BOJ
Reports & Research Papers

Payment and Settlement Systems Report

2010-2011

Bank of Japan
March 2012

Table of Contents

This report is a part of the Payment and Settlement Systems Report published in June 2011 in Japanese. Section 2 and 3 in the part II of the original report are translated. Some of the information has been updated at the time of translation.

I. The Bank of Japan's Oversight

A. Formulation of the Bank's Oversight Policy

The primary responsibility for ensuring the safety and efficiency of payment and settlement systems lies with the operator of each system. In addition to this self-discipline, central banks in many countries oversee private sector systems. Oversight of payment and settlement systems managed by the private sector is defined as central banks' activities to monitor the design, risk management, and operation of systems; to assess the systems against established safety and efficiency objectives; and to induce changes for improvements where necessary. In their oversight of payment and settlement systems, central banks seek to establish a common understanding with system operators and other stakeholders on ways to maintain and improve the safety and efficiency of systems and support their efforts to make improvements. Through these activities, the Bank of Japan (hereafter "the Bank") aims to ensure the safety and efficiency of settlement, not only in individual systems, but also in overall payment and settlement arrangements in Japan.

To better clarify its oversight objectives and policy, taking into account the recent changes surrounding payment and settlement systems, the Bank revised the previously published policy statement[1] and released "Policy on Oversight of Payment and Settlement Systems" in May 2010. At the same time, the Bank released "Policy on Oversight of Offshore Yen Payment Systems."

In "Policy on Oversight of Payment and Settlement Systems," the Bank stipulates that the scope of its oversight encompasses private sector payment systems, securities settlement systems, and central counterparties (CCPs), and clarified that its oversight places particular focus on systematically important payment and settlement systems. It also clarified that in exercising its oversight, the Bank assesses individual payment and settlement systems against the safety and efficiency objectives set out in internationally accepted standards (hereinafter "international standards") for these systems, and induces improvements by exchanging views with the system operators and participants.

In "Policy on Oversight of Offshore Yen Payment Systems," the Bank presented its approach for yen payment systems operated by entities located outside Japan, or "offshore yen payment systems." Specifically, it stated that the Bank will adopt the principles for international cooperative oversight and oversee offshore yen payment systems according to

[1] See "Role of Bank of Japan in Payment and Settlement Systems" released by the Bank in September 2002.

their impact on domestic payment arrangements.

Based on the oversight policies described above, the Bank will make ongoing efforts to ensure the safety and efficiency of yen payment and settlement arrangements in cooperation with system operators, participants, and other stakeholders including relevant governmental agencies. The following introduces the Bank's recent oversight activities.

B. The Bank's Oversight Activities

The Bank carries out interviews and exchanges views with operators of and other stakeholders in private sector payment and settlement systems on an ongoing basis to gain an overview of business and financial conditions and risk management procedures, and to discuss ways to improve their functions. In addition, in semi-annual interviews with the management of payment and settlement system operators, the Bank exchanges opinions with respect to the issues for improvement and possible solutions. Taking international standards into account, the Bank encourages system operators and participants to take action designed to secure and maintain the necessary institutional arrangements in cases where new payment and settlement systems are established, existing systems introduce new services, or changes are being made to a system's major risk management framework.

The collapse of Lehman Brothers Japan (LBJ) in September 2008 provided an opportunity for each payment and settlement system, including CCPs, to reconfirm the importance of managing credit risk and liquidity risk. Immediately after the failure of LBJ, the Bank sought to ensure smooth settlement by working closely with the relevant authorities and operators of private sector payment and settlement systems. In March 2009, the Bank released a report summarizing the lessons Japan's payment and settlement systems had learned from the failure of LBJ, and discussed how the Bank had worked with the relevant parties to develop a common understanding about various challenges that had been revealed by the LBJ failure. In addition, with operators of payment and settlement systems, the Bank has been exchanging views and encouraging improvements in the following areas: (1) assessing models for initial margin requirements; (2) examining the adequacy of level of haircuts and stress test scenarios; (3) improving funding arrangements; and (4) enhancing operational procedures and capabilities to respond to a participant's default.

In terms of operational risk management, the Bank has been obtaining information and exchanging opinions on progress in the renewal/upgrade of core IT systems being carried

out in several payment and settlement systems, as well as on their management of such projects. Regarding business continuity planning, the Bank confirmed whether progress had been made in crisis measures against pandemics in each payment and settlement system. When the Great East Japan Earthquake struck on March 11, 2011, the Bank sought continuously to confirm the stable functioning of payment and settlement systems and, as necessary, implemented measures such as the extension of BOJ-NET Funds Transfer System (BOJ-NET) operating hours. At the same time, the Bank disseminated information, both at home and abroad, clarifying that Japan's core payment and settlement systems had continued to operate without interruption.

The Bank sought to ensure that the comprehensive review of international standards for payment and settlement systems and the review of the Basel Capital Accord on banks' exposures to CCPs would be appropriate, participating in international working groups on these issues. On the process of international rule-making, the Bank has been exchanging views with operators and participants of private sector payment and settlement systems, and has been providing its views and proposals within the relevant working groups in light of the current status of Japan's payment and settlement systems and financial markets. It has also been participating in discussions, both at home and abroad, on the introduction of CCPs in over-the-counter (OTC) derivative settlements.

II. Basic Framework for Risk Management

Improvements in risk management have assumed greater importance since the outbreak of the global financial crisis. This chapter outlines the basic framework for risk management with a focus on CCPs, and introduces the risk management characteristics of Japan's CCPs.

A CCP interposes itself between trade counterparties in financial contracts agreed between them, assumes their original obligations, and guarantees the settlements of such obligations as the sole counterparty to both the seller and the buyer.[2] In providing these functions, CCPs are exposed to credit and liquidity risks that may arise in the event of a CCP participant's default. They also face operational risk resulting from human error,

[2] The basic functions of a CCP are, by assuming the original obligations, to (1) net down a large number of obligations into a smaller number of obligations (multilateral netting), and (2) guarantee the settlement of such obligations.

system deficiencies, and disruptions from external events such as natural disasters.

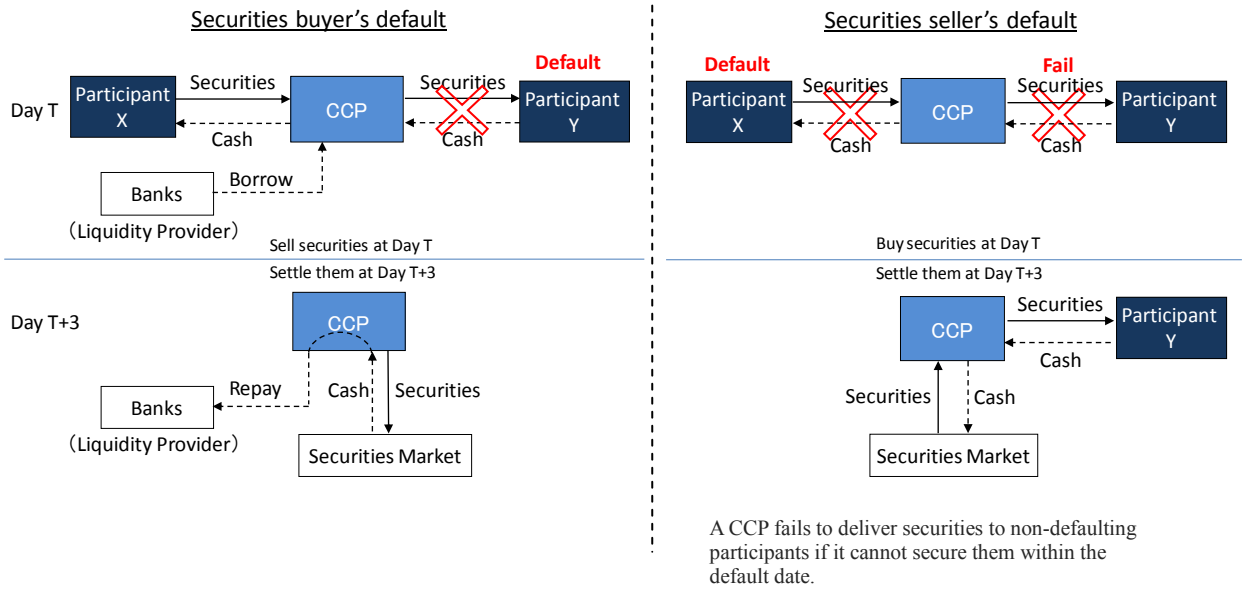
In general, credit risk associated with the settlement of transactions may be classified into principal risk and risk concerning replacement/liquidation costs. Principal risk refers to the risk that the seller of a financial asset will deliver but not receive payment, or that the buyer will pay but not receive delivery. The delivery-versus-payment (DVP) mechanism for securities settlement and the payment-versus-payment (PVP) mechanism for foreign exchange settlement have been designed to avoid such risk.[3] DVP and PVP have already been implemented in the settlement of core financial market transactions in Japan, including those for Japanese government securities, stocks, corporate bonds, CP, and foreign exchange trades. The following therefore focuses on risk associated with replacement/liquidation costs to which CCPs are exposed.

Chart 1 shows the mechanics of how a CCP bears credit and liquidity risks for securities settlement in the event of a participant's default. When the buyer of securities, Y, defaults, the CCP is exposed to liquidity risk because it must fund the cash equivalent to fulfill its payment obligation to the seller of securities, X. The securities the CCP had initially planned to deliver to Y but which remained at hand are sold and used to repay the funds. The value of the securities, which is obviously identical to the amount to be paid to X at the time the trade was executed, may change over time due to fluctuations in market prices after the CCP's assumption of the payment obligation, exposing the CCP to potential losses from the gap between the original price and the replacement/liquidation price. In this way, a CCP faces credit risk arising from both a participant's default and fluctuations in market prices.[4]

[3] DVP eliminates the principal risk associated with settlement of a securities transaction by ensuring that a delivery of securities occurs if, and only if, payment takes place. PVP eliminates the principal risk associated with settlement of a foreign exchange transaction by ensuring that a transfer of one currency occurs if, and only if, a transfer of the counterpart currency takes place.

[4] Credit risk borne by a CCP results in losses reflecting the market risk associated with the replacement/liquidation of unsettled positions of the defaulting participant. Because new international standards define such market risk as part of credit risk, the same definition is applied in this report.

Chart 1　CCP Procedure on a Participant's Default



A.　Participation Requirements and Monitoring[5]

In order for payment and settlement systems to reduce credit and liquidity risks arising from a participant's default and operational risk resulting from human error and system deficiencies, they need to limit participants to those with low credit and operational risks. Thus, all CCPs in Japan require participants to be in an adequate financial condition and to have robust operational capacity.

In addition, CCPs have procedures in place to monitor (1) the extent to which participation requirements are met on an ongoing basis; and (2) the amount of obligation assumed from each participants. Where necessary, CCPs also put in place additional risk management measures on participant qualifications. Based on the results of analysis derived from monitoring, CCPs in Japan take steps against participants by holding interviews, imposing additional margin requirements, and calling for a reduction in accumulated positions (Table 1).

As described above, the fundamental points that should be checked in assessing the risk management capabilities of payment and settlement systems are the appropriateness of participation requirements, along with the appropriateness of procedures for monitoring

[5] Participation requirements and monitoring are not only applicable to participants of CCPs, but also to those of payment and settlement systems in general.

participants and addressing monitoring outcomes.

Table 1 Monitoring and Actions

Monitoring		Actions
Financial condition Compliance with CCP rules Reliability of settlement execution Operational capacity	⇒	Increase in margin, Suspension of assumption of obligations, Disqualification from participation, Requirement to improve financial condition
Positions (if excessively large, actions are triggered)	⇒	Increase in margin, Advice/Instructions to reduce positions, Suspension of assumption of obligations, Disqualification from participation
Corporate governance	⇒	Requirement to make improvements, Suspension of assumption of obligations

Note: Objectives of monitoring and actions taken by CCPs vary among CCPs.

B. Framework for Managing Risks

1. Credit Risk

Credit risk materializes when a participant defaults and losses arise from the replacement/liquidation of the defaulter's positions. CCPs attempt to mitigate credit risk in two stages. First, they attempt to contain the risk of incurring losses in advance by collecting variation margin. Second, they ensure they maintain sufficient financial resources to cover losses. A key component of financial resources is initial margin, which covers potential future losses resulting from the replacement/liquidation of a defaulter's positions.

a. Containing Current Exposures through Variation Margin

From the date settlement obligations are assumed until the date of settlement, CCPs face exposures to participants. The scale of exposures changes continuously as a result of fluctuations in market prices. CCPs mark participants' positions to market, collect variation margin, and reset CCPs' current exposures to zero on a daily basis, thereby limiting the accumulation of current exposures.[6]

[6] When the value of a position/obligation of a CCP to a participant is identified as "positive" as a result of marking to market, the CCP has a current exposure to the participant. The total amount of variation margin paid/received against all participants is equal to zero. Some CCPs collect/return variation margin and initial margin (discussed below) together, while others do so separately.

CCPs in Japan mark their positions to market once a day and require variation margin to be paid and received on the following day. For cases of large price fluctuations during a day, many CCPs have the authority to make intraday variation margin calls within that day.

Table 2 Variation Margin Systems

	Exposed period	Frequency, Marked price	Intraday margin call / Trigger event
Japan Securities Clearing Corporation (JSCC)	Equity: During T+3 settlement cycle Derivatives: until settlement date after maturity[1]	Daily, Exchange closing price	Equity: Not introduced (planned) Derivatives: Introduced/Price changes from closing on the previous business day to closing in the morning session
Japan Government Bond Clearing Corporation (JGBCC)	Outright: During T+3 settlement cycle Repo: until settlement date of end-transaction	Daily, Effective price on OTC markets	Introduced[2]/Price changes from closing on the previous business day to closing in the morning session for JGB Futures
Osaka Securities Exchange (OSE)	Derivatives: until settlement date after maturity[1]	Daily, Clearing price	Introduced[3]/Changes in clearing price from the previous business day to 11:00
Tokyo Financial Exchange (TFX)	Derivatives: until settlement date after maturity[1]	Daily, Clearing price	Introduced[3]/Changes in clearing price from the previous business day to 11:25

Note: 1. As for derivative products, CCP exposures are offset by participants' crossed trades prior to maturity dates.
2. JGBCC has introduced intraday calls for initial margin, but not for variation margin.
3. FX margin contracts and other retail products on the OSE and the TFX do not have intraday margin calls. Cash securities traded on OSE are cleared by JSCC (see section III D and G). Clearing service of exchange derivatives in OSE and TFX are internalized in those exchanges.

b. Maintaining Sufficient Financial Resources to Cover Potential Losses

The range of financial resources that CCPs hold to cover losses arising from a participant's default includes:

- Initial margin posted by the defaulting participant;
- Retained earnings and other reserve funds held by CCPs;[7]
- Pre-funded default arrangements, such as default funds deposited *ex ante* by all CCP participants[8] or *ex post* funding among surviving (non-defaulting) participants based on a loss-sharing arrangement.

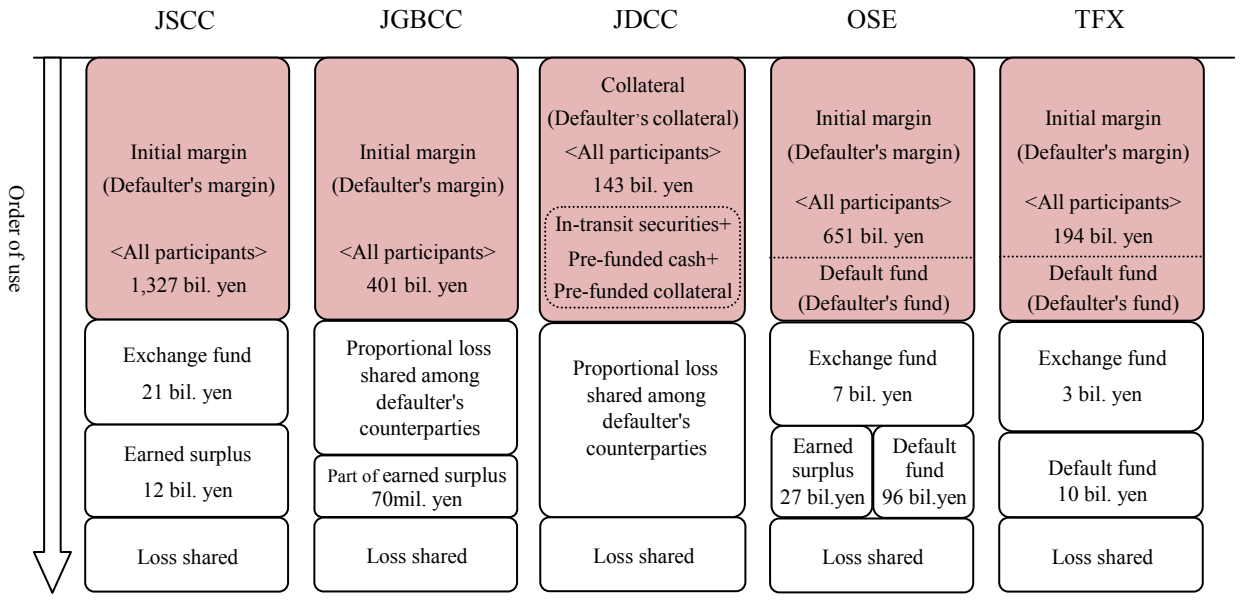
[7] Including insurance benefits, parent companies' guarantees, or default compensation reserve funds accumulated by exchange participants (exchange funds).

[8] Such arrangements have various names, for example, clearing deposits, clearing funds, and guaranty funds. In some CCPs, initial margin is also called clearing funds, which may cause confusion among initial margin and default funds.

Chart 2 presents the order in which financial resources are used to cover losses, namely, the waterfall structure of financial resources, for CCPs in Japan. Although the variety, relative size and sequence of the use of financial resources differ significantly, CCPs primarily use the pre-funded resources provided by the defaulting participant. Where there are residual losses, CCPs proceed into using their reserve funds, other pre-funded default arrangements or loss-sharing arrangements among surviving participants.

CCPs' arrangements for covering losses are designed by taking into account the targeted coverage level, incentives for preventing moral hazard,[9] and the CCP's governance structure such as its ownership. Therefore, while the international standard provides the minimum requirement (see page 13 for details), there is no single answer to the question of what is the most desirable design.

Chart 2 Waterfall Structure of Financial Resources



Note: Names of initial margin and default fund vary among CCPs. This report uses general terms instead of specific names. Shaded resources correspond to defaulter's pay. Defaulter's contributions to pre-funded resources are first used to cover realized losses on default. Figures are as of March 2010, other than that for the JSCC exchange fund which is as of August 2010. OSE and TFX resources include those for FX margin contracts and other retail products. The figure for JDCC collateral does not include in-transit securities used as collateral in the process of DVP (model 2). JGBCC and JDCC have two stages of loss-sharing arrangements. In the first one, only the defaulter's counterparties have an obligation to cover the remaining loss. The second and final backstop for loss sharing in these CCPs comes into play only where the defaulter's counterparties cannot fulfill their obligations in the first stage.

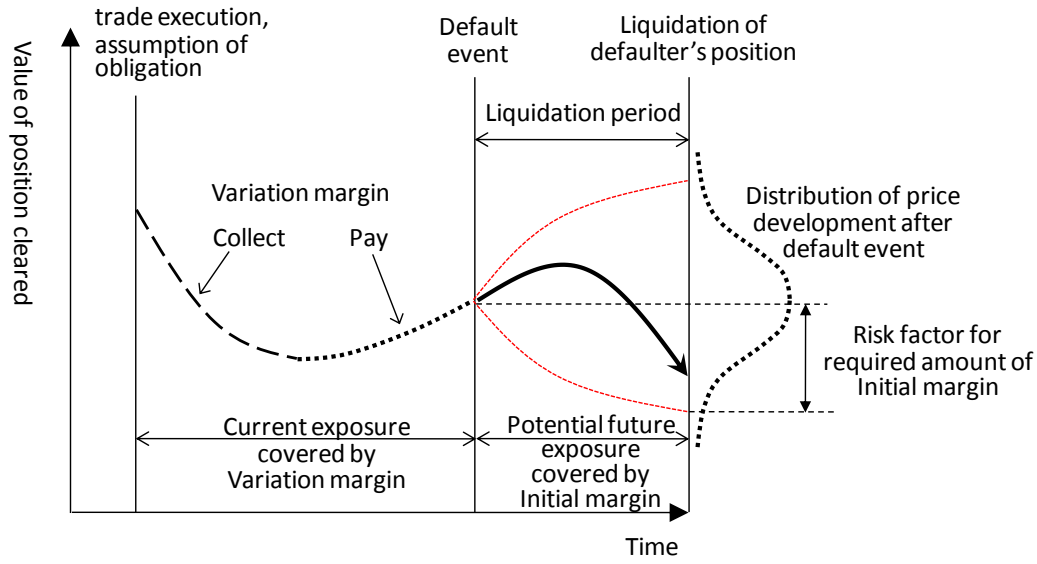
[9] One drawback of mutualized financial resources is that it may cause participants to take on excessive risk because the responsibility of a defaulting participant to pay for losses stemming from its default is limited to the amount of the defaulter's contribution to pooled financial resources plus its initial margin.

(1) Initial Margin

In the process of replacing/liquidating a defaulting participant's positions, CCPs face the risk of loss from market price fluctuations.[10] CCPs therefore collect *ex ante* initial margin in proportion to the outstanding net value of a participant's unsettled positions.

Variation margin, as explained above, is a risk management tool for current exposures arising from price changes realized after the trade and the assumption of settlement obligations. In contrast, initial margin is a tool for protecting a CCP against potential losses arising from future price changes during the replacement/liquidation period, that is, between the last mark-to-market calculation for a variation margin call and completion of replacement/liquidation of the defaulting participant's positions (Chart 3).

Chart 3 Roles of Variation and Initial Margin



Note: The chart illustrates the development of variation margin and the determinants of initial margin for a securities buyer. A fall in the security price after the trade contract/assumption of obligations results in a buyer's valuation loss (CCP's valuation gain) and therefore the CCP's exposure to the buyer. The CCP requires the buyer to provide variation margin in order to cover the realized exposure (current exposure). The CCP also requires the buyer (and the seller) to post initial margin at the time it assumes settlement obligations in order to cover the market risk after the event of the buyer's (the seller's) default, that is, the potential future exposure. In a strict sense, the risk includes price changes after the last mark-to-market for variation margin rather than after the default event. The chart assumes that the assumption of settlement obligations coincides with the trade contract, but this is not always the case, and depends on the CCP's institutional design.

[10] In other words, variation margin mitigates current exposure, and initial margin covers potential future exposure in the event that a participant defaults.

When calculating initial margin requirements, a CCP generally estimates distributions in future price movements following a participant's default (to be exact, following the last mark-to-market valuation), taking into account the liquidation period and historical price movements. The applicable international standard mandates that at a minimum, an initial margin requirement should be set to cover the 99 percent confidence level of the loss distribution stemming from replacement/liquidation.[11]

CCPs in Japan tend to calculate the required initial margin using the historical method,[12] under which the 99 percent confidence level of the price change distribution is typically calculated (Table 3). Generally, however, while this method is simple and easy to deal with in terms of estimation, it has a potential weakness with respect to its degree of accuracy and stability in measuring risk with a degree of confidence as high as 99 percent. Bearing these points in mind, it is worthwhile verifying models used for initial margin requirements.

In the process of calculating initial margin, the setting of an appropriate liquidation period is vital, as the CCP will be subject to market risk from the time of last mark-to-market valuations until completion of liquidation. In setting such a period, a CCP must take into account the adequacy of the following, particularly under stressed market conditions under which a participant defaults: (1) its capability to execute trades for replacement/liquidation and the necessary arrangements for the execution; (2) the market liquidity of the cleared assets/products; and (3) the frequency of mark-to-market valuations and the collection of variation margin.[13] Based on (1) and (2) above, it is also worth considering ways to reflect market impact in the estimation of potential losses.

---

[11] Even if margin requirements are set to cover less than the 99 percent confidence level of the distribution of future price changes in the initial margin calculation process, margin requirements should be capable of containing sufficient risk, that is, of covering risk beyond the 99% level of the loss distribution, as long as other assumptions used to calculate the requirements are designed conservatively.

[12] In addition to the historical method whereby the confidence level of the price changes is calculated based on the histogram of actual price changes in the past, various other methods have been adopted by overseas CCPs in calculating initial margin. For example, these include a method whereby the standard deviation of past price changes is multiplied by a given scale; a method whereby the expected volatility measured by a GARCH model is multiplied by a given scale; a method whereby the tail distribution is estimated by using extreme value theory (EVT); a method using a high confidence level for a synthetic (composite) normal distribution; and a method using an expected shortfall (ES) instead of VaR.

[13] For CCPs in Japan, variation margin is collected on the day following a mark-to-market valuation. Thus, there are cases where such a time lag between the two dates is accounted for when calculating initial margin requirements.

Table 3 Initial Margin Systems

	Model	Sample period	Liquidation period	Netting	Other properties
JSCC	Equity: Historical VaR Derivatives: SPAN with historical VaR [1]	120 business days	1 day	Equity: Full netting of long/short (worse case between net long and net short[1]) Derivatives: SPAN (partial netting among inter-month and inter-commodity positions[1])	Equity: monthly floor to cover fluctuations in daily requirements and reduce margin delivery workload Derivatives: Additional charge for market risk stemming from delivery lag in initial and variation margins
JGBCC	Historical VaR	120 business days	1 day	Partial netting across/within close maturity brackets	Downward rigidity after past peak value and additional charge for risk of failure in variation margin delivery
OSE[2]	SPAN with VIX and historical VaR [1]	Higher of 4 week or 24 week historical VaRs	1 day	SPAN (partial netting among inter-month and inter-commodity positions[1])	Short and long sample periods to cover shortcoming of historical VaR VIX introduced for some products to cover shortcoming of VaR
TFX[2]	SPAN with historical VaR [1]	6 months	1 day	SPAN (partial netting among inter-month and inter-commodity positions[1])	Special charge for delivery lag due to holiday gap in clearing of the same product listed on an overseas exchange

Note: 1. SPAN is a margin model for exchange derivatives developed by the Chicago Mercantile Exchange. The model estimates the maximum loss for the required amount of initial margin using combinations of scenarios on both underlying asset prices and their volatility. User CCPs make their choice of any method to set upper and lower limits for both price and volatility scenarios namely scan range; one method typically used for the price scan rage is historical VaR. SPAN also provides many options in setting portfolio netting among both inter-month products (intra-commodity) and inter-commodity. If the prices of different products have perfect positive correlations, in principle, the CCP may net out all long and short positions across products. JGBCC applies a portfolio margining method; first, fully offsetting risk amounts of securities within the same maturity brackets, and second charging additional risk amounts according to price correlations. While the same method is applied for the portfolio margining across the close maturity brackets, it is only applicable in the case that high correlations over thresholds are observed.

2. The table does not cover FX margin contracts or other retail products on the OSE and the TFX.

In addition, regarding (1) and (3) above, CCPs can mitigate losses by increasing the frequency of mark-to-market valuations and improving their execution ability, which will shorten the liquidation period and reduce the market impact in liquidating positions.[14] For example, CCPs in general may place small orders to minimize the market impact and hedge with highly liquid derivatives to avoid market risk before liquidation procedures begin. Having in place robust procedures to liquidate positions in a quick and efficient manner is

[14] To liquidate a defaulting participant's open positions, a CCP typically uses tender by non-defaulting participants or appoints participants with a strong trading capabilities to execute trades on its behalf.

also important in mitigating losses. Relevant arrangements such as rules and guidelines for the liquidation, IT systems to support it, and testing for proficiency should therefore prove to be effective.

A CCP backtests its initial margin models against identified targets to validate its assumptions and models. When backtesting finds that a model does not perform appropriately, the margin methodology will be reviewed.

When market prices move significantly during the day, future price volatility also tends to increase. For this reason, CCPs have the authority to collect additional initial margin within the same day as well as variation margin (Table 2).

Box 1: Use of Collateral in CCPs

Among the financial resources posted by defaulting participants *ex ante*, there are cases where collateral is pledged instead of initial margin. For example, when delivery from one counterparty to another is "one way", CCPs interposing themselves between the two counterparties will use collateral to cover losses resulting from a payer's default.

The Zengin-Net, which operates an interbank clearing system for domestic funds transfers in Japan, guarantees the settlement of financial institutions' payment obligations. When a payer defaults, the Zengin-Net will obtain the necessary liquidity from banks assigned as "liquidity provider banks" and make payments to the payee to complete settlement within the same day. In the meantime, the Zengin-Net sells the collateral pledged *ex ante* by the defaulting participant in the market in order to repay liquidity provider banks using the funds received a few days after the date of sale.

Conversely, securities transactions involve "two-way" delivery, that is, the buyer of securities transfers funds and the seller delivers securities in return. By linking securities transfers to funds transfers in a way that achieves DVP, CCPs for securities settlement minimize principal risk.

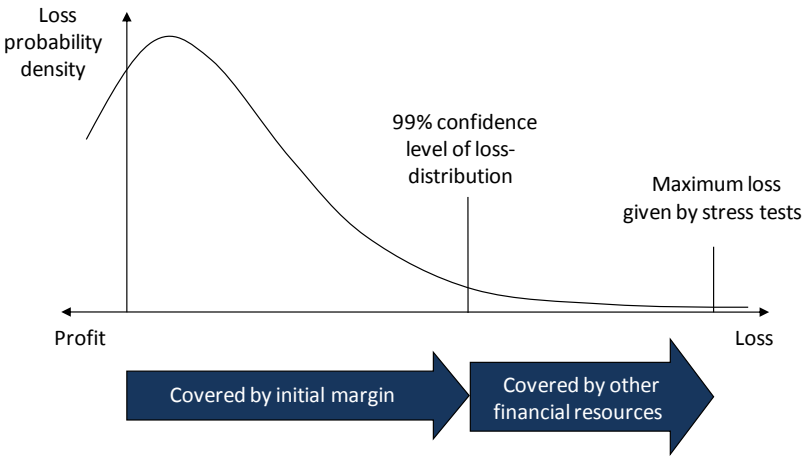
By eliminating *ex ante* the principal risk associated with credit exposures, CCPs limit the risk of losses from participants' defaults to market risk exposures arising from movements in collateral prices and changes in the value of credit obligations.

(2) Default Funds and Loss-Sharing Arrangements

The current international standard requires every CCP to maintain sufficient financial resources to withstand various stress scenarios such as "a default by the participant to which it has the largest exposure in extreme but plausible market conditions." The consultative report on the new standard prepared by the Committee on Payment and Settlement Systems (CPSS) and the Technical Committee of the International Organization of Securities Commissions (IOSCO) addresses the necessity and adequacy of setting more severe stress scenarios and seeks comments on these issues.

The amount of the potential loss calculated on the basis of a stress scenario is the amount of financial resources every CCP should maintain. Any excess loss beyond the defaulting participant's margin and its contribution to default funds is covered by other financial resources such as reserve funds held by the CCP, pre-funded default arrangements such as default funds deposited by all participants, and loss-sharing arrangements among surviving participants (Chart 4). Margin posted by defaulting participants covers losses caused by their own default, but default funds and loss-sharing arrangements require surviving participants to cover remaining losses as well. Default funds are deposited *ex ante* by all participants. In contrast, loss-sharing arrangements are allocated and paid *ex post* by surviving participants in accordance with loss-sharing rules determined *ex ante*. Such arrangements are adopted by all CCPs in Japan and some CCPs in the United States. In Japan, there are also CCPs with a waterfall structure in which both default funds and loss-sharing arrangements are adopted (Chart 2).

Chart 4 Coverage of Loss Distribution



Note: The chart assumes the peak of the loss distribution shifts to the right because price developments in the liquidation of a defaulter's position tend to move adversely and asymmetrically for a CCP due to potential market impacts.

If default funds are used up in covering the loss and no other financial resources remain, the CCP will be insolvent, posing the risk of systemic consequences. Therefore, for CCPs to be able to maintain their clearing function even when their financial resources have run out, it is essential to prepare schemes for loss-sharing arrangements to allocate realized losses to relevant entities (see Box 2).

Current international standards state that stress tests to examine the adequacy of resources should be performed monthly or more frequently. In addition, they state that comprehensive stress tests involving the reconsideration of appropriate stress scenarios should be conducted at least annually. They also state that a CCP should have a clear policy on the actions it would take when stress tests indicate that its financial resources are not likely to be adequate.

Box 2: Loss-Sharing Arrangements

The value of losses exceeding pre-funded financial resources does not change, regardless of whether or not the CCP has adopted loss-sharing arrangements. Meanwhile, when such arrangements are in place, participants may no longer effectively limit their losses by themselves. Some market participants question the deficiencies of such arrangements.

It must be noted, however, that once a CCP defaults, scheduled settlements will not be executed; in addition, shocks caused by the default could spread to the overall financial system, as market transactions will be significantly constrained due to settlement disruptions. In such an event, CCP participants themselves would be severely affected by the adverse effects of the default. Thus, in discussing loss-sharing arrangements, possible secondary losses associated with the spread of systemic risk should also be considered.

Based on the above discussion, the vital points to be considered in assessing the adequacy of credit risk management in payment and settlement systems are (1) the variation margin system, especially the frequency with which positions are marked to market for margin calls and margin payment arrangements; (2) the initial margin model in terms of correlation, sample period, degree of confidence level, and the liquidation period; arrangements for performing backtesting to validate the model; and the ability to replace/liquidate a defaulter's positions; and (3) stress tests to evaluate the adequacy of financial resources such as default funds in terms of their frequency and appropriate choice of stress scenarios.

2. Liquidity Risk

Just like credit risk, liquidity risk at a CCP materializes in the event of a participant's default. When a participant defaults, the CCP makes payment by raising the amount of funds the defaulting participant was scheduled to pay. The CCP is also required to address daily demand for funds for variation margin payments on behalf of the defaulting participant until its positions are liquidated completely.

Generally, payment for cash securities tends to require greater liquidity funding in the event of default by a participant, which requires the amount equivalent to the principal, than for that required for derivatives, which does not involve principal payments. In addition, the amount tends to be greater when payments are netted per security issue, compared with when they are netted across securities. Table 4 lists CCPs in Japan with a focus on payment type and the use of netting in their clearing services. CCPs generally need to continue funding until the defaulting participant's positions are liquidated and settled. The length of the period necessary for liquidation depends on, for example, the settlement cycle, market liquidity of the securities and the ability of the CCP to liquidate positions effectively.

Table 4 Objects of Payments and Scope of Netting

	Principal, Margin, Net settlement	Scope of netting	
		Payment	Settlement
JSCC	Equity: Principal (DVP model 3)	Across issues	Issue by issue
	Derivatives: Margin, Net settlement to close out positions	Across products	—
JGBCC	Principal (DVP model 1)	Issue by issue	Issue by issue
JDCC	Principal (DVP model 2)	Across issues	Gross settlement without netting
OSE	Margin, Net settlement to close out positions	Across products	—
TFX	Margin, Net settlement to close out positions	Across products	—

To accommodate liquidity risk, a CCP needs to have means of securing the necessary funds, which may include the following: (1) cash owned by the CCP; (2) cash composed of funds posted by participants such as initial margin; (3) loans from banks; and (4) funding through repo agreements. It is vital that the CCP be able to secure funds in a timely manner, particularly in the case of a contingent event of default by a participant. Therefore,

it is necessary to examine whether cash is readily available, and whether the bank loans and collateralized funding arrangements are highly effective and reliable.

As in the case of estimating the amount of liquidity funding needed, the current international standard requires a CCP to estimate the amount of funds it should be able to raise based on the stress scenario of a default by the participant to which the CCP has the largest exposure. In the consultative report on application of the new standard prepared by the CPSS and the Technical Committee of the IOSCO, they discuss the suitability of raising stress scenario levels and seek comments accordingly.

Based on the above discussion, the vital points to be considered in assessing liquidity risk management in payment and settlement systems are ensuring the availability of liquidity sources for reliable and immediate funding and adequate stress testing to evaluate the amount of liquidity that needs to be raised.

3. Operational Risk[15]

Operational risk at CCPs is inherent in various aspects of their business operations and includes, among others, human error, fraudulent activities by staff, deficiencies in IT systems, information leakage, and difficulties in business continuity due, for example, to natural disasters. This section outlines, in particular, the importance of risk management in the development and operation of IT systems and the importance of enhancing business continuity arrangements.

Business operations at CCPs are generally highly automated because financial instruments and transactions they handle, as well as methods of payment and settlement, are standardized, and because they must process settlements for a large volume of transactions in a timely manner with precision. Consequently, CCPs are highly dependent on IT systems. In addition, every CCP executes business operations by interactively linking and synchronizing its IT systems with those of many participants and other payment and settlement systems. It is therefore important that CCPs enhance the robustness of their IT systems and their capabilities in the event of system deficiencies.

Highly automated business operations at CCPs require only a small number of staff, but it is vital that they be highly skilled and trained to enable them to develop and manage highly specialized IT systems effectively, and to properly manage business outsourced to vendors.

---

[15] Operational risk is relevant not only to CCPs, but also to payment and settlement systems in general.

For the steady development, maintenance, and management of IT systems at CCPs, it is therefore essential to have a risk management framework in which CCP management is fully involved.

Enhancing business continuity arrangements is also a critical challenge for CCPs, because there is a risk of market-wide instability if a CCP fails to maintain its operations. In developing business continuity arrangements, CCPs should consider various scenarios, including natural disasters such as earthquakes and outbreaks of pandemics, technical disasters such as IT system failures, and man-made disasters such as terrorist attacks.

Concrete measures to ensure business continuity include duplicate arrangements for IT systems, network lines and data storage; establishing backup centers and offices as operational sites; developing emergency procedures to secure staff; cross-training staff to perform multiple roles and to serve as backups for each other; enhancing decision-making processes and communication channels; and conducting various forms of contingency testing.

To that end, the vital points to be taken into account in assessing operational risk management in payment and settlement systems are the adequacy of (1) the governance of IT system development and operations, and frameworks for project management and the administration of vendors; and (2) business continuity management.

III. Recent Initiatives Taken by Private Sector Payment and Settlement Systems to Strengthen Risk Management

An important challenge for payment and settlement systems operated by the private sector is to establish and develop risk management frameworks and to ensure the safety of their systems. The risk management frameworks outlined in the previous chapter are examples of approaches taken to this end. However, there is no uniform approach which all systems should take. This is because the type of clearing and settlement services provided and the types of financial products handled by each system varies, which makes each system exposed to risks unique to each service/product. It is necessary to identify these risks and develop risk management procedures tailored to each of them.

Various risk control mechanisms incorporated into private sector payment and settlement systems in Japan proved to be effective when LBJ collapsed, preventing global financial

shocks from spreading throughout Japan's financial system and becoming amplified. For example, preventing principal risk from materializing in the settlement of funds and securities through the PVP and DVP mechanisms and CCPs' management of credit and liquidity risks contributed greatly to the smooth processing of payment and settlement during this period. On the other hand, some challenges for the future were identified, as one CCP faced a high level of funding needs and repo transactions in the JGB market decreased due to the significant level of settlement fails. These challenges include improving CCPs' capabilities to provide reliable and timely funding and to liquidate a defaulting participant's positions. Another important challenge is to examine the adequacy of the arrangement for covering losses by, for example, conducting backtesting and stress testing.

Ensuring the robustness of IT systems is important in relation to operational risk management, because private sector payment and settlement systems perform a large number of complex business operations using advanced IT. It is particularly important for some private sector payment and settlement systems that face the need to update their core IT systems. In these circumstances, it is necessary to enhance the governance of IT system management with a sufficient level of senior management commitment, to train staff to acquire specialized skills, and to improve project management and the administration of vendors.

In the wake of the Great East Japan Earthquake, payment and settlement systems in Japan functioned effectively as part of the financial infrastructure. It is important that operators of these systems continue their efforts to maintain and strengthen their business continuity management. Based on lessons drawn from the experience of the earthquake and system failures in recent years, it is particularly important that new arrangements include various alternative procedures to maintain functions, frameworks for decision-making and communication, and various testing and exercises for a wide range of events, and to enhance IT system capabilities to cope with a potential surge in the volume of transactions in times of disaster.

In the following sections, major payment and settlement systems operated by the private sector are introduced, each with their major risk management measures and initiatives. (See Chart A at the end of the report illustrating the structure of major payment and settlement systems in Japan.) Through its oversight of these systems, the Bank shares with them its assessment of their current status, and has been exchanging views with them on further improvements.

A. Japanese Banks' Payment Clearing Network: Zengin-Net

The Zengin-Net was established by the Tokyo Bankers Association (TBA) and the Japanese Bankers Association (JBA) in April 2010. It started operations in October 2010 as a licensed interbank payment clearing institution based on the Payment Services Act. The Zengin-Net operates the Domestic Funds Transfer System it inherited from the TBA. In fiscal 2010, the average daily value of payments processed by the Zengin-Net was 10.2 trillion yen, and the average daily value of payments settled after netting out all participants' positions was 2.1 trillion yen.[16] Both values have generally been above the levels observed in the previous year, reflecting the moderate recovery of Japan's economy (Charts 5 and 6).

Chart 5 Value of Payments Processed

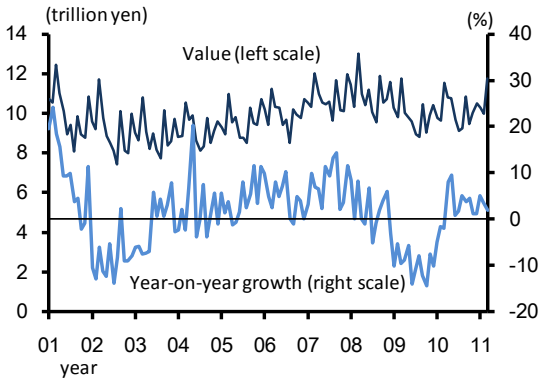
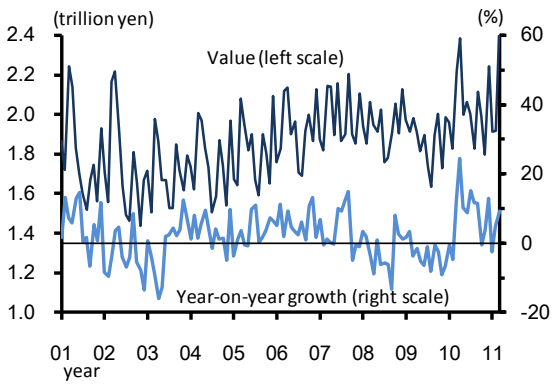


Chart 6 Value of Payments Settled



Note: Average daily values during a month.
Source: Bank of Japan.

The Domestic Funds Transfer System is an interbank clearing system for domestic retail payments that transmits transfer requests and nets out the accompanying interbank payments. A sender's transfer request to its bank, X, to credit the receiver's account in another bank, Y, is transmitted from the sender's bank X to the receiver's bank Y. Bank X undertakes the payment obligation to bank Y, which credits its money transfer to the receiver's account on behalf of bank X. Interbank payments from X to Y are cleared through the Zengin-Net. It assumes payment obligations from clearing participant financial institutions throughout the day of settlement, and these obligations are then netted out at the time of settlement -- which is normally 16:15 -- by offsetting the value of existing

[16] The value of payments settled is the sum of the value paid by sending banks to the Zengin-Net and the value paid to receiving banks from the Zengin-Net. The total value of obligations is reduced by 90 percent because of netting.

credits and debits between participants. Each participant's net position is settled using current accounts at the Bank held by the Zengin-Net and its participants.[17]

The Zengin-Net sets a net debit cap for each participant -- that is, an upper limit on the net position (the amount by which debits exceed credits), i.e., an exposure of the Zengin-Net to a net sender (a net debtor) -- and does not assume debt obligations beyond the cap. Meanwhile, the Zengin-Net mandates that each participant submit, *ex ante*, collateral whose value covers the full amount of their cap (see Box 1). The Zengin-Net has liquidity funding contracts in place as a liquidity risk management measure taken against participants' potential inability to pay or delay in payment. The funding contracts guarantee that the Zengin-Net can obtain bank loans covering the sum of the two largest net debit caps of its participants.

With the implementation of Phase 2 of the Bank's Next-Generation Real-Time Gross Settlement (RTGS-XG) project in November 2011, large-value retail payments that is equal to or more than 100 million yen are no longer cleared by the Zengin-Net and settled on a deferred net settlement (DNS) basis, and have been settled by the BOJ-NET on an RTGS basis with its liquidity saving features. With this change, the settlement of large-value retail payments became final during the course of the day, resulting in a reduction in intraday settlement exposures. These changes have enhanced safety of settlement of large-value payments. After analyzing settlement activity following the shifting of large-value retail payments to the RTGS, the Zengin-Net will review its risk control mechanisms, such as the net debit cap framework and liquidity funding contracts, to determine whether these arrangements should be revised.

The Zengin Data Telecommunications System (Zengin System) is the core computer processing system of the Domestic Funds Transfer System operated by the Zengin-Net. It was upgraded in November 2011, simultaneously with the implementation of Phase 2 of the RTGS-XG project. In order to support internationally accepted standards, the next-generation Zengin System introduced XML formats in accordance with ISO 20022, the universal financial industry message scheme of the International Organization for Standardization, and other versatile standards and technologies. The flexibility of the system was enhanced at the same time. Moreover, in order to reduce settlement risk, the next-generation Zengin System implemented modifications for the implementation of Phase 2 of the RTGS-XG project and strengthened its business continuity arrangements.

[17] The DNS system carries the risk that unsettled positions will accumulate until the net obligations are settled.

The Zengin System processed approximately 5.65 million domestic retail credit transfers per business day in fiscal 2010, including salary and pension benefit payments. Because the average daily volume of transactions processed and settled amounts to trillions of yen, as explained earlier, stable functioning of the system is vital. In developing the next-generation Zengin System, the system's risk management was enhanced by using expertise from outside the organization: specifically, external audits of the overall system improved project risk management, and inspections of outside vendor services ensured the quality of the updated system. Comprehensive running tests were carried out for the next-generation Zengin System, and the changeover to the next-generation system was ultimately accomplished smoothly in November 2011.

In the middle of March 2011, a major bank's computer system failed and stopped operating for more than a week. Following the failure, a substantial number of account holders at the bank requested other banks to process their credit transfers, resulting in an increase in the volume of retail credit transfers at these banks in the Zengin System. These banks submitted additional collateral to the system to temporarily raise the net debit cap, and managed to maintain smooth funds settlement operations. Raise of the net debit cap takes place also at normal times, usually at the end of the month when the number and value of settlements increase, and additional collateral necessary to raise the cap is limited to cash.

B. Japan Securities Depository Center: JASDEC

JASDEC operates a book-entry transfer system for settling stocks, corporate and other bonds, CP, investment trusts, and other securities. Together with the BOJ-NET, JASDEC provides DVP settlement services for the following: (1) the transfer, issuance, and redemption of corporate and other bonds and CP; (2) the purchase and redemption of investment trusts; and (3) the issuance and redemption of stocks and bonds with share options.[18] In fiscal 2010, both the value of corporate and other bonds and CP transactions and the value of sales and repurchases of investment trusts were more or less at the same level as the previous year (Charts 7 and 8).

JASDEC is not exposed to credit risk or liquidity risk, even in the event of a participant's default, because it does not assume obligations from its participants. However, it does

[18] Transfers of stock trades are carried out on a DVP basis with two CCPs and settlement banks (see the JSCC and JDCC sections).

bear operational risk. In the system failure experienced on February 4, 2011, part of its gateway system failed and became disconnected from the BOJ-NET. As a result, certain DVP settlements and transactions related to collaterals for the Bank were significantly delayed, for example, those for corporate and other bonds, CP, and investment trusts[19]. JASDEC completed settlement for the day using backup measures such as the BOJ-NET terminal file import/export function for sending and receiving settlement instructions. JASDEC subsequently identified the cause of the system failure and adopted the necessary rectification measures. Moreover, in collaboration with the Bank, JASDEC has been working to step up its framework for responding to system failures by, for example, improving operational procedures and capabilities, as well as strengthening cooperation with participants and relevant institutions in the sharing and dissemination of information.

Chart 7 CP, Corporate and Other Bonds
Value of Transactions Processed

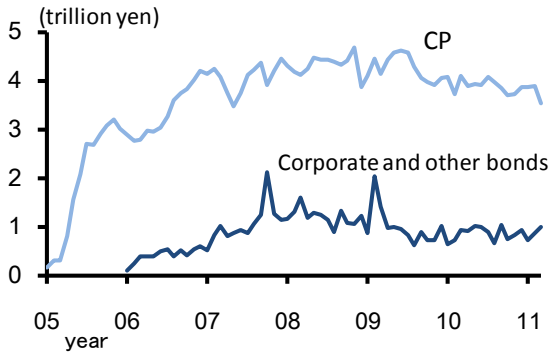
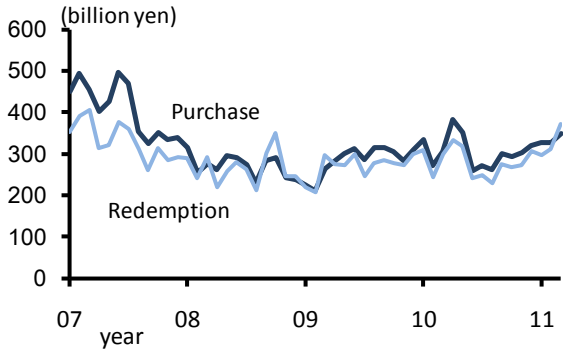


Chart 8 Investment Trusts
Value of Transactions Processed



Note: Average daily value of settlements during a month. While book entry transfers were converted from a paper-based CP system to a dematerialized system in March 2003, the value of new transfers began to increase in 2005 as stamp tax relief on paper-based CP came to an end at the end of March 2005. The chart starts in 2005.
Source: Bank of Japan.

JASDEC has scheduled the next system replacement for January 2014, and it deliberated on functions to be incorporated into the new system during the first half of 2011. The new system aims to improve user convenience and system efficiency by restructuring the host system -- which is used in the book-entry transfer system for stocks -- into an open architecture platform, and by strengthening the foundations of the IT system in accordance with the renewal of equipment. Moreover, JASDEC aims to support internationally

[19] DVP settlement for the issuance and redemption of stocks and bonds with share options was not scheduled on that day.

accepted procedures and lower the cost of cross-border transactions by introducing ISO 20022 into its systems, and enabling connections to SWIFTNet, the network of the Society for Worldwide Interbank Financial Telecommunication.

As part of its effort to improve securities settlement systems, JASDEC has been deliberating with market participants on ways to reduce settlement risk in stock lending transactions. JASDEC has initiated such efforts based on lessons learned from the collapse of LBJ in September 2008, when principal risk materialized in some stock lending transactions that were not settled on a DVP basis. In August 2010, JASDEC established a special committee on stock lending transactions comprising major market participants, and has been discussing a detailed scheme to introduce DVP settlement for such transactions.[20]

C. Japan Government Bond Clearing Corporation: JGBCC

JGBCC provides clearing services for OTC trades in JGBs, i.e., outright trades and repo trades (either in the form of securities lending with cash collateral or sales with repurchase agreements). JGB trading activity has remained low, especially in repo, with the average daily value of settlement obligations accepted and cleared by JGBCC being 36.5 trillion yen in fiscal 2010, more or less the same as the previous year's level, and the average daily value settled after netting being 9.4 trillion yen (Chart 9). JGBCC settlements as a share of overall market transactions[21] have continued to grow, mainly because of an increase in the number of participants, reaching 47 percent in fiscal 2010 (Chart 10).

JGBCC nets out JGB transactions per security issue (Table 4). In fiscal 2010, it reduced the original value of obligations by an average of 74 percent through netting (Chart 9). In order to reduce settlement risk, JGBCC settles netted obligations on an RTGS basis. Clearing value is the largest among Japan's CCPs because the scale of JGB market

[20] In January 2010, the Financial Services Agency (FSA) released a paper entitled "Development of Institutional Frameworks Pertaining to Financial and Capital Markets" and made the following request to related parties: "In order to reduce the settlement risk relating to stock lending transactions, . . . possibly the parties should promptly prepare and publish a roadmap that includes the timing for the mandatory use of CCPs or the development of rules for DVP settlement. (One possible target is for the roadmap to be prepared and published by the end of 2010.)" In response, a roadmap for reducing settlement risk in stock lending transactions was released by JASDEC and related parties in December 2010. Following discussions based on the roadmap, a revised roadmap was released in June 2011.

[21] Overall market transactions here are defined as the sum of (1) JGB DVP settlement transactions that do not take JGBCC as the counterparty, that is, bilateral settlement of market transactions; and (2) the value of settlement obligations accepted by JGBCC (Chart 10). Given that bilateral netting settlement appears to be widespread, however, the value settled through (1) may underestimate the actual value of market transactions. It is therefore possible that the market share of JGBCC is overestimated.

transactions is large, the clearing of cash securities requires principal settlements unlike for derivatives, and the scope of netting is limited to the same issue under the DVP model 1 for RTGS. Accordingly, it is important for JGBCC to carefully examine whether it has secured a sufficient amount of financial resources to cover potential losses and has liquidity funding arrangements in place to cover a high level of demand for liquidity on a participant's default, as well as to further enhance its capacity to liquidate the defaulter's positions.

Chart 9 Transactions Processed and Settled

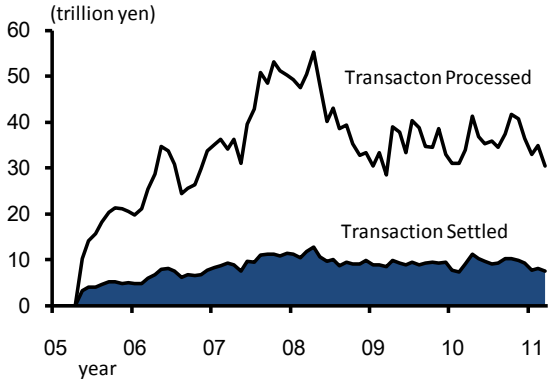
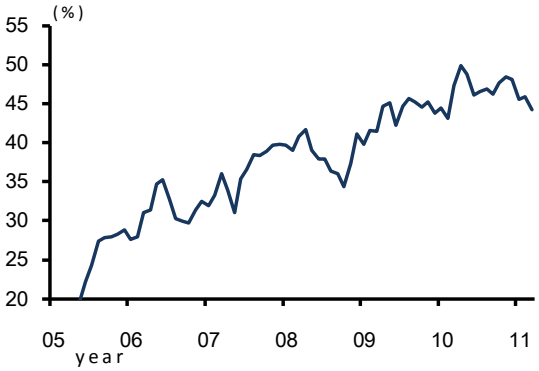


Chart 10 JGBCC's Share of Settlements



Note: Average daily value during a month. See footnote 21 on the calculation of market share of settlements.
Source: Bank of Japan.

Since JGBCC was established by participant banks, securities firms and brokers with evenly allocated shares of capital, most of its executives and staff were initially employees temporarily assigned from the participants. In recent years, an increased proportion of staff has been directly employed by JGBCC itself, thereby improving and stabilizing its operational procedures and capabilities; however, further improvements in both its business and risk management frameworks were judged necessary to meet the challenges described above. Accordingly, in September 2010, JGBCC announced a plan to boost its cooperation with JSCC, which would take 35.6 percent of outstanding JGBCC shares. JGBCC has also been working to further bolster its management and operational structure by taking on executives and staff from the Tokyo Stock Exchange Group.

In fiscal 2009, JGBCC began renewing its core systems for the first time since starting operations in 2005, completing the task in May 2011. It strengthened its project risk management capabilities and improved the quality of its systems, drawing on external expertise such as a third party's objective assessment of the renewal and assistance received from JSCC system experts.

In addition, taking account of lessons learned from the collapse of LBJ in September 2008, JGBCC worked to clarify its rules for handling settlement fails in line with the revision of fails practice in the market in November 2010, and increased the transparency of these rules. It has also held deliberations and consulted with the Trust Companies Association of Japan on expanding the use of clearing functions in JGB transactions with the aim of reducing settlement risk.[22]

D. Japan Securities Clearing Corporation: JSCC

JSCC is a subsidiary of the Tokyo Stock Exchange Group, and provides clearing services for stocks traded on stock exchanges across Japan (including lending transactions), as well as for derivatives traded on the Tokyo Stock Exchange (TSE) such as futures/options on stock indices and JGBs.

JSCC substantially reduces the value of obligations requiring settlement through its stock clearing process. While JSCC carries out securities settlement netting on a product by product basis, the amount of cash payment is netted out across all stocks under DVP model 3 (net settlement of both securities and cash). In fiscal 2010, the average daily value of transaction cleared by JSCC was 1,854 billion yen, and that settled after netting was 119 billion yen. The value of payment obligations was reduced by 94 percent through netting. With stock market activity remaining at a low level, both of these values were generally around the same level as the previous year (Charts 11 and 12).

From March 11, 2011 -- the day of the Great East Japan Earthquake -- until the following week, stock market activity increased sharply, with the trading volume reaching a record high level. JSCC succeeded in providing smooth clearing and settlement services despite the surge in transactions, as it had been enhancing the processing capacity of its clearing system.

[22] In January 2010, the FSA released "Development of Institutional Frameworks Pertaining to Financial and Capital Markets." With the aim of reducing settlement risk for JGB transactions, the FSA pointed to the need to expand the use of CCPs in JGB transactions, and to that end, the desirability of strengthening the structure of JGBCC. In response, the Japan Securities Dealers Association (JSDA), JGBCC, and the Trust Companies Association of Japan jointly released in June 2010 a roadmap that clarified the deadlines for implementing efforts aimed at reducing settlement risk for JGB transactions, and in December 2010 released a revised, detailed roadmap on their efforts.

Chart 11 Clearing: JSCC and JDCC

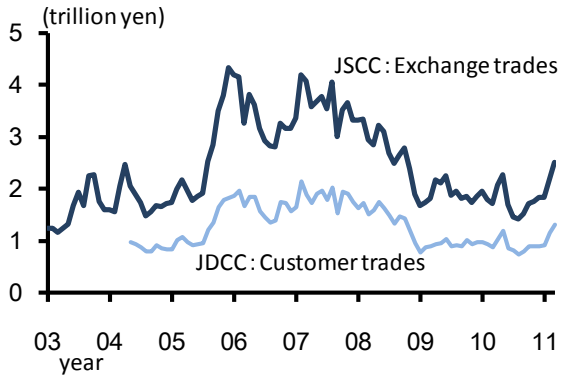
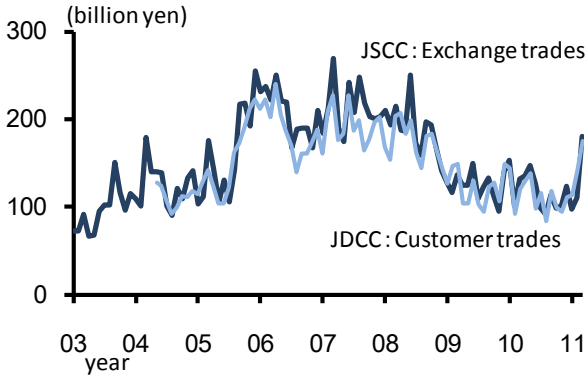


Chart 12 Settlement: JSCC and JDCC



Note: 1. Average daily value by month.
2. JSCC figures show equity and other cash product trades (not including derivative trades).
Source: Bank of Japan

JSCC started OTC derivatives clearing services for index credit default swaps in July 2011.

Given the wide variety of participants, it is important for JSCC to monitor its participants effectively, as well as to develop more refined methods for calculating the amount of margin required and other risk management methods while taking participants' operational workloads into account.

JSCC has been reviewing its risk management framework. In recent years, it has introduced the following measures focused on credit risk management in line with the "Comprehensive Improvement Plan of the Risk Management System" it released in January 2008.

(1) It strengthened procedures for monitoring participants and actions in response to outcomes by, for example, raising the amount of margin required as necessary.

(2) It improved the management of risks associated with collateral securities used as margin, such as by reducing concentration in collateral securities, introducing proportional haircut ratios according to the time remaining to maturity for such securities, and limiting the range of eligible securities by excluding those issued by participants themselves or their affiliate companies.

(3) It reviewed the system for margin requirements (Table 5).

Table 5 JSCC's Review of Margin Systems

Equities	Shortening deposit period	Two days after trade date → Next day
	Review of initial margin model	Price: TOPIX → Individual prices
		Price change used to calculate required margin: The largest decline over the last 60 business days →The second largest decline over the last 120 business days
		Refining method of calculating the amounts of margin required to correctly identify uncollected variation margin and initial margin
Derivatives	SPAN risk parameter	Update quarterly → Every week
	Review of initial margin model	Additional margin charge to protect against risk of JSCC not receiving initial margin in the next day

E. JASDEC DVP Clearing Corporation: JDCC

JDCC, a wholly owned subsidiary of JASDEC, provides clearing services to facilitate DVP settlement of stocks and other securities that are settled by the JASDEC book-entry transfer system but are traded off-exchange. JDCC assumes obligations from its participants on the day of settlement, then settles on a DVP basis with gross settlement for the securities leg and net settlement for the cash leg (DVP model 2). In fiscal 2010, the average daily value of obligations assumed by JDCC was 964 billion yen, and that of payment obligations settled was 118 billion yen. JDCC has reduced the value of payment obligations by 88 percent through the DVP method. With stock market activity remaining at a low level, both of these values were at around the same level as the previous year (Charts 11 and 12).

As a CCP, JDCC assumes obligations based on the following procedures.

(1) Obligations are assumed on the day of settlement;

(2) JDCC assumes securities obligations after confirming that the sender participant (the seller of securities) has secured the necessary amount of the relevant securities;

(3) JDCC assumes payment obligations after confirming that the payer participant (the buyer of securities) has pledged collateral sufficient to cover the amount scheduled to be paid in and that the value does not exceed its net debit cap set *ex ante* by JDCC.

By means of the procedures outlined in (2), JDCC is able to deliver securities to the buyer, even in the event the seller defaults after JDCC has assumed its obligations, and thus is not required to acquire securities from the market. In other words, in terms of this securities settlement arrangement, JDCC is not exposed to the credit risk of the seller.

On the other hand, in the event of the buyer's default, JDCC has to fund cash liquidity to settle the payment obligations. Therefore, in its funds settlement arrangement, JDCC is exposed to credit and liquidity risks. Given the framework described in (1), however, payment obligations assumed by JDCC exist for only several hours on the settlement day and, as set forth in (3), JDCC can manage credit risk by securing collateral before assuming the payment obligation within the value of the collateral. The point of its risk management practice, therefore, is that JDCC applies appropriate haircuts to collateral to mitigate credit risk, taking into account the risk of the value of collateral plunging during the collateral liquidation process. JDCC has been conducting backtests of the adequacy of haircuts since fiscal 2010, releasing their results on a quarterly basis.[23]

To control liquidity risk, JDCC sets a net debit cap on the amount of funds it pays on behalf of each participant by means of (3) above. Specifically, JDCC sets the maximum net debit cap for every participant at 30 billion yen. Given the cap, JDCC has an arrangement in which a total of 60 billion yen of liquidity can be funded through participants' funds deposited *ex ante* as collateral against the credit risk of the seller and commitment line agreements with banks.

Given the framework described in (1), participants bear credit and liquidity risks from their counterparties from the trade date to the settlement date. Consequently, managing counterparty risk is important for participants.

F. Tokyo Financial Exchange: TFX

TFX lists financial derivatives such as short-term interest rate futures/options, FX margin contracts, and equity index margin contracts, and provides clearing services for these instruments.

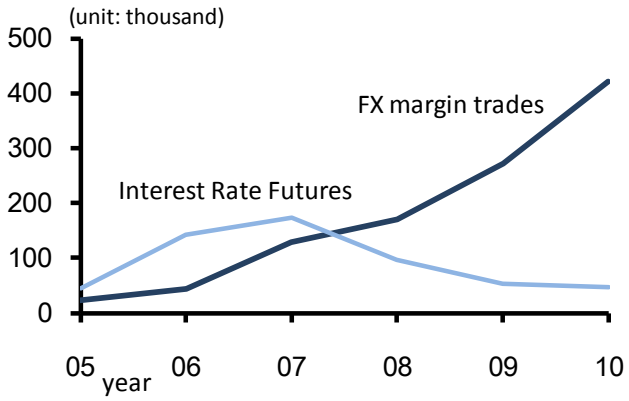
---

[23] Backtesting is carried out for each category of collateral securities subject to different haircuts on each business day, such as stocks, CBs and JGBs. JGBs are classified into different categories according to maturity and bond type. Backtesting assumes two-day price developments from the time of the last mark-to-market preceding the default date to the day following the default, assuming collateral is sold on the day following the default date.

Financial resources to cover potential losses on TFX include a default fund for loss mutualization, initial margin and TFX's own funds (Chart 2). In November 2008, TFX released "Review of Risk Management Methods for Clearing Services", and in line with its plan, had reviewed the methods used for calculating initial margin requirements and the default fund and improved risk management for collateral securities.[24]

FX margin contracts have grown to become one of the major products of TFX, with the volume of trades increasing each year since they were first listed on TFX in July 2005 (Chart 13). While short-term interest rate futures are traded by financial institutions, FX margin contracts are mainly traded by individual investors through participants. Moreover, TFX began offering equity index margin contracts in November 2010, and proceeded with efforts to expand trading among individual investors. Given the wide variety of participants active in such margin contracts, it is important for TFX to monitor them in an appropriate manner.

Chart 13 Trade Volume (unit: trades)



Note: Average daily volume by year.
Source: TFX

[24] (1) Reviews of the method used for calculating the initial margin requirement have resulted in an increase in the frequency with which Standard Portfolio Analysis of Risk (SPAN) risk parameters are updated from quarterly to monthly and an increase in the degree of confidence applied in estimating the price scan range in SPAN from 95 percent to 99 percent (the price scan range is the maximum range of price fluctuations; see the note to Table 3). (2) In reviews of the default fund, the calculation method has shifted from a flat amount system to a *pro rata* system based on the amount of risk borne by the participant, and the frequency of re-calculations has been increased from biannually to monthly. The new system introduced a minimum requirement, and individual risk amounts are measured at the 95 percent confidence level of daily fluctuations in the difference between the amount of margin required for current positions and margin posted to cover previous positions. Daily fluctuations are measured based on a one-year period. (3) Improvements in risk management for collateral securities include implementing credit rating standards for qualifying securities and bond haircuts according to maturity, as well as prohibiting the use of securities issued by participants themselves or their affiliate firms.

G. Osaka Securities Exchange: OSE

OSE lists (1) stocks and other securities; (2) financial derivatives such as equity-based derivatives; and (3) FX margin contracts. While OSE provides clearing services for trades in derivatives and margin contracts, the clearing of stocks and other securities is carried out by JSCC. Trade volumes in 2010 indicate that transactions in Nikkei 225 options and Nikkei 225 minis (small contracts in futures) have been increasing (Chart 14).

Financial resources used to cover potential losses include a default fund and initial margin. A unique feature of OSE's waterfall structure is that reserve funds owned by OSE and the default fund are used in the same order of priority (Chart 2).

The amount required for the default fund is set in line with the probable maximum loss (PML) calculated by OSE. The PML for equity-based derivatives, for example, is calculated using the following steps.

(1) The standard deviation of the daily price change rate is calculated over the 120 business days preceding each trade date;

(2) The largest standard deviation since 1985 is multiplied by three, and the resulting value is defined as the maximum price change rate;

(3) Open interest netted out in each derivative product is multiplied by the maximum rate for each product. The aggregate of these values for all derivatives is taken to represent the amount of exposure;

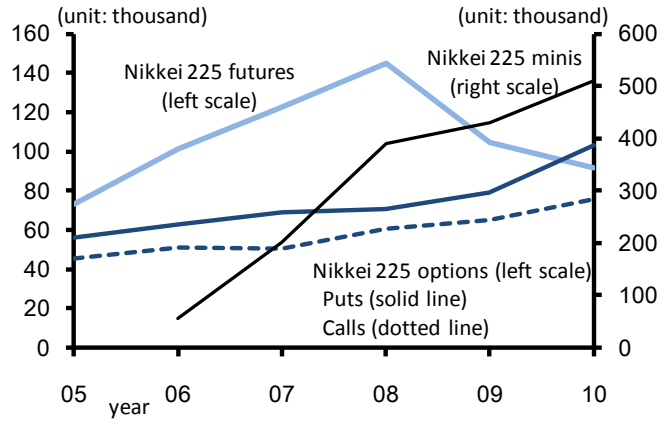
(4) The sum of the largest and second largest exposures among all participants is defined as the PML for that particular business day.

Given the wide variety of OSE participants, it is important to monitor them in an appropriate manner. OSE makes use of the PML system as a measure to monitor individual participants' exposures at certain times during the day, and ensures that their positions have not grown excessively (Table 1).

One challenge to have arisen in operational risk was the significant surge seen in the volume of trading in equity index options after the earthquake. However, given the large capacity of its clearing system, OSE was able to deal smoothly with the hike in clearing and settlement demand.[25]

[25] On March 14, 2011, the daily volume of trades in Nikkei 225 put options reached a record high of 560,000.

Chart 14 Trade Volume (unit: trades)



Note: Average daily volume
Source: OSE

H. CLS: Continuous Linked Settlement

CLS is a cross-border payment system that settles foreign exchange transactions for the major currencies on a PVP basis. The settlement service is provided by CLS Bank in New York. Yen payments arising from foreign exchange transactions are primarily processed by CLS and the Foreign Exchange Yen Clearing System (FXYCS). For CLS, a cooperative oversight arrangement has been developed by relevant central banks including the Bank. The value of yen payments processed by CLS in fiscal 2010 increased compared to the previous year (Chart 15), as the value of transactions in the foreign exchange market was on an increasing trend. Meanwhile, the market share of CLS in the settlement of foreign exchange transactions rose further due to a weak increase in FXYCS volumes.

In recent years, CLS has expanded its coverage of PVP settlement services, and has been taking the following actions to further reduce risks associated with foreign exchange transactions.

(1) It started to offer the Aggregation Service in January 2010, whereby a large number of small-value payment instructions are aggregated prior to settlement by CLS bank;

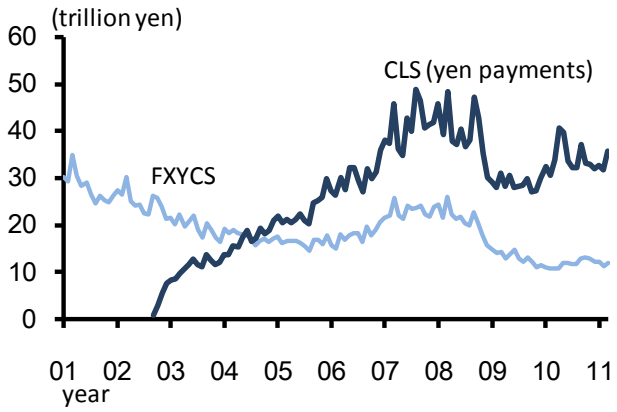
(2) It has deliberated on further expanding the range of currencies eligible for settlement from the current 17;

(3) It has been considering a service for same day settlement, for which CLS has not, in

principle, provided services in the past. The service will be initially designed to settle U.S. dollar - Canadian dollar transactions.

CLS plays a significant global role in reducing settlement risks associated with foreign exchange transactions. Therefore, in providing these new services, it is critical to develop robust IT systems and to take sufficient account of the effects of the services on liquidity risk management.

Chart 15 Yen Payment Value in CLS and FXYCS



Note: Average daily value.
Source: Bank of Japan

I. Society for Worldwide Interbank Financial Telecommunication: SWIFT

SWIFT provides international messaging services to financial institutions and other related entities. Although SWIFT is not a payment/settlement system in a strict sense, disruptions in the functioning of SWIFT's messaging services might adversely affect the global financial system and payment and settlement systems, as its networks are widely used by financial institutions and operators of settlement systems worldwide. With a view to securing appropriate governance and improving risk management, central banks of the G10 countries, including the Bank, have been cooperating internationally in their oversight of SWIFT.

In order to improve its resilience and strengthen its contingency planning, SWIFT has been conducting a project since 2007 to rebuild its operating centers -- the "distributed architecture" project -- as follows.

(1) In 2009, it established a new command-and-control center in the Asia-Pacific

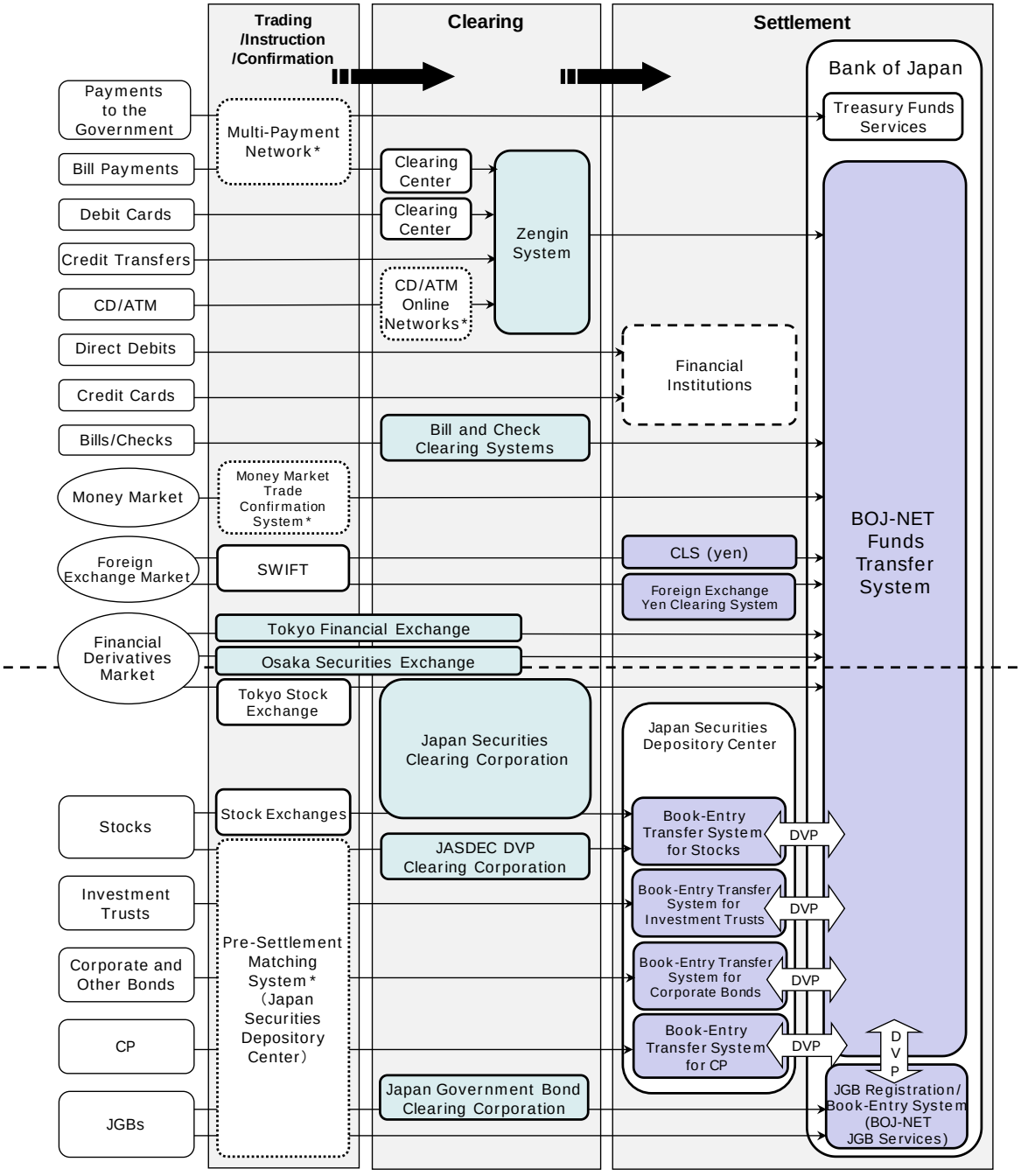
region, thereby creating a structure that allows for the monitoring of SWIFT operations to be rotated among three centers in Europe, the United States and the Asia-Pacific region during their allotted timeframes under a "follow the sun" model;

(2) In 2010, it established a structure under which SWIFT manages messaging services in two processing zones -- the European zone and the Trans-Atlantic zone -- by introducing a second operating center in Europe hosted in leased premises;

(3) It has scheduled the establishment of a new fully state-of-the art operating center in Europe to replace the center described in (2).

SWIFT's challenge for the time being is to ensure the smooth establishment and functioning of the new operating center in Europe.

Chart A Structure of Major Payment and Settlement Systems in Japan



* Systems surrounded by the dotted line are used in some instruction, confirmation and clearing activities.

Table A Average Daily Value and Number of Transactions Processed by Major Payment and Settlement Systems in Japan[1]

Payment Systems		Value (trillion yen)		Number (thousand)	
BOJ-NET Funds Transfer System		103.6	(-4.1)	51.3	(2.9)
of which:	interbank transfers	38.0	(-0.8)	n.a.	--.
	DVP for JGBs	40.1	(-1.4)	n.a.	--.
CLS (yen payments)		34.5	(16.7)	100.0	(21.2)
Foreign Exchange Yen Clearing System (FXYCS)		12.0	(-1.8)	26.1	(2.8)
Zengin System[2]		10.2	(3.8)	5,652.2	(-0.1)
Bill and Check Clearing Systems[3]		1.0	(2.0)	114.5	(-7.4)

Securities Settlement Systems		Value (trillion yen)		Number (thousand)	
BOJ-NET JGB Services[4]		75.4	(-4.4)	16.0	(3.6)
Japan Government Bond Clearing Corporation (JGBCC)[5]		36.5	(2.6)	n.a.	--
Japan Securities Clearing Corporation (JSCC)[5]		1.9	(-3.6)	n.a.	--
JASDEC DVP Clearing Corporation (JDCC)[5]		1.0	(1.5)	83.3	(-1.9)
Japan Securities Depository Center (JASDEC)[6]					
of which:	Stocks	n.a.	--	341.3	(-1.9)
	dematerialized CP	4.8	(-7.2)	1.2	(-7.4)
	corporate and other bonds	0.9	(5.7)	2.1	(4.7)
	investment trusts	0.7	(2.8)	16.7	(3.2)

Notes: 1. Figures are average daily value and number for fiscal 2010. Figures in round brackets represent year-on-year growth.

2. Figures for the Zengin System show the value and number of payments processed.

3. Figures for bill and check clearing systems show the value and number of bills and checks processed at the Tokyo Clearing House.

4. Figures for BOJ-NET JGB services include collateral transfers, issues/redemptions and monetary policy operations, as well as market transactions.

5. Figures for JGBCC, JSCC and JDCC show the value of transactions processed by the CCP. JSCC is a CCP for stock transactions executed on stock exchanges. JDCC is a CCP for stocks traded between securities companies and their customers.

6. Figures for JASDEC show the total amount of issuance, transfers and redemptions executed on the book-entry transfer system for each type of security.

Sources: Bank of Japan; Zengin-Net; CLS; JGBCC; JSCC; JDCC; JASDEC.