make them available also for the BOJ-NET Funds Transfer System and the BOJ-NET JGB Services. This change is in response to participating financial institutions’ increased need to manage their balances as and when desired and to process efficiently the expanding volume of transactions for settlement following the changeover to the RTGS system.

4. Funds were first moved from the lender’s BOJ account to the *tanshi* company’s BOJ account, and then transferred from there to the borrower’s BOJ account. For repayment, the process was reversed.

5. “Open-end transactions” are transactions where the repayment date is not specified at contract, but is decided later when it becomes necessary.

an increase in the funds that market participants need for settlement and in the burden of their collateral needs. The concentration on overnight transactions was therefore reviewed, and open-end transactions were introduced, reducing the daily value of transactions to be settled.⁶

b. Number of transactions

Since the start of the RTGS system, the number of transactions settled through BOJ accounts has increased by about 10 percent (Chart 2), in line with the increase in the number of JGS transactions settled on a DVP basis (see below).

In the first six months after the introduction of the RTGS system, the number of payments other than DVP payments settled showed only a small decline, despite the sharp drop in the value of these payments. This was because, while open-end transactions and an increasing use of payment netting⁷ were factors reducing the number of payments, changes in the market practices of call money transactions were a factor working counter to this. Before the changeover to the RTGS system, financial institutions conducting unsecured call money transactions made a single funds transfer to a *tanshi* company to cover payments for a number of transactions to a number of counterparties, and the *tanshi* company made transfers to the individual recipients. At the same time, the *tanshi* company collected multiple payments made to each institution from various financial institutions, and made a single funds transfer to the recipient. Since the start of the RTGS system, however, financial institutions have been transferring funds directly to each other, without using the accounts of the *tanshi* companies. Consequently, given that many of the payments are no longer collected and distributed by *tanshi* companies, the number of transactions settled has increased, offsetting much of the decline in number attributable to other factors.

2. Settlement in the course of the day

Examination of the way funds are settled in the course of a normal business day since the start of the

RTGS system—in terms of the number of transactions settled—shows that the majority of settlement activity takes place in the morning, and most of settlement activity in the morning consists of DVP payments for JGS transactions. About 80 percent of the day's transactions were settled between 9:00 a.m. and 11:00 a.m. on the sample day, which was a normal day when no JGSs were issued (Chart 3).⁸

Funds settlement for most payments other than DVP payments was carried out in the morning. About 65 percent of these transactions were settled between 9:00 a.m. and 11:00 a.m. on a normal business day (Chart 3).

Funds settlement between BOJ accounts, including that for DVP payments, takes place at a fast pace starting early in the morning, and in this way, “gridlock”⁹ has been avoided. Three major factors have contributed to this smooth settlement. First, market participants have been adhering to a new market practice, aimed at promoting smooth settlement in the call money market; participants are to place priority on repaying call money in the early morning trading session, and to make payments for trades agreed on the day within one hour from contract. Second, large financial institutions have been making full use of CPU-to-CPU connections between their in-house computer systems and those at the Bank to originate transfer instructions as and when desired. And third, the Bank has been supplying liquidity throughout the day via its intraday overdraft facility, which helps support settlement of a large volume of funds early in the day as discussed below.

Funds settlement at the Bank is generally processed in line with the timeline shown in Chart 4 below.

C. JGS Settlement

1. Developments in the daily volume of transactions

a. Value of transactions

Since the start of the RTGS system, the value of JGS transactions settled at the Bank has been roughly the same as before (Chart 5).

6. In addition to the above changes in settlement methods, financial institutions are increasingly applying payment netting (see Footnote 7) to payments (transfers of funds from the lender to the borrower) and repayments (transfers from the borrower to the lender) for call money transactions carried out directly between financial institutions without the intermediation of *tanshi* companies.

7. Payment netting is settlement on a net basis of payments due on the same date for transactions between two financial institutions. Settlement obligations between them are offset against each other, and only the resulting differences are settled.

8. Chart 3 shows the profile of settlement activity on a normal business day, for funds settlement excluding settlement of net positions arising from private clearing systems, funds settlement for the Bank's money market operations, and receipt and payment of banknotes and coins. The sample day was May 10, 2001, a normal day when there was no issuance of JGSs.

9. “Gridlock” refers to a situation where financial institutions try to receive funds before they make payments, causing the start of settlement to be delayed until late in the day.

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The daily average value of transactions settled in January 2001 was about 65 percent of that before the changeover. This was because some market participants reduced their JGS trading until they had accommodated to the new settlement mode immediately after the changeover to the RTGS system. After that, however, the volume of JGSs traded and settled both rebounded, and by April had recovered to the level before the introduction of the RTGS system.¹⁰ The daily average value of transactions settled was 44 trillion yen in 2000, 37 trillion yen in January–March 2001, and 45 trillion yen in April–June 2001.

b. Number of transactions

The number of JGS transactions settled, on the other hand, has increased 35 percent since the start of the RTGS system (Chart 5).

Market practices for JGSs were also reviewed prior to the introduction of the RTGS system, and market participants agreed to set an upper limit of 5 billion yen on the size of trades. Trades that exceeded 5 billion yen are split so that no single trade exceeds 5 billion yen. This change was aimed at preventing a situation where one financial institution's delivery of an unusually large value of JGSs could stop settlement of all other JGS transactions if the delivery was delayed until the institution had obtained the vast amount of JGSs necessary to complete it. As a result of the adoption of this new market practice, the average size of JGS transactions settled since the start of the RTGS system has fallen to about two-thirds of the average prior to the changeover to the RTGS system. The average value per transaction for JGS settlement was 4.9 billion yen in 2000, and 3.5 billion yen in January–June 2001, but the number of transactions settled has risen sharply.¹¹

2. Settlement in the course of the day

Examination of the way JGSs are settled in the course of a normal business day (when no Japanese government bonds [JGBs], treasury bills [TBs], or financing bills [FBs] are issued) since the start of the RTGS system—in terms of the number of transactions settled—shows that 90 percent of

settlement activity takes place between 9:00 a.m. and 11:00 a.m. (Chart 6).

Large amounts of JGSs are held by financial institutions for the purpose of daily funding and by financial institutions and firms as part of their short-term trading portfolios because JGSs are highly liquid assets compared to other securities such as stocks and corporate bonds. For example, financial institutions often reinvest funds that return from a call money transaction in cash-collateralized securities lending transactions (referred to as repo transactions in Japan). Reflecting the close relationship between settlement of funds and securities, and the concentration of funds settlement in the early part of the morning, JGS settlement under the RTGS system also takes place in the early hours of the day.

To maintain the marketability of JGSs, there must be a mechanism that allows JGS settlement to be conducted as and when desired throughout the day, in parallel with settlement of call money or other funds transactions. To this end, the RTGS system provides two facilities: (1) it provides institutions with CPU-to-CPU connections between their computer systems and those of the Bank upon request, so that they can originate transfer instructions for JGS settlement as and when desired; and (2) it provides simultaneous processing of DVP and collateralization (SPDC), through which institutions buying JGSs can draw intraday overdrafts against the JGSs they receive. Given these facilities, new practices were adopted to settle JGS transactions: for smooth settlement, large-value transactions are broken up into two or more contracts; and settlement activity starts at a brisk pace at 9:00 a.m. and most of the day's settlement is completed by noon. Settlement of JGS transactions early in the day is a recent development brought about by the introduction of the RTGS system and by new market practices, and these changes have helped to increase the marketability of JGSs.

When financial institutions make payments through the BOJ-NET for newly issued JGBs, TBs, and FBs, the payments are still processed at

10. In addition, netting is increasingly used between market participants for settlement of JGS transactions. Through netting, the net amount of more than one trade in the same issue of JGSs is settled between the same pair of counterparties on the same day. The value of JGS transactions settled seems to have dropped by 20 to 30 percent as a result of netting. The drop has, however, been offset by an increase in the volume of JGS trading.

11. The number of JGS transactions settled seems to have decreased by 20 to 30 percent as a result of netting of these transactions, but it has in fact decreased only slightly, due to an increase in the volume of JGS trading, as well as the upper limit on the size of trades.

the designated time of 3:00 p.m. even after the introduction of the RTGS system. As a result, on days when JGBs, TBs, or FBs are issued, settlement activity is divided into two major periods in the day: one in the morning (settlement of transactions in already-issued JGSs) and another after 3:00 p.m. (mainly settlement of transactions in newly issued JGSs). On such days, settlement activity tends to be slow overall and generally shows a shift to later in the day. For example, on days when 10-year interest-bearing JGBs are issued, roughly 70 percent of the day's settlement activity takes place between 9:00 a.m. and 11:00 a.m., and about 20 percent between 3:00 p.m. and 5:00 p.m. (Chart 6).

The Bank usually stops accepting transfer instructions to the BOJ-NET JGB Services at 4:30 p.m. (the deadline for entering instructions), but the Bank extends the system's operating hours on days when JGBs, TBs, or FBs are issued, so that there is time to complete settlement of transactions in newly issued JGBs, TBs, and FBs smoothly. Transfer instructions are accepted until 6:00 p.m. on days when interest-bearing JGBs are issued, and until 5:30 p.m. on days when discount JGBs, or TBs, or FBs are issued.

The Bank of Japan is developing its systems further so that by about the middle of 2002, payments related to issuance of JGBs, TBs, and FBs, including payments made online via the BOJ-NET by financial institutions, are also processed on an RTGS basis (see Appendix for details). Market participants will then be able to start the settlement for newly issued JGBs, TBs, and FBs from the morning and will not need to wait until 3:00 p.m., the current designated settlement time for these transactions.

3. Fails in the JGS market

The "fail" practice has been introduced in the JGS market simultaneously with the changeover to the RTGS system. With the new practice, a failure to deliver securities on the scheduled settlement date is referred to as a "fail,"¹² and not as a default, and therefore the right of cancellation is not exercised, and settlement is allowed to be delayed until the end of the following day or in some cases later. In the U.S. and European securities markets, the need to

accept fails to some extent has been acknowledged to ensure the smooth and efficient settlement of securities, and the practice is well established.

Immediately after the start of the RTGS system, the number of fails was near zero for JGSs settled on a DVP basis, but since then it has risen gradually, and now stands at about 400 to 600 per month (Chart 7).¹³ As a percentage of the total number of JGS transactions settled on a DVP basis, fails have remained at the 0.2 to 0.3 percent level since March 2001. This is still low compared with figures for Europe and the United States,¹⁴ and settlement risk has not increased considerably in the JGS market.

D. Use of the Intraday Overdraft Facility

Together with the start of the RTGS system, the Bank began providing an intraday overdraft facility against collateral, free of charge to account holders, to ensure prompt and smooth settlement.

The daily profile of the outstanding balance of intraday overdrafts shows that the balance expands rapidly from the start of the BOJ-NET's operating hours at 9:00 a.m. until it reaches a peak at around 9:40 or 9:50 a.m., as the need for funds increases given the concentration of repayment for call money and payment for JGS transactions in the hours between 9:00 a.m. and 10:00 a.m. From then onward, overdrafts are gradually repaid, and almost all of the balance is repaid shortly after 3:30 p.m. on normal business days. Since intraday overdrafts must be repaid by the end of the day, the balance at the end of the day is always zero (Chart 8).

The peak outstanding balance of intraday overdrafts is about 14 trillion yen on average, but it varies significantly from day to day depending on the value of transactions for funds settlement and JGSs (Chart 9).

Of the 14 trillion yen drawn as intraday overdrafts, about 5 to 7 trillion yen is used to make payments for JGS transactions, and half of the remaining 6 to 9 trillion yen is used to repay call money. Borrowers of call money generally rely on their own reserves and intraday overdrafts for funds to repay call money from 9:00 a.m.

12. A fail is a situation where one party has not delivered securities by the end of the scheduled settlement date due to reasons other than its creditworthiness.

13. See also "New Practices in JGB Markets after the Introduction of the RTGS System: Focusing on the 'Fail to Deliver' Practice," (2001-J-7) Market Review J-Series, the Bank of Japan Financial Markets Department (available only in Japanese).

14. Official data on the rate of fails in the U.S. and European markets are not available, but the rate in the United States is said to be about 1 to 2 percent, and in Europe close to 5 percent.

(Reference) Changes in the Volume of Trades after the Start of the RTGS System

Changes in the volume of trading in high-liquid funds instruments since the start of the RTGS system have been as follows. In the call money market, direct transactions between financial institutions have increased, and some of the transactions in the market have shifted away from secured transactions toward unsecured transactions. In terms of trading volume, there was no notable change compared with prior to the introduction of the RTGS system. Since April, however, the call money market has shrunk substantially, following the Bank's monetary easing measures decided in March. Amounts outstanding of certificates of deposit (CDs) and commercial paper (CP) issued, on the other hand, have grown sharply since the start of the RTGS system (Chart 10).¹⁵

As for developments in JGS trading after the start of the RTGS system, many market participants took a cautious approach until they had become accustomed to the new JGS settlement method. Market participants were temporarily inclined to keep their level of trading low, in particular in repo transactions. After market participants had familiarized themselves with settlement in the RTGS system, however, the trading volume of JGSs increased steadily, and soon recovered to levels close to those in the previous year (Chart 11).

In the long-term view, the changeover to the RTGS system helps to prevent a situation where some market participants avoid conducting business in yen because they perceive the settlement risk as too large. The Bank believes that the changeover to the RTGS system is an important factor encouraging more active trading in Japan's financial markets.

III. The Effectiveness of the RTGS System in Reducing Risk

The purpose of the introduction of the RTGS system was the reduction of systemic risk inherent in settlement of funds and JGSs between financial institutions. Systemic risk is the risk that a bank, due to receive funds from Bank X and make payment to Bank Y, is unable to do so because Bank X fails to complete settlement of the first transaction, and this triggers a chain of settlement failures among other financial institutions.

In any system where, as in designated-time net settlement, a single settlement failure could affect settlement of other transactions by financial institutions, the more dependent the transactions are on other transactions, the greater the systemic risk. Further, the greater the amount outstanding of unsettled transactions that are not completed early in the day—in other words, the greater the number of transactions that remain unsettled and thus could be affected by a settlement failure—the greater the systemic risk.

RTGS is a settlement mode in which (1) every transaction is settled individually, so settlement of each transaction is unrelated to that of other transactions, and (2) every transaction is settled immediately, so transactions are processed one after another from early in the day. In RTGS, even if a financial institution fails to complete settlement at any point in the day, settlement of many transactions will have been completed by then, and thus there is no large amount outstanding of unsettled transactions that could potentially be disrupted. In the section below, the reduction of systemic risk by RTGS is evaluated from two viewpoints: “gross settlement” and “real-time settlement.”

With the changeover to the RTGS system, settlement of both funds and JGSs are completed in the early hours of the settlement day, reducing the amount outstanding of unsettled transactions. In the JGS market, however, the prevailing practice is to settle trades on the third business day after the trade, i.e., the day of contract (T+3 settlement). As a result, transactions to be settled the next day or thereafter remain unsettled.

When these unsettled transactions accumulate, and if a party becomes bankrupt prior to the settlement day, any counterparty in transactions with that party may be forced to obtain from other market participants the JGSs or funds it planned to obtain in the original transaction. There is a risk that replacing the JGSs or funds will cost more than originally planned for. Therefore, it is necessary to shorten the time-lag between trade and settlement (settlement interval) as much as possible, to reduce settlement risk.

Market participants as well as the Bank have been working to shorten the settlement interval for JGSs. In the past, JGS settlement occurred on certain

15. This reflects, in part, investors' preference for CP and CDs in view of low interest rates on FBs and TBs.

days of the month,¹⁶ but in 1996 rolling settlement was introduced so that settlement took place seven business days after trade (T+7 settlement). This was shortened the following year to the current T+3 settlement. From the perspective of reducing risk, however, it is considered that there is a need to shorten the settlement interval further.

A. Effects of Gross Settlement: Disentangling Interrelated Transactions

1. Funds settlement

Prior to the changeover to the RTGS system, almost all transactions settled through BOJ accounts were processed on a net basis.¹⁷ For transactions processed through private clearing systems such as the bill and check clearing systems, the Domestic Fund Transfer System, and the Foreign Exchange Yen Clearing System, the net settlement position for each financial institution was calculated by the system (netting), and the settlement position was, again, netted at the Bank with other transactions such as call money transactions and payments for JGS transactions. As a result, if there was a delay in settlement or a settlement failure by one financial institution at a designated settlement time, all other transactions to be settled for other institutions at that settlement time came to a halt. There was an extremely large systemic risk.

The daily average value of transactions settled through BOJ accounts was 140 trillion yen in 2000, 180 trillion yen if all transactions transmitted to private clearing systems are included. This enormous amount of transactions was all interrelated in the system under the designated-time net settlement mode (Chart 12).

Since the start of the RTGS system, however, every transaction is settled individually through the BOJ-NET, and the interrelation of transactions has been eliminated. Even if a financial institution becomes unable to complete settlement, financial institutions that are not its counterparties are not directly affected by the settlement failure.

Even in the RTGS system, there is still a risk that a financial institution expecting payments from other institutions may become unable to settle

its obligations to another institution due to its counterparties' delay in settlement or settlement failure (a chain of settlement failures). However, in designated-time net settlement the effect of settlement delay or failure could spread to all financial institutions settling at the same settlement time, while in the RTGS system the effect is limited and systemic risk is substantially reduced.

2. JGS settlement

The changeover to the RTGS system has also meant a sharp reduction in systemic risk for JGS settlement. Before the changeover to the RTGS system, nearly all JGS transactions were settled on a net basis at 3:00 p.m. The daily average value of transactions settled was about 44 trillion yen in 2000. Considering that nearly all of these transactions were settled at one point in the day at 3:00 p.m., the systemic risk involved in JGS settlement was considerable.

Since the start of the RTGS system, JGS transactions are settled individually. Consequently, even if a financial institution becomes unable to settle its obligation, the risk of settlement of all JGS transactions in the system being stopped as a result has been eliminated.

B. Effects of Real-Time Settlement: A Reduction in Transactions Remaining Unsettled on the Settlement Day

1. Funds settlement

In designated-time net settlement, 60 percent of transactions were settled at the designated settlement time of 1:00 p.m., 30 percent at 3:00 p.m., and about 5 percent at 5:00 p.m. (Chart 12). Taking a weighted average of settlement time according to the value of transactions settled, the average time for settlement in the designated-time net settlement mode was around 2:00 p.m.¹⁸

Since the start of the RTGS system, a new pattern has emerged where settlement takes place at a fast pace starting early in the morning trading session. Taking a weighted average of settlement time by the value of transactions settled since the start of the RTGS system, the average time of settlement has been moved up to around

16. Before T+7 settlement was introduced, JGSs were settled on the 5th, 10th, 15th, 20th, 25th, and the last business day of every month. On these settlement days, transactions for up to five days' trading were settled. The settlement interval was about seven to ten days.

17. Even before the changeover to the RTGS system in Japan in 2001, the BOJ-NET provided the RTGS mode alongside the designated-time net settlement mode. In practice, however, the RTGS mode was seldom used.

18. Using data for the daily average value of transactions settled through BOJ accounts in September 2000, the weighted average time for funds settlement was 1:53 p.m.

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11:30 a.m.,¹⁹ two and a half hours earlier than before the changeover.²⁰

The value of transactions for funds settlement has been reduced by over 40 percent since the start of the RTGS system. The daily average value of transactions for funds settlement was 143 trillion yen in 2000, and this decreased to 81 trillion yen in January–June 2001.

Chart 13 shows changes in the amount outstanding of unsettled transactions (the value of transactions remaining to be settled on a settlement day) over the course of a typical day, before and after the introduction of the RTGS system. The horizontal axis shows the time, and the vertical axis is the value of unsettled transactions remaining to be settled on the day.

As Chart 13 shows, since the changeover to the RTGS system, the overall daily value of transactions settled has declined, and settlement has been conducted earlier in the day. Both factors have contributed to a sharp reduction in the amount outstanding of unsettled transactions. This reduction in unsettled transactions minimizes the value of transactions that could be affected should a financial institution suddenly become unable to complete settlement, and thus it also reduces the potential negative impact of such a failure on other financial institutions. Moreover, because settlement is conducted earlier in the day, financial institutions have more time to obtain funds they need from other parties, in the unlikely event a settlement failure becomes apparent. This is another way in which the changeover to the RTGS system has contributed to the reduction of systemic risk.

2. JGS settlement

In designated-time net settlement, almost all transactions were settled at 3:00 p.m. In other words, from 9:00 a.m. to 3:00 p.m. on settlement days, virtually all JGS transactions that were to be settled on the day remained unsettled. Since the changeover to the RTGS system, however, settlement of JGS transactions takes place at a fast pace starting early in the morning trading session. Average settlement

time, weighted according to the value of transactions settled on a normal business day since the changeover to the RTGS system, is around 10:00 a.m.,²¹ five hours earlier than previously.

The overall value of JGS transactions settled has changed little since the start of the RTGS system. The number of fails in JGS transactions has been kept at a low level.

Chart 13 shows these changes in the amount outstanding of unsettled transactions in the course of the day. As can be seen in the chart, JGS transactions are settled at a fast pace from 9:00 a.m., greatly reducing the amount outstanding of unsettled transactions in the course of the day. Real-time settlement has also reduced systemic risk in JGS transactions.

IV. Future Challenges

The changeover to the RTGS system for the settlement of funds and JGSs at the Bank has been achieved smoothly, and systemic risk has been reduced as planned.

On April 24, 2001, the Bank published a “Schedule for Additional Measures Relating to Real-Time Gross Settlement of JGS Transactions” (available only in Japanese; see Appendix for summary). This paper indicated the schedule for the changeover to full RTGS, including for some JGS transactions that were not included in the initial RTGS scheme started in January 2001 for system development reasons, as well as the schedule for other measures to make the RTGS system safer and more efficient.

The additional measures will help to further increase the stability of Japan’s financial infrastructure, making an important contribution to an environment conducive to more active trading in Japan’s market.

The Bank of Japan’s settlement services, which are the basis of Japan’s payment and settlement system, must be such as to promote safety and efficiency of settlement between financial institutions and through payment and settlement systems,

19. Using data for May 10, 2001, the weighted average time for funds settlement was 11:22 a.m.

20. Assuming that all transactions are contracted before 9:00 a.m. on the settlement day, it is possible to measure the average time that a transaction remains unsettled on the day as the time from 9:00 a.m. until the average time of settlement (which was 2:00 p.m. before the introduction of the RTGS system, and 11:30 a.m. since the start of the RTGS system). Some transactions, however, are contracted after 9:00 a.m. for settlement on the same day, so the actual average time that a transaction remains unsettled on the settlement day is somewhat shorter than “from 9:00 a.m. to the average settlement time.” Considering that most call money transactions have been contracted early in the day both before and since the start of the RTGS system, the average settlement time is a useful indication of the average time a transaction remains unsettled on the settlement day.

21. Based on data from May 10, 2001, the weighted average time of JGS settlement was 9:59 a.m.

and ultimately those of settlement of transactions by firms and individuals. As innovation in information technology is advancing at a fast pace, the specific nature of services required of the Bank's settlement systems will also continue to change. Thus, the Bank needs to improve the BOJ-NET by employing technological innovations in all aspects of the operations of the system, for example, in order to reduce its provision of intraday liquidity and ease the burden on financial institutions of acquiring collateral for intraday liquidity. In other words, the

next important challenge that the Bank faces is to achieve an optimal balance between the safety of the settlement system and the efficiency of the system for users, through the use of advanced information technology.

The Bank of Japan will continue to make unceasing efforts to improve the safety and efficiency of the BOJ-NET and Japan's payment and settlement system as a whole in close cooperation with market participants and the operators of private clearing systems.

Real-Time Gross Settlement (RTGS) in Japan: An Evaluation of the First Six Months

Chart 1

Time Taken for the DVP Settlement of JGS Transactions in 2001¹

monthly avg.

	Time taken (minutes per transaction)
January	10.3
February	10.1
March	10.0
April	9.9
May	9.6
June	9.4

Note: 1. Time taken for the DVP settlement of JGS transactions is the length of time between the origination of a transfer instruction from the party delivering JGSs and the subsequent origination of payment instruction from the recipient of JGSs using the BOJ-NET. Specifically, where BOJ-NET participant A is delivering JGSs to BOJ-NET participant B on a DVP basis, it is the time between the origination of transfer instruction by A to the Bank of Japan (and simultaneously to B), and the subsequent origination of payment instruction by B to the Bank.

Chart 2

Number and Value of Transactions Settled through BOJ Accounts

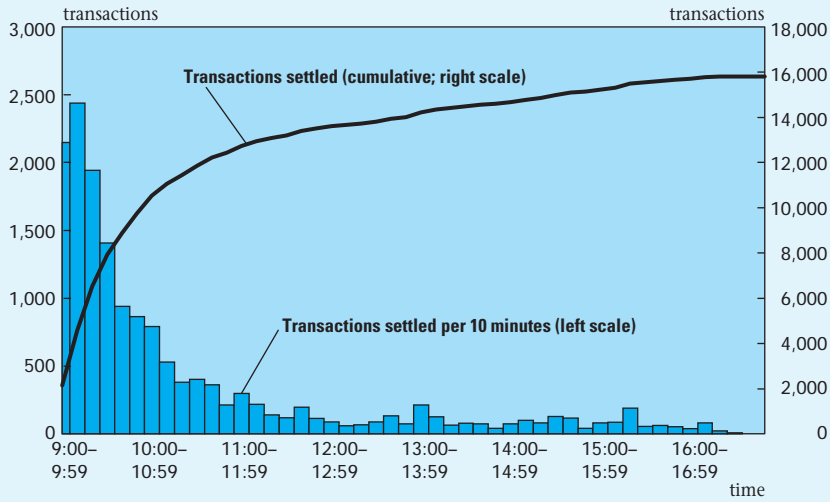
daily avg.

		Value of transactions (tril. yen)	DVP payments for JGSs	Payments other than DVP payments	Number of transactions	DVP payments for JGSs	Payments other than DVP payments
2000		142.7	27.9	114.8	19,013	5,943	13,070
2001	January-June	81.2	26.6	54.6	20,837	8,259	12,578
	January	68.4	16.8	51.6	17,628	5,347	12,281
	February	81.2	26.7	54.5	21,233	8,135	13,097
	March	88.5	26.9	61.6	21,659	8,451	13,209
	April	85.5	28.4	57.1	21,439	9,009	12,430
	May	80.4	29.3	51.1	21,362	9,101	12,261
	June	82.2	30.9	51.3	21,464	9,258	12,206

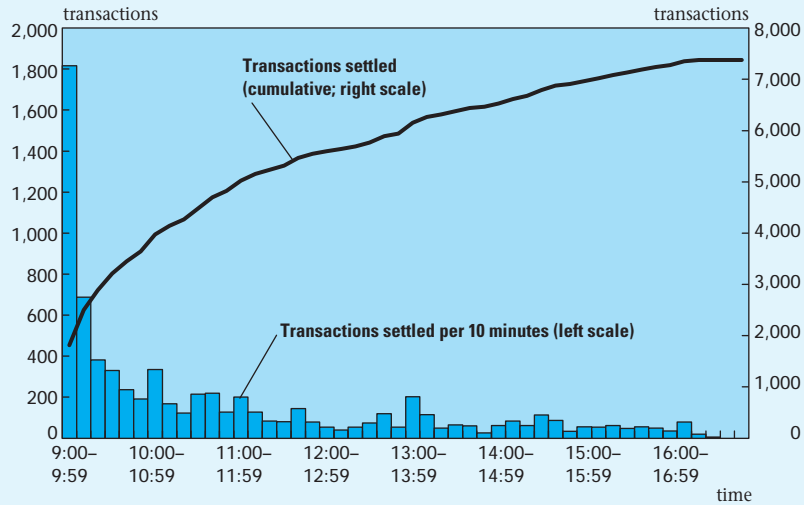
Chart 3

Number of Transactions Settled through BOJ Accounts on May 10, 2001

■ Including Transactions Settled on a DVP Basis



■ Excluding Transactions Settled on a DVP Basis



Real-Time Gross Settlement (RTGS) in Japan: An Evaluation of the First Six Months

Chart 4

Timing of Funds Settlement through BOJ Accounts by Type of Transaction

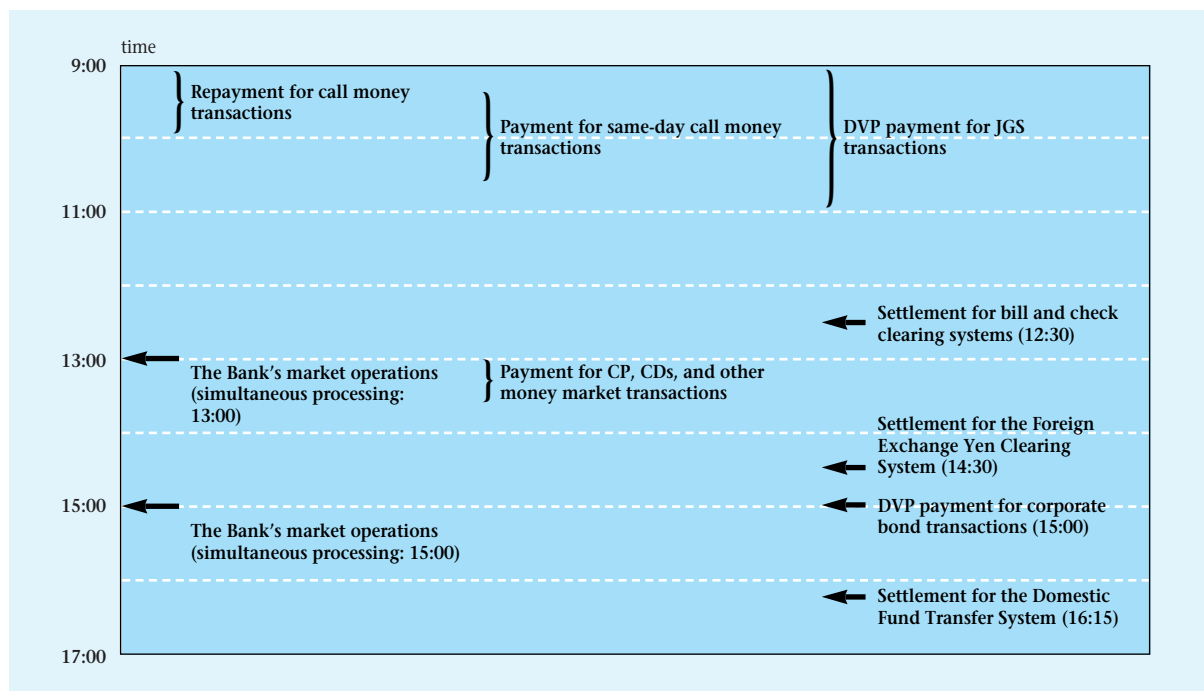


Chart 5

Number and Value of JGS Transactions Settled¹

daily avg.

		Value of transactions (tril. yen)	Number of transactions
2000		43.7	8,939
2001	January-June	41.1	11,607
	January	28.2	8,046
	February	41.2	11,723
	March	40.4	11,955
	April	44.0	12,429
	May	44.2	12,533
	June	47.4	12,667

Note: 1. Number and value of JGS transactions include those not settled on a DVP basis. The value of transactions is the face value of JGSs settled.

Chart 6

Number of Transactions Settled on a DVP Basis

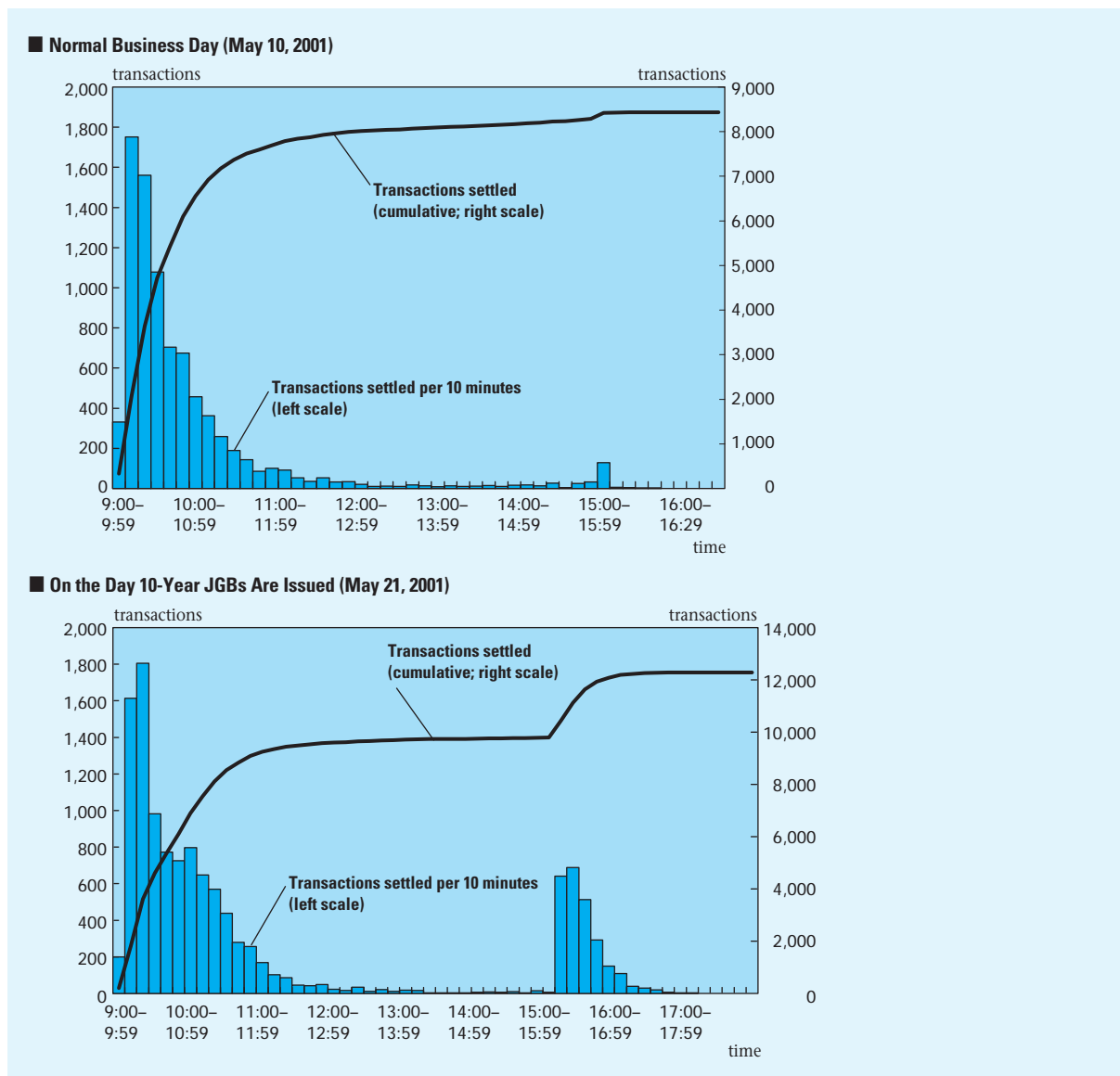


Chart 7

Number, Value, and Duration of Fails in 2001¹

	Number of fails	Total face value (bil. yen)	Avg. duration of fail (business days)	Longest duration of fail (business days)	Fail rate (%)
January	99	257.9	1.21	3	0.10
February	296	877.1	1.29	5	0.19
March	616	1,367.3	1.20	4	0.35
April	492	1,155.1	1.20	6	0.27
May	474	1,243.1	1.15	4	0.25
June	392	840.3	1.21	4	0.20

Note: 1. Figures are based on a monthly survey on financial institutions and some other types of institutions that are direct participants in the JGB book-entry system and also participants in the BOJ-NET for the settlement of JGS transactions on a DVP basis. The survey covers all transactions that are settled using the BOJ-NET JGB DVP services.

Real-Time Gross Settlement (RTGS) in Japan: An Evaluation of the First Six Months

Chart 8
Outstanding Balance of Intraday Overdrafts in the Course of the Day (May 10, 2001)

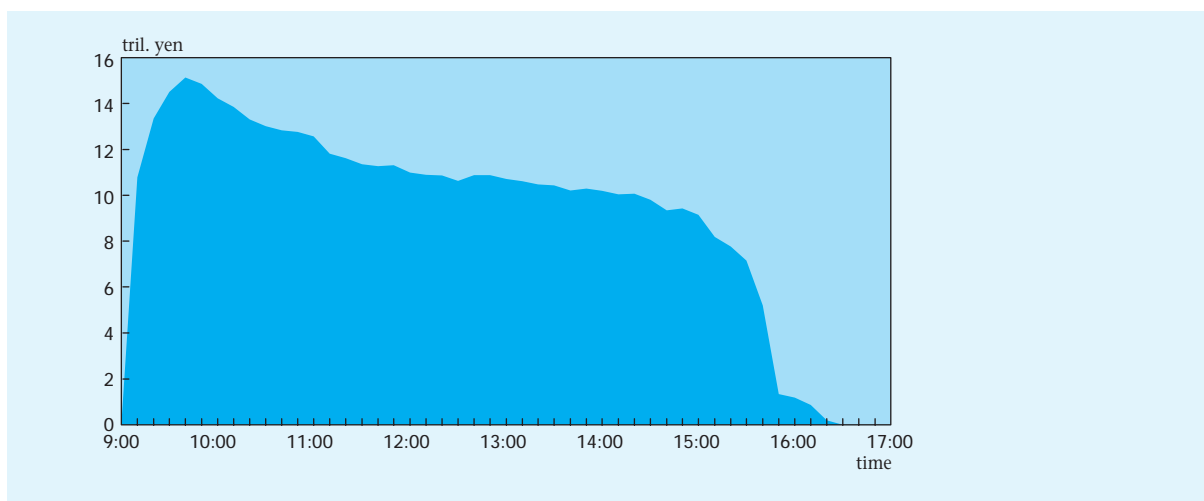


Chart 9
Daily Peak of the Outstanding Balance of Intraday Overdrafts in 2001¹

tril. yen; monthly avg.

January	February	March	April	May	June
11.3	13.8	14.8	16.4	14.4	13.1

Note: 1. The largest aggregate value of net debit positions in BOJ accounts. Net debit positions are updated every 10 minutes.

Chart 10
Amount Outstanding of Call Money Trading, CDs, and CP

tril. yen; monthly avg.¹

		Call money		CDs	CP (excluding CP issued by banks)
			Secured		
2000	January–March	26.0	13.9	34.9	16.6
	April–June	21.9	12.5	27.2	15.9
	July–September	25.2	9.6	32.2	15.6
	October–December	25.1	7.5	37.6	17.7
2001	January–March	26.4	7.1	41.6	19.2
	April–June	18.8	6.9	44.6	20.5

Note: 1. Figures are calculated by averaging figures at the end of the month in each quarter.

Chart 11

Volume of JGS Trading¹

tril. yen; monthly avg.

		Outright purchases/sales	Repo and <i>gensaki</i> transactions
2000	October	8.1	30.0
	November	10.2	30.9
	December	7.6	23.9
2001	January	8.0	21.6
	February	9.1	31.3
	March	8.7	28.3
	April	9.2	33.1
	May	9.1	33.2
	June	9.5	34.2

Note: 1. Figures are the total of purchases and sales for outright purchases/sales and *gensaki* transactions, and the total of cash-collateralized securities borrowing and lending for repo transactions.

Source: Japan Securities Dealers Association.

Chart 12

Value of Transactions Settled through BOJ Accounts: Prior to the Changeover to the RTGS System in January 2001¹

tril. yen; daily avg.

Settlement options		Value of transactions ²	[Reference] Value of transactions settled for major private clearing systems at the designated settlement time
RTGS		0.2 (0.1)	
Designated-time net settlement	9:00	0.5 (0.4)	
	13:00	80.1 (59.4)	Bill and check clearing systems (settled at the Bank) 4.0
	15:00	46.9 (34.8)	Foreign Exchange Yen Clearing System 25.8
	17:00	7.1 (5.3)	Domestic Fund Transfer System 9.5
Total		134.8 (100.0)	39.3

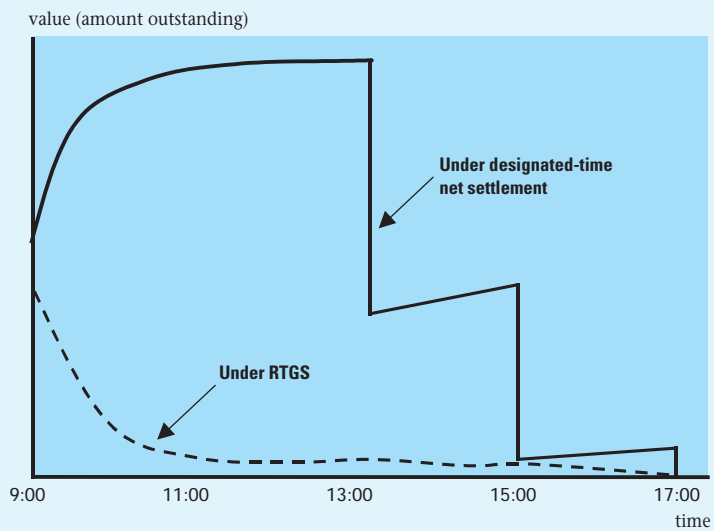
Notes: 1. Figures are value of transactions settled through BOJ accounts at the Bank's Head Office in Tokyo in September 2000. Transactions stemming from the Bank's market operations, and payment and receipt of banknotes and coins are not included.

2. Figures in parentheses are percentage shares.

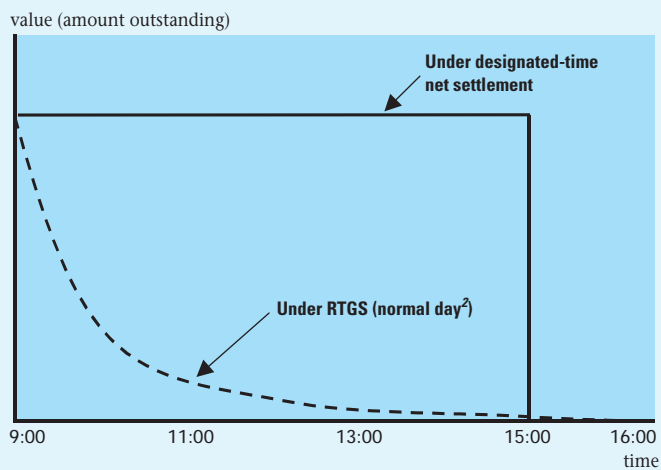
Real-Time Gross Settlement (RTGS) in Japan: An Evaluation of the First Six Months

Chart 13
Unsettled Transactions in the Course of the Day

■ Funds Settlement¹



■ JGS Settlement¹



- Notes: 1. Size of unsettled transactions under RTGS and designated-time settlement.
2. A normal business day when there is no issuance of JGSs.

APPENDIX: SCHEDULE FOR ADDITIONAL MEASURES RELATING TO RTGS FOR JAPANESE GOVERNMENT SECURITIES (JGS) TRANSACTIONS

Projects		Scheduled date	
JGS transactions that will be changed to RTGS	Issuance of JGSs for which payments for newly issued JGSs are made online	Mid-2002	
	Transactions of JGSs which the Bank holds on behalf of foreign central banks and international organizations ("foreign central banks")	Delivery of book-entry JGSs by foreign central banks (excluding the delivery of JGSs received on the day)	In 2001
		JGS transactions other than the above (e.g., receipt of book-entry JGSs by central banks, and the delivery of JGSs received on the day)	Introduction of RTGS as soon as the above two measures are implemented (under examination)
	JGS transactions by the Bank or the government	JGS borrowing operations (JGS repo); JGS repurchase agreements by the Fiscal Investment Loan Program (FILP) in which the Bank or the FILP is the recipient of the JGSs	In 2002
		(1) All JGS borrowing operations and outright purchase/sales operations of TBs (2) Purchases/sales of JGSs by the FILP or the Government Debt Consolidation Fund (the Fund) where the FILP or the Fund is the recipient of the JGSs	Introduction of RTGS as soon as the above two measures are implemented (under examination)
Expansion of the availability of CPU-to-CPU connections		System development underway for start in 2001	
Shortening of periods for accepting JGS transfers between JGS interest calculation accounts established before the interest payment period in the JGB book-entry system (from five business days to one business day)		Will be started from interest payment calculation period on and after August 20, 2001	