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Migration to New Margin Calculation Method (JSCC-VaR) in Listed Financial Derivatives Brief Overview and Impact Analysis

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Migration to New Margin Calculation Method (JSCC-VaR) in Listed Financial Derivatives Brief Overview and Impact Analysis

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Abstract

This paper reports a brief overview of the migration of JSCC's Listed Derivatives Margin calculation method from SPAN (Standard Portfolio Analysis of Risk) to a new method using Value-at-Risk (VaR) implemented on November 6, 2023 and the impact analysis results. This paper starts with an overview of VaR as a calculation method, and then gives a brief explanation of the points of the new method and the issues we had with SPAN. Lastly, the report presents the results of the analysis on the changes seen in the Margin level for Index Futures/Options Group and JGB Futures/Options Group under JSCC's Listed Financial Derivatives Clearing. While some issues in the procyclicality assessment method and suppression method were identified, certain enhancement was observed in the areas that had issues from a viewpoint of sophistication of risk management in respect of Margin for Clearing Participants with relatively large risk amount (i.e., Stress Loss Over IM), such as a trend of decrease in many accounts.

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1 Introduction

1.1 Background

Awareness of risk management at financial institutions was heightened through global financial crisis triggered by the collapse of Lehman Brothers in 2008, and various regulatory measures have been taken. Particularly, with an experience that centrally cleared trades were generally processed stably at the financial crisis, G20 Leaders agreed, at their Pittsburgh summit in 2009, to mandate utilization of clearing organizations (CCPs) for standardized OTC derivatives (hereinafter referred to as "Central Clearing"). Since then, CCPs' clearing volume has been expanding, and CCPs have become more and more important.

On another front, CCPs are facing various risks because they centrally handle post-trade processing of financial products. One of the largest risks that CCPs face is a credit risk. CCPs stand between Clearing Participants (securities firms and banks) that are direct users of their services, to isolate the trade from a credit risk of Participants. To this end, CCPs themselves undertake such risk. In fact, upon Clearing Participant default, payments and delivery of securities to CCPs would stop and CCPs would be required to procure funding and securities required for the settlement in lieu of the defaulter, and thereby would possibly incur losses. If CCP would also default due to such loss, systemic risk would emerge and other financial institutions would be affected. So, the credit risk management at CCPs is extremely important. Therefore, CCPs accept various collaterals from Clearing Participants and secure financial resources in preparation for a possible Clearing Participant default. Margin can be said to be the base of such financial resources.

Margin is a collateral posted by investors to Clearing Participants or Clearing Participants to CCPs, when they execute a trade, according to their trading volume, to cover daily exposure arising from change in market prices and loss arising from price fluctuation at the time of a Participant default. CCP performs settlements with the defaulter's original counterparties, even in the event of a Clearing Participant default. To perform these settlements, CCP liquidates unsettled position of the defaulter, such as stocks and derivatives. CCP may incur loss in the course of liquidation of the unsettled position. CCP calculates the amount of Margin by quantifying such risk. With respect to positions in Futures and Option, CCP covers market price fluctuation through daily mark to market of actual profit and loss and also accepts a deposit of Margin designed to cover plausible future risk at at least 99% confidence level.

Value-at-Risk (VaR), the financial institutions in the U.S. and Europe had been using since the 1990s, has attracted attentions as one of the means for quantitative assessment of this market risk. Japan Securities Clearing Corporation (JSCC) has adopted the Margin calculation method using VaR for its OTC Derivatives, namely CDS (since July 2011) and IRS (since October 2012), as well as cash equity trades (since January 2016).

Subsequently, a momentum for an introduction of VaR to Margin calculation has been gathered among CCPs all over the world largely driven by Chicago Mercantile Exchange (CME)'s announcement of migration of its Margin calculation method from SPAN (Standard Portfolio Analysis of Risk) to VaR. JSCC, adopted SPAN for its Listed Derivatives Margin calculation at that time, started its study for an implementation of VaR to realize sophisticated risk management in light of global trend.

Then, JSCC realized a migration of the Margin calculation method for its Listed Derivatives from SPAN to a new method using VaR.

This paper starts with a brief description of VaR as calculation method, key points of the new method and the issues with SPAN, and then review what changes were brought to the Index Futures/Option Group and the JGB Futures/Option Group, which are the major product groups in JSCC's Listed Financial Derivatives.

1.2 CCP's Risk Management

When trading in stocks or derivatives, one needs to always have in mind a risk of its counterparty failing to perform its settlement (i.e., counterparty risk). In the trading that involves mass participants at an exchange, it is inefficient to make judgment of whether or not to trade by considering counterparty risk of each trade because trades are continuously executed among multiple participants. So, for exchange traded contracts, CCP has built a structure of providing settlement guarantee by CCP standing between market participants for all trades, accepting obligations arising from trades and acquiring claims. In recent years, CCPs have expanded their coverage to OTC transactions.

Functions specifically expected for CCPs are netting associated with clearing and settlement guarantee. The parties that have executed trades with multiple counterparties may settle the net buy (long)/sell (short) position with CCP because CCP is replaced with counterparties to all the trades as a result of the clearing. Thereby, settlement volume and settlement amount are compressed, and settlement efficiency is enhanced. This is a significant benefit for trading parties.

In terms of the settlement guarantee, CCP guarantees the settlement even in the event of a default of the counterparty because CCP has assumed the obligations of the defaulter. Trading parties may trade without worrying about credit risk of their counterparties.

By contrast, CCP takes credit risk of trading counterparties entirely by guaranteeing the settlement. So, it is important for CCP to appropriately grasp and manage such risks. JSCC has in place the Clearing Participant rules and the collateral rules for an appropriate risk management of its clearing.

As to the Clearing Participant rules, any person who participates in JSCC clearing must go through screening process in line with a specific participation criteria, and become a Clearing Participant with an approval. As its risk management practice, JSCC monitors Clearing Participants' financial conditions and trading status based on the prescribed criteria on a daily basis.

As to the collateral rules, JSCC has structured the multi-layered default loss compensation scheme in preparation for possible loss that JSCC may incur upon a possible Clearing Participant default. Specifically, JSCC mandates posting of collateral called Margin and clearing fund for Clearing Participants.

Margin is also referred to as "defaulter-pay type collateral," which is used upon Clearing Participant default to cover loss associated with the liquidation of the position of the defaulter itself. By the product category it clears, JSCC has established to what level the required margin should cover the future price fluctuation risk. Margin amount for the Listed Financial Derivatives is calculated to cover 99% of the historical price fluctuation so that it should be sufficient to cover ordinary market

risk. The target is set at 99% coverage. So, of course, there may be a case where a loss in the amount exceeding Margin amount would arise. In preparation for such case, multi-layered default loss compensation scheme, including clearing fund, would become necessary.

Clearing fund is also called "mutualized loss recovery collateral," which is the financial resources assuming simultaneous default of multiple Clearing Participants under extreme but plausible market conditions for each Clearing Business. In the calculation of the clearing fund, the amount sufficient to cover at least the risk amount associated with the largest fluctuation in the past upon simultaneous default of the default assumptions is calculated in principle, and Margin of the assumed defaulters is subtracted therefrom. Then, the amount so obtained is prorated according to the risk amount of all Clearing Participants participating in that Clearing Business to decide the amount of clearing fund for each Clearing Participant. So, clearing fund corresponds to a tail risk beyond the ordinary market risk. Conceptually, the risk amount arising from position of the default assumptions associated with the historical largest fluctuation can be sufficiently covered by Margin and clearing fund.

However, because Margin and clearing fund are not called on a real-time basis, and because of the fact that potential risk that may emerge in the future is estimated based on historical data, loss beyond expectation may arise due to time required for actual deposit after the deposit request. So, in addition to Margin and clearing fund, JSCC has in place the additional financial resources called Settlement Guarantee Reserve and the structure of requesting survivors' posting of additional collateral in crisis. This structure of financial resources is sometimes called "Waterfall" taking waterfall as analogy for phased expenditure of financial resources to loss recovery. As a reference, the conceptual diagram of Waterfall in Listed Financial Derivatives is presented as Table 1.

This paper discusses the revision of Margin calculation method, the first priority resources related to the Listed Financial Derivatives.

	Index Futures Clearing Qualification	JGB Futures Clearing Qualification
1st Priority: Defaulter's Collatera	Margin	Margin
	Clearing Fund (Defaulter)	Clearing Fund (Defaulter)
2nd Priority: Exchange's Contribution	Exchange's loss compensation	
3rd Priority: JSCC's Contribution	Securities and Similar Contracts Settlement Guarantee Reserve	
4th Priority: Survivors' Contribution	Clearing Fund	Clearing Fund
5th/6th Priority: Assessment on Survivors	First Special Clearing Charge	First Special Clearing Charge
	Second Special Clearing Charge/VM Gains Haircutting	Second Special Clearing Charge/VM Gains Haircutting
When above resources are insufficient to cover entire loss	Contribution based on agreement	Contribution based on agreement
	Partial Tear-up	Partial Tear-up

Table 1: Waterfall

1.3 What is VaR

VaR [1] is a standard for financial institutions' risk management benchmark, in which a market risk is measured using statistical approach. Specifically, VaR is the largest loss in the present value that may emerge with a specific probability (confidence interval) assumed through an estimation of fluctuations in the portfolio that would occur in association with the fluctuations in the risk factors, such as underlying asset price, volatility and futures price, during a certain period of time from current to future based on the actual data for a certain period in the past by using statistical approach. We use statistical approach because we need to assume portfolio fluctuations for a certain period of time within a frame of probability statistics since it is impossible to accurately predict future loss at present time.

Now, let me briefly explain using a formula: Assuming present value of the portfolio as $V(t)$, value as of the timing Δt after a certain period of time (MPOR) $t+\Delta t$ as $V(t+\Delta t)$. When a phenomenon a price fluctuation $V(t+\Delta t)-V(t)$ at a future timing $t+\Delta t$ being below a certain level $-x\,(x>0)$ occurs with probability α, x is called VaR of the period Δt at the level $100\,(1-\alpha)\,\%$ of this portfolio. In JSCC's Listed Financial Derivatives, $\alpha = 0.01$, so JSCC calculates Margin targeting VaR of 99% level. FYI, for Listed Financial Derivatives, $\Delta t = 2$ days.

Definition. (VaR)

VaR at the level $100\,(1-\alpha)\,\%$ is $x\,(x>0)$ that satisfies the following equation:

$$P\{V(t+\Delta t)-V(t)\leq -x\}=\alpha.$$

One of the benefits of using VaR is that we may get the picture of the risk of the portfolio as a whole with one aggregated data. Also, objectivity can be ensured by presenting the statistical confidence interval for the loss amount obtained from the calculation. Because a risk amount is presented in a money value, i.e., loss amount, it is easy to judge adequacy of the risk amount (Margin amount) through a comparison with an actual portfolio loss.

While there are several specific methods for VaR calculation (VaR measurement model), major VaR measurement model JSCC has adopted for the Index Futures/Option Group and the JGB Futures/Option Group is called a historical method. In this method, on a premise of the market stationarity that is a fluctuation occurred in the past would occur in the future without assuming a distribution of risk factor, historical performances are used as is as scenarios that would occur in the future. Because the historical method uses historical performances without adjustment, it is a non-parametric estimation technique that would not assume a distribution, and it enables an expression of risk features of disnormality and non-linearity. Therefore, we need to have daily contract prices reflecting the prevailing market conditions to adopt the historical method.

The new Margin calculation method in JSCC's Listed Financial Derivatives are largely divided into two methods. One is Historical Simulation Method (HS-VaR) that is to use the historical method as a base and make scenario adjustment according to the current volatility level. The other is an alternative method (AS-VaR) introduced as a substitute for HS-VaR for the products for which HS-VaR is difficult to adopt from trading status and the like. In the latter method, we calculate VaR for the assumed risk factors, and calculate the portfolio loss according to the scenarios generated based on the VaR so obtained. The choice of the applicable calculation method is made by product in light of the trading status and Clearing Participants' comments (see Table 2).

Calculation Method	Listed Financial Derivatives
HS-VaR	Index Futures/Options (excluding Dividends Index Futures) Securities Options JGB Futures/Options Interest Rate Futures
AS-VaR	Dividends Index Futures

Table 2: Product Classification by Calculation Method related to Listed Financial Derivatives

In HS-VaR method, as means for realization of VaR target level of 99%, we use an average of top 97.5 percentile losses calculated using the scenario, aiming to realize 99% value coverage more stably.

At overseas derivatives markets, Eurex Clearing, Option Clearing Corporation (OCC) and Brasil Bolsa Balcao (B3) have already introduced VaR-based Margin calculation. Also, VaR-based Margin

calculation has been introduced in phase at CME for Energy-related commodity and equity-related commodity, and at Intercontinental Exchange (ICE) for ICE US Index Futures and Interest Rate Futures.

For the purpose of this paper, the new Margin calculation method in JSCC's Listed Derivatives is referred to as JSCC-VaR without regard to detailed calculation method.

1.4 Issues with SPAN

Our motivations behind an introduction of VaR concept are a sophistication of risk management driven by the financial crisis, as well as global trend needless to say. Especially, SPAN had several issues from risk management viewpoint. Major risk management issues with SPAN are as follows:

1. Cannot directly calculate account level portfolio risk that is the subject of the risk management;
2. An issue in scenario credibility because SPAN hypothetically generates scenarios from specific risk factors;
3. Small number of scenarios; and
4. In Option scenarios, a structure of volatility between instruments is not taken into consideration.

Particularly, Point 1 is an issue of SPAN's calculation structure, wherein, after calculating risk amount using prices of specific instruments as risk factors, difference of risks between contracts months and inter products offset effect are separately calculated and combined. SPAN has a benefit in terms of flexibility because a calculation is conducted separately by part on the one hand, but, on the other hand, there has been a concern of a room for arbitrariness from increased parameters.

Of course, it is desirable from risk management viewpoint to set various highly credible scenarios and directly calculate account level portfolio risk. Then, VaR which enables direct calculation of portfolio risk and setting of many highly credible scenarios based on historical data has drawn attention. What is expected for the new Margin calculation method is to remedy coarse risk management by an adoption of many highly credible scenarios, and to calculate Margin amount that is more practical by incorporating offset effect within the portfolio by a portfolio level calculation.

In the next chapter, we will look at what outcome the new Margin calculation method has achieved on the points that have been expected, focusing on the Index Futures/Option Group and the JGB Futures/Option Group, which are highly liquid and adopt HS-VaR, a portfolio level calculation.

2 Analysis

2.1 Comparison of Margin Amount for Hypothetical Portfolio

In this section, we will confirm what outcome the migration from SPAN to JSCC-VaR achieved in the Margin per unit of Nikkei 225 Futures (1st Contract Month), 10-year JGB Futures (1st Contract

Month) and Margin amount for the spread position of representative Nikkei 225 Futures (1st Contract Month) and TOPIX Futures (1st Contract Month).

We compared SPAN Margin and JSCC-VaR Margin for the period from November 1, 2022 to October 31, 2024.

Moreover, in August 2024, Margin shortfall occurred several times due to steep market fluctuations partly because of the policy decision of Bank of Japan (BOJ). We will confirm Margin shortfall improvement status comparing to the case of SPAN Margin. For the purpose of Financial Derivatives, Margin Shortfall refers to the status of "Margin amount on Day t" $<$ "Portfolio Loss from Day t to Day $t+2$."

2.1.1 1 Unit of Nikkei 225 Futures (1st Contract Month)

Throughout the observation period, JSCC-VaR Margin has been slightly more than SPAN Margin. Especially, we can tell that, at the time of steep market fluctuation in August 2024, JSCC-VaR Margin moved upwards largely more than SPAN, and SPAN Margin steeply moved downwards thereafter while JSCC-VaR Margin decayed modestly.

Margin shortfalls occurred during the observation period 6 times for SPAN (July 23, July 31, August 1, August 5, September 3 and September 25, 2024) and 3 times for JSCC-VaR (July 31, August 1 and August 5, 2024). At the time of steep market fluctuation in August, Margin shortfall occurred with both SPAN and JSCC-VaR, and, after steep market fluctuation in August, Margin shortfall occurred twice only with SPAN.

Steep market fluctuation in August 2024 was the one that goes beyond the one on the Black Monday. So, it was considered an emergence of a tail risk beyond the JSCC-VaR target level of 99%. Although tail risk could not be covered, because JSCC-VaR Margin captured the large fluctuations after that, the migration to JSCC-VaR is considered to have worked from risk management viewpoint.

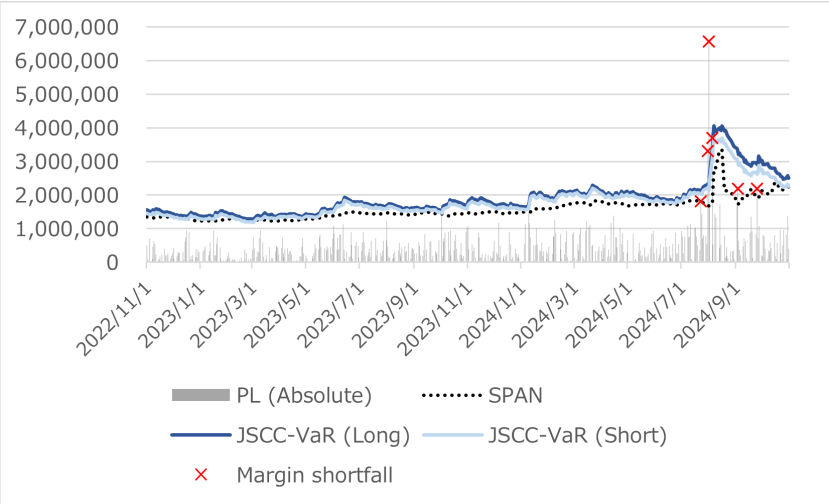

Figure 1: 1 Unit of Nikkei 225 Futures (1st Contract Month) (vertical axis: yen)

2.1.2 1 Unit of 10-year JGB Futures (1st Contract Month)

While SPAN Margin and JSCC-VaR Margin (Long) showed mostly the same level throughout the observation period, JSCC-VaR Margin (Short) were below SPAN. At the time of steep market fluctuation in August 2024, no significant difference was observed in the trend of SPAN Margin and JSCC-VaR Margin.

Margin shortfalls occurred during the observation period 4 times with SPAN (December 16 and 19, 2022, March 10, 2023 and August 1, 2024) and twice with JSCC-VaR (Long) (December 16 and 19, 2022) and 3 times with JSCC-VaR (Short) (January 17 and March 10, 2023 and August 1, 2024).

In a comparison of SPAN and JSCC-VaR (aggregated short and long), Margin shortfall occurrence was 1 time more with JSCC-VaR than SPAN. This was because short risk could be estimated more tightly in JSCC-VaR. In SPAN, there was a restriction that the Margin amount would be the same for short and long, but JSCC-VaR realized more precise estimation of respective risk of short and long.

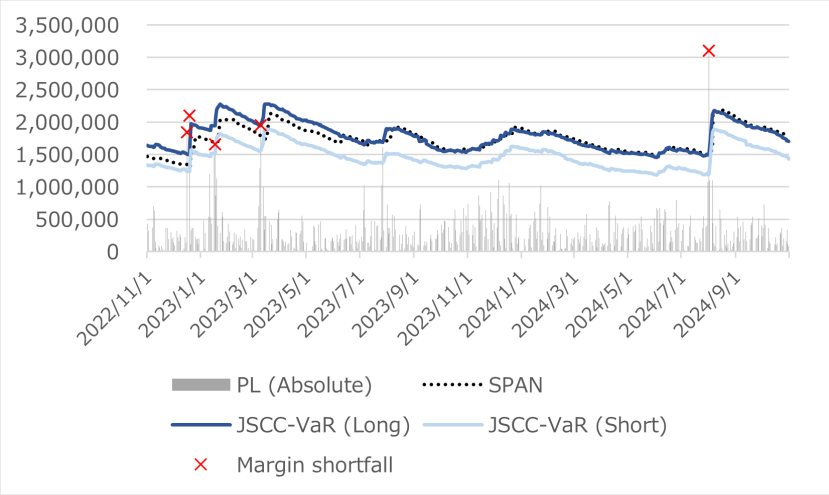

Figure 2: 1 Unit of 10-year JGB Futures (1st Contract Month) (vertical axis: yen)

2.1.3 1 Unit of Nikkei 225 Futures (1st Contract Month)-TOPIX Futures (1st Contract Month) Spread

We can confirm that while SPAN Margin and JSCC-VaR Margin showed mostly the same level throughout the observation period, at and after steep market fluctuation in August 2024, SPAN Margin steeply moved downwards, but JSCC-VaR Margin decayed modestly.

Margin shortfalls occurred during the observation period 3 times for SPAN (August 1, September 1 and September 25, 2024) and once for JSCC-VaR (August 1, 2024).

Similarly as in the case of 1 Unit of Nikkei 225 Futures, although tail risk could not be covered, because JSCC-VaR Margin captured the large fluctuations after that, the migration to JSCC-VaR is considered to have worked from risk management viewpoint.

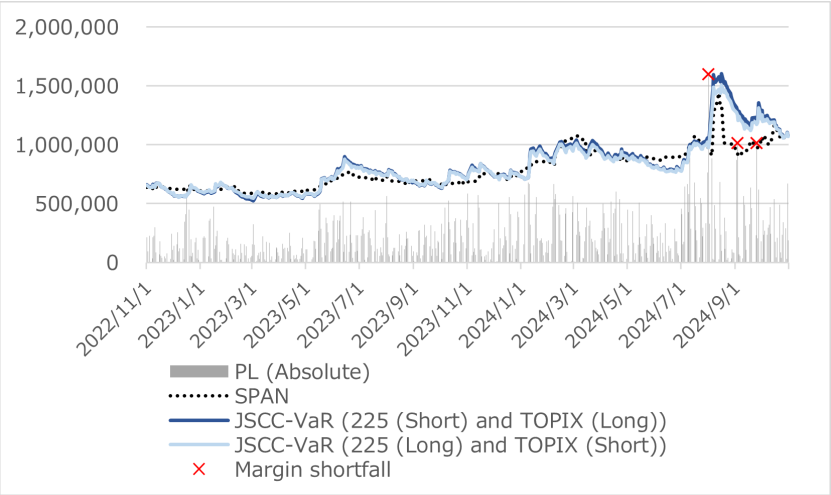

Figure 3: 1 Unit of Nikkei 225 Futures (1st Contracts Month)-TOPIX Futures (1st Contract Month) Spread (vertical axis: yen)

2.2 Comparison of Margin for Actual Portfolio

In this section, we compare increase/decrease trend of SPAN Margin and JSCC-VaR Margin for actual portfolios using scatter diagram.

The observation period is from November 1, 2022 to November 2, 2023 when SPAN data exist. Actual portfolios covered are the Index Futures/Option Group and the JGB Futures/Option Group.

Scatter diagram of SPAN Margin and JSCC-VaR Margin for all accounts, domestic leading Clearing Participants with top risk amounts, foreign leading Clearing Participants with top risk amounts and other Clearing Participants during the observation period in each of the product groups covered under this analysis is presented.

Clearing Participants with top risk amounts are Clearing Participants included in the group of accumulated Stress Loss Over IM over 95% from the top as of October 31, 2024. Stress Loss Over IM means the risk amount obtained by subtracting Margin amount from the risk amount based on the extreme but plausible scenario that would be the basis for clearing fund calculation.

2.2.1 Scatter Diagram for All Accounts

In the Index Futures/Option Group, the accounts experienced Margin increase were slightly more than the accounts experienced Margin decrease from the migration to JSCC-VaR. On the other hand, in the JGB Futures/Option Group, little less than 70% of the accounts experienced Margin decrease from the migration to JSCC-VaR.

1. Index Futures/Option Group (Figure 4)
   Number of Samples: 23,573, ratio of JSCC-VaR $\leq$ SPAN: 44.06%

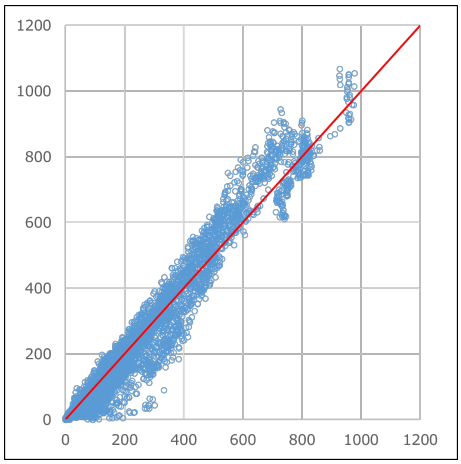

Figure 4: horizontal axis: SPAN, vertical axis: JSCC-VaR, unit: in JPY 0.1bil

2. JGB Futures/Option Group (Figure 5)
   Number of Samples: 18,296, ratio of JSCC-VaR $\leq$ SPAN: 68.34%

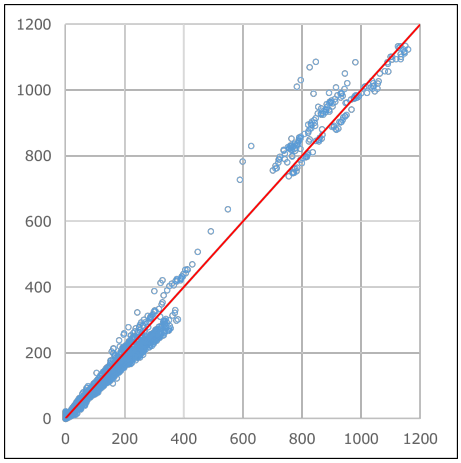

Figure 5: horizontal axis: SPAN, vertical axis: JSCC-VaR, unit: in JPY 0.1bil

2.2.2 Scatter Diagram of Domestic Leading Clearing Participants with Top Risk Amounts

As a result of the migration to JSCC-VaR, Margin decreased for more than 70% of the accounts for the Index Futures/Option Group and little less than 70% of the accounts for the JGB Futures/Option Group.

1. Index Futures/Option Group (Figure 6)
   Number of Samples: 1,988, ratio of JSCC-VaR $\leq$ SPAN: 74.94%

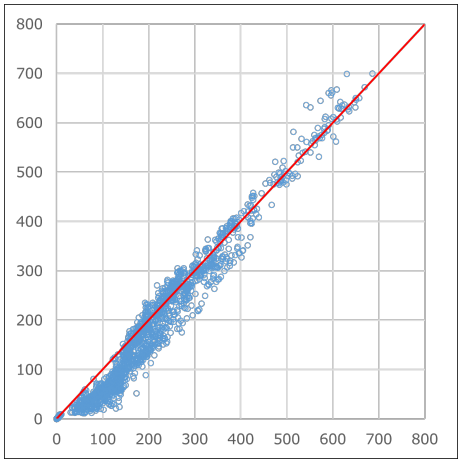

Figure 6: horizontal axis: SPAN, vertical axis: JSCC-VaR, unit: in JPY 0.1bil

2. JGB Futures/Option Group (Figure 7)
   Number of Samples: 1,989, ratio of JSCC-VaR $\leq$ SPAN: 68.22%

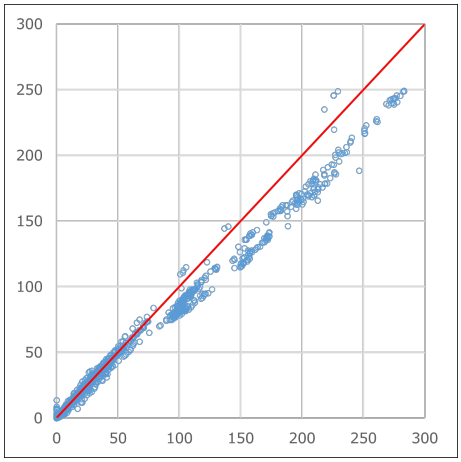

Figure 7: horizontal axis: SPAN, vertical axis: JSCC-VaR, unit: in JPY 0.1bil

2.2.3 Scatter Diagram of Foreign Leading Clearing Participants with Top Risk Amounts

As a result of the migration to JSCC-VaR, Margin decreased for little more than 50% of the accounts for both of the Index Futures/Option Group and the JGB Futures/Option Group.

1. Index Futures/Option Group (Figure 8)
   Number of Samples: 7,095, ratio of JSCC-VaR $\leq$ SPAN: 52.37%

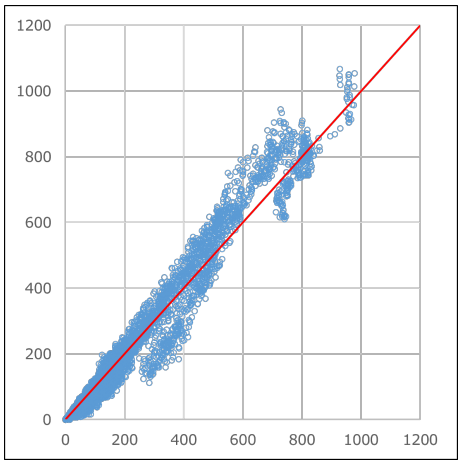

Figure 8: horizontal axis: SPAN, vertical axis: JSCC-VaR, unit: in JPY 0.1bil

2. JGB Futures/Option Group (Figure 9)
   Number of Samples: 9,196, ratio of JSCC-VaR $\leq$ SPAN: 58.50%

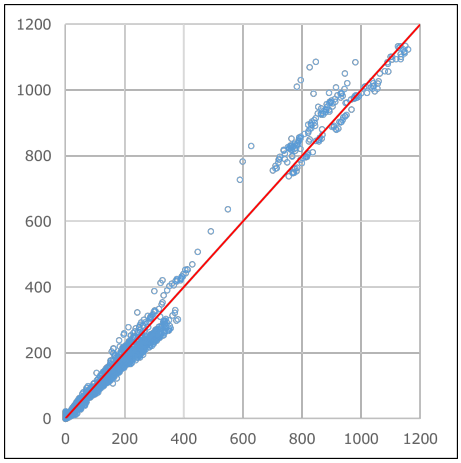

Figure 9: horizontal axis: SPAN, vertical axis: JSCC-VaR, unit: in JPY 0.1bil

2.2.4 Scatter Diagram of Other Clearing Participants

As a result of the migration to JSCC-VaR, many accounts experienced Margin increase for the Index Futures/Option Group. By contrast, more than 80% of the accounts experienced Margin decrease for the JGB Futures/Option Group.

1. Index Futures/Option Group (Figure 10)
   Number of Samples: 14,490, ratio of JSCC-VaR $\leq$ SPAN: 35.75%

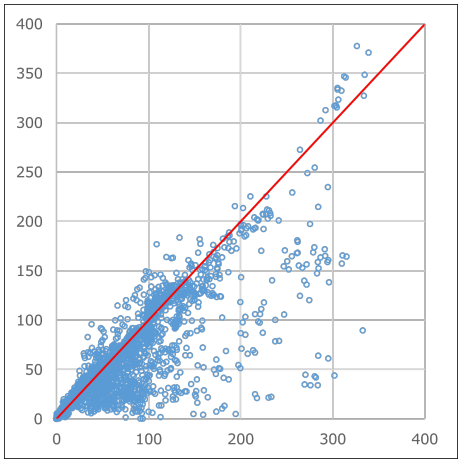

Figure 10: horizontal axis: SPAN, vertical axis: JSCC-VaR, unit: in JPY 0.1bil

2. JGB Futures/Option Group (Figure 11)
   Number of Samples: 7,111, ratio of JSCC-VaR $\leq$ SPAN: 81.11%

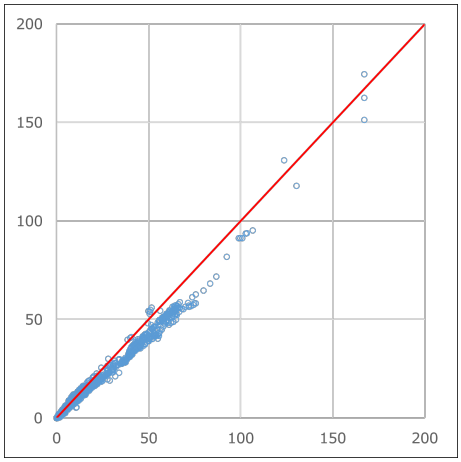

Figure 11: horizontal axis: SPAN, vertical axis: JSCC-VaR, unit: in JPY 0.1bil

For the Index Futures/Option Group, Margin generally increased on the one hand, but, on the other hand, by looking at just the Clearing Participants with large risk amounts, Margin amount tends to decrease. Especially, at domestic leading financial institutions with top risk amounts, Margin decreased for many accounts. For the JGB Futures/Option Group, we can confirm that overall trend was Margin decrease.

In an analysis of accounts at which SPAN Margin was significantly greater than JSCC-VaR Margin on a specific date, we found 3 major causes for this phenomenon.

The first of those causes is that a possibility of emergency of some of the scenarios selected in SPAN was very limited. In SPAN method, Margin is calculated by combining hypothetical scenarios for price fluctuations and volatility fluctuations. So, a risk related to combinations of scenarios with a limited possibility of emergence tends to be high, an adoption of which may result in high Margin. To put it the other way around, a generation of realistic scenarios has become possible in JSCC-VaR by generating scenarios based on a lot of actual historical data.

The second is a possibility that SPAN method may apply scenarios with a limited possibility of emergence, because of an independent scenario generation at each Combined Product. This may lead to a high Margin level. On this point as well, we consider that the Margin level was improved as a result of JSCC-VaR enabling an actual historical data-based scenario generation in a cross-sectoral manner at one large Product Group.

Lastly, since distribution of price fluctuation has a longer tail in the downward direction, a position risk in long Futures Contracts tends to be great in JSCC-VaR which adopts different scenarios between short and long, and, conversely, SPAN Margin tends to be high Margin in strong short trend. This also is considered to be an improvement as a result of JSCC-VaR enabling an accurate calculation of asymmetric nature of the price fluctuation risk.

As discussed under 1.4 Issues with SPAN, in JSCC-VaR, an off-set effect between the products within the portfolio is incorporated naturally through a realization of direct calculation of portfolio risk based on many historical data. So, this is thought to be a result of a realization of a calculation closer to the truth in the area where SPAN calculated roughly through an application of scenarios with a limited possibility of emergence and the same scenario to short and long.

2.3 Margin Calculation Efficiency

In this section, we analyze whether or not the migration to JSCC-VaR that made the direct measuring of portfolio risk possible achieved more efficient Margin collection closer to the reality of the portfolio loss.

The observation period is from November 1, 2022 to November 2, 2023 when SPAN data exist. Actual portfolios covered are the Index Futures/Option Group and the JGB Futures/Option Group.

First of all, we have quantified the efficiency of the Margin calculation closer to the reality of portfolio loss as a divergence ratio of Margin amount to portfolio loss. Margin amount divergence ratio is defined as the formula below:

$$\text{Divergence Ratio} := \frac{|\text{Margin Reuirement} - \text{Portfolio Loss}|}{\text{Portfolio Loss}}.$$

Where, the portfolio loss is the amount of loss arising from the actual price fluctuations for 2 days against the portfolio. The numerator in the right side of the equation would be the divergence of Margin from the portfolio loss. The accounts subject to the Margin divergence ratio are the accounts actually experiencing the portfolio loss. From the definition above, if the Margin divergence ratio is low, Margin call is considered to be efficient against the portfolio loss.

According to the segmentation of all accounts aggregate, domestic leading Clearing Participants with top risk amounts, foreign leading Clearing Participants with top risk amounts and other Clearing Participants for each of the product groups covered under this analysis, the trend of Margin divergence from the portfolio loss and the median of the divergence ratio are presented.

2.3.1 All Accounts Aggregate

Looking at median, the divergence ratios were smaller with JSCC-VaR comparing to SPAN in each of the Index Futures/Option Group and the JGB Futures/Option Group. However, the difference was insignificant for the Index Futures/Option Group.

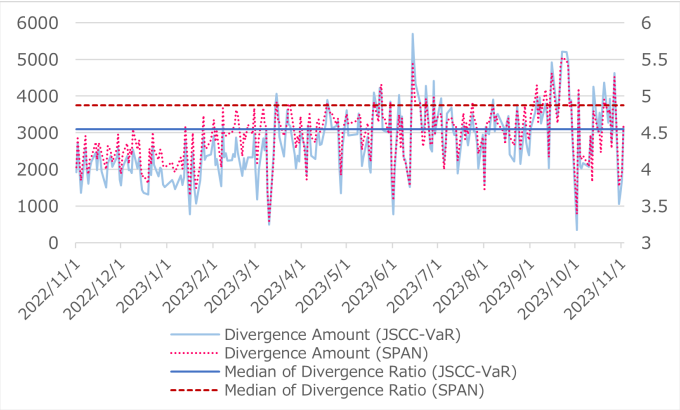

Figure 12: Index Futures/Option Group (vertical axis: in JPY 0.1bil)

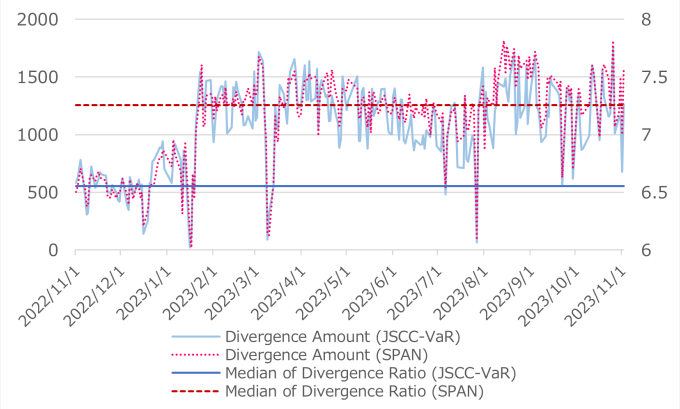

Figure 13: JGB Futures/Option Group (vertical axis: in JPY 0.1bil)

	JSCC-VaR	SPAN
Index Futures/Option Group	4.54	4.87
JGB Futures/Option Group	6.55	7.25

Table 3: Median of Divergence Ratio in All Accounts Aggregate

2.3.2 Domestic Leading Clearing Participants with Top Risk Amounts

Looking at median, the divergence ratios were smaller with JSCC-VaR comparing to SPAN in each of the Index Futures/Option Group and the JGB Futures/Option Group. For both Groups, there were a certain difference in divergence ratio between JSCC-VaR and SPAN.

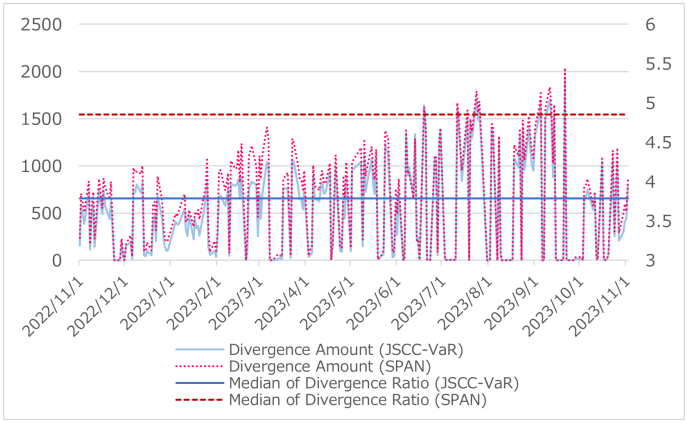

Figure 14: Index Futures/Option Group (vertical axis: in JPY 0.1bil)

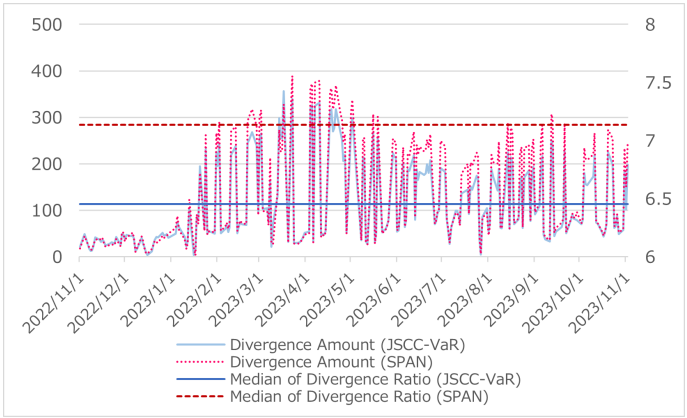

Figure 15: JGB Futures/Option Group (vertical axis: in JPY 0.1bil)

	JSCC-VaR	SPAN
Index Futures/Option Group	3.78	4.85
JGB Futures/Option Group	6.45	7.13

Table 4: Median of Divergence Ratio in Domestic Leading Clearing Participants with Top Risk Amounts

2.3.3 Foreign Leading Clearing Participants with Top Risk Amounts

Looking at median, the divergence ratios were smaller with JSCC-VaR comparing to SPAN in each of the Index Futures/Option Group and the JGB Futures/Option Group. The difference was insignificant for the Index Futures/Option Group.

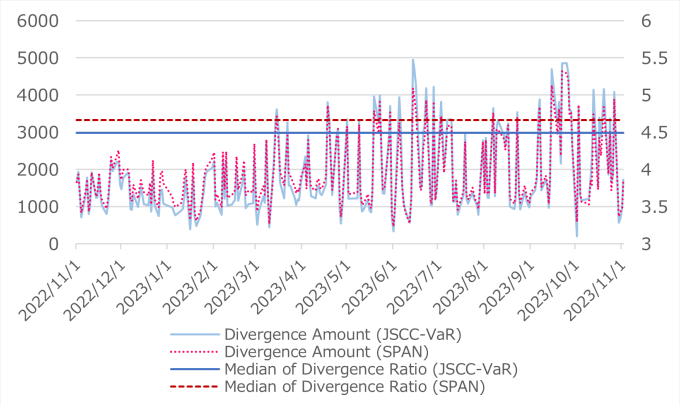

Figure 16: Index Futures/Option Group (vertical axis: in JPY 0.1bil)

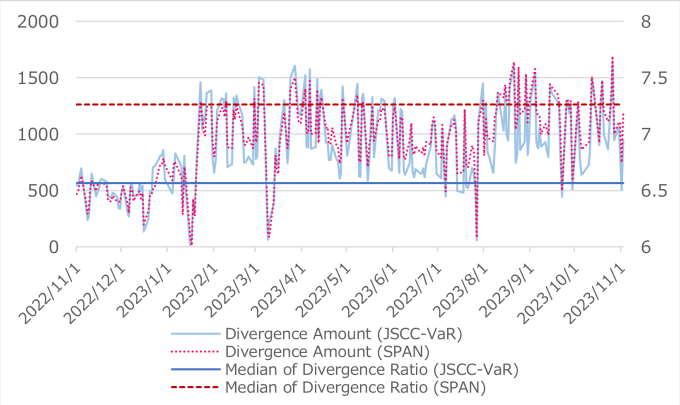

Figure 17: JGB Futures/Option Group (vertical axis: in JPY 0.1bil)

	JSCC-VaR	SPAN
Index Futures/Option Group	4.48	4.66
JGB Futures/Option Group	6.56	7.26

Table 5: Median of Divergence Ratio in Foreign Leading Clearing Participants with Top Risk Amounts

2.3.4 Other Clearing Participants

Looking at median, the divergence ratios were smaller with JSCC-VaR comparing to SPAN in each of the Index Futures/Option Group and the JGB Futures/Option Group. For both Groups, there were a certain difference in divergence ratio between JSCC-VaR and SPAN.

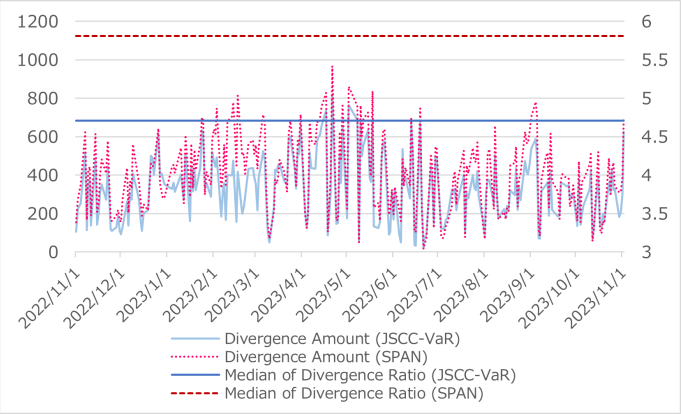

Figure 18: Index Futures/Option Group (vertical axis: in JPY 0.1bil)

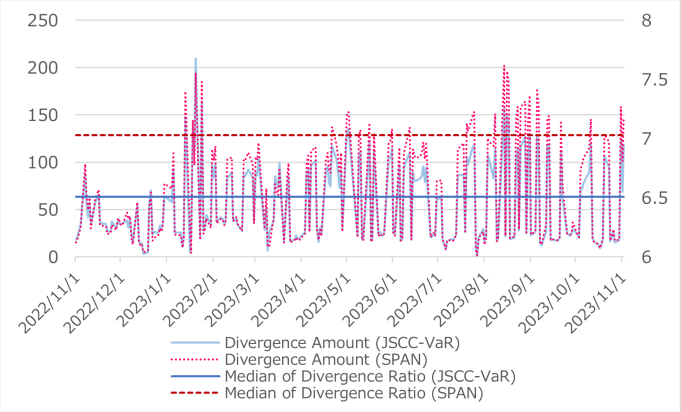

Figure 19: JGB Futures/Option Group (vertical axis: in JPY 0.1bil)

	JSCC-VaR	SPAN
Index Futures/Option Group	4.70	5.80
JGB Futures/Option Group	6.50	7.02

Table 6: Median of Divergence Ratio in Other Clearing Participants

In terms of median of the divergence ratios, the migration to JSCC-VaR realized efficient Margin call against the required amount for the portfolio loss in both categories of the Index Futures/Option Group and the JGB Futures/Option Group.

Moreover, for the Index Futures/Option Group, similarly as in the trend under 2.2 Analysis of Margin Reduction Effect related to Actual Portfolio, Margin call against the domestic leading Clearing Participants with top risk amounts tends to be more efficient than the foreign leading Clearing Participants with top risk amounts.

2.4 Procyclicality Assessment

Suppression of procyclicality is one of the discussion points concerning Margin calculation method. Procyclicality is a phenomenon where a steep rise in Margin resulted from volatile market conditions causes further market fluctuations. CCPs are required, in its Margin framework design, to introduce the measures for suppression of procyclicality and maintain rigorous Margin framework that has both risk sensitivity and soundness.

In this section, we present a comparison of the long-term soundness and the short-term soundness, and a balance of soundness, conservativeness and efficiency ("Balancing") in SPAN and JSCC-VaR for the period from November 1, 2022 to October 31, 2024 to analyze the procyclicality suppression viewpoint in SPAN and JSCC-VaR. Also presented in this section is the number of Margin shortfall occasions during this observation period.

The long-term soundness is presented as a comparison of the ratio between the largest and the smallest Margin amount during the observation period for a fixed position [2]. The short-term soundness is presented as the largest rate of Margin increase during the prescribed period. Here, the prescribed period is 20 days by reference to the Bank of England (BOE) publication [3].

As to Balancing, by reference to the European Securities and Markets Authority (ESMA) publication [4], soundness is the largest Margin increase rate in 3 days, conservativeness is the largest Margin shortfall in backtesting of the retroactive calculation of Margin for a fixed position and efficiency is the largest Margin in the retroactive calculation of Margin for a fixed position. Each rate is represented as "$\frac{\text{VaR}}{\text{SPAN}} - 1$". In short, we may consider efficient if the result is enclosed within 0% shown as dotted triangle.

A fixed position is 1 unit of Nikkei 225 Futures (1st Contract Month) and 1 unit of 10-year JGB Futures (1st Contract Month).

2.4.1 1 Unit of Nikkei 225 Futures (1st Contract Month)

For the long-term soundness, JSCC-VaR was inferior. On the other hand, JSCC-VaR was superior for the short-term soundness.

For Balancing, only efficiency was not effective for both short and long.

	SPAN	JSCC-VaR (Long)	JSCC-VaR (Short)
Largest Margin	JPY 3,330,000	JPY 4,060,319	JPY 3,720,799
Smallest Margin	JPY 1,230,000	JPY 1,271,853	JPY 1,183,482
Long-term Soundness	2.71	3.19	3.14
Short-term Soundness	98.21%	98.04%	89.21%
Margin Shortfall Occasions	6	2	1

Table 7: Soundness in 1 Unit of Nikkei 225 Futures (1st Contract Month)

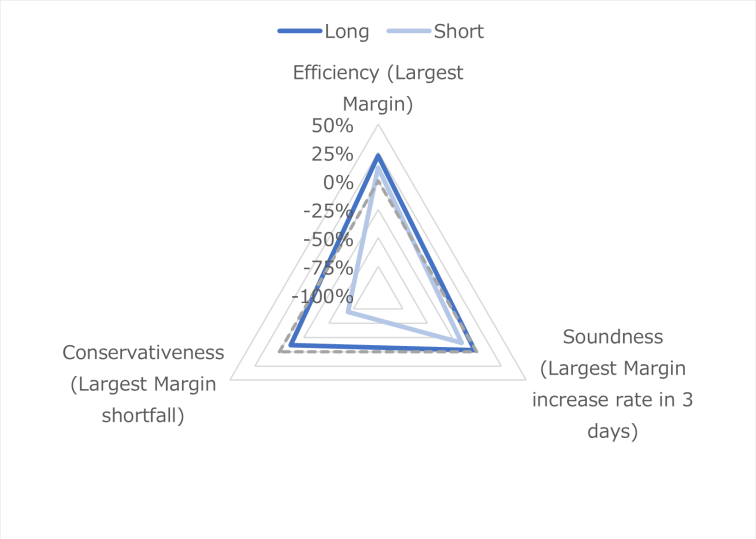

Figure 20: Balancing in 1 Unit of Nikkei 225 Futures (1st Contract Month)

	Long	Short
Efficiency (Largest Margin)	21.93%	11.74%
Soundness (Largest Margin Increase Rate in 3 days)	-2.34%	-15.44%
Conservativeness (Largest Margin Shortfall)	-11.58%	-69.69%

Table 8: Balancing in 1 Unit of Nikkei 225 Futures (1st Contract Month)

2.4.2 1 Unit of 10-year JGB Futures (1st Contract Month)

JSCC-VaR was superior for the long-term soundness. On the other hand, JSCC-VaR was inferior for the short-term soundness.

For Balancing, the result shows the efficacy only in conservativeness for Long and only in efficiency for Short.

	SPAN	JSCC-VaR (Long)	JSCC-VaR (Short)
Largest Margin	JPY 2,190,000	JPY 2,281,853	JPY 1,893,610
Smallest Margin	JPY 1,290,000	JPY 1,456,198	JPY 1,182,141
Long-term Soundness	1.70	1.57	1.60
Short-term Soundness	46.00%	47.13%	58.94%
Margin Shortfall Occasions	4	2	3

Table 9: Soundness in 1 Unit of 10-year JGB Futures (1st Contract Month)

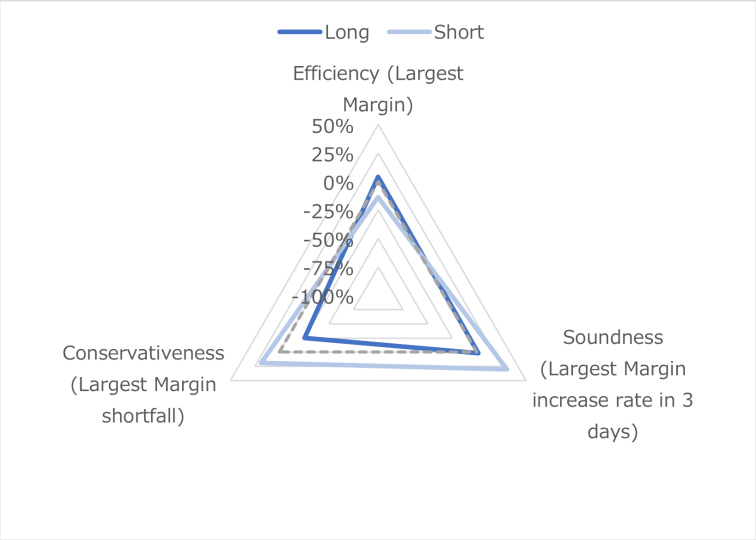

Figure 21: Balancing in 1 Unit of 10-year JGB Futures (1st Contract Month)

	Long	Short
Efficiency (Largest Margin)	4.19%	-13.53%
Soundness (Largest Margin Increase Rate in 3 days)	1.28%	30.42%
Conservativeness (Largest Margin Shortfall)	-25.46%	18.86%

Table 10: Balancing in 1 Unit of 10-year JGB Futures (1st Contract Month)

Looking at both the long-term soundness side and the short-term soundness side, the migration to JSCC-VaR did not necessarily improve the situation. This is considered to be largely because of the significant rise in the largest value of Margin during the observation period due to the significant rise in JSCC-VaR from steep market fluctuation exceeding confidence level of 99% that is the target coverage for Margin occurred in August 2024.

In terms of Balancing, the migration was effective on Nikkei 225 Futures except for efficiency, but effect on 10-year JGB Futures was limited. As discussed in 2.1, the reason for this result in Short is considered to be an impact of Margin decrease through reflection of asymmetric effect of price fluctuation risk associated with the migration to JSCC-VaR.

By contrast, looking at the status of Margin shortfall, Margin shortfall, that could have occurred in SPAN, could be suppressed by a large increase of JSCC-VaR Margin at the time of steep market fluctuation and moderate decay thereafter. At the time of steep market fluctuation, unless we increase Margin to follow such fluctuation, it would be a cause for Margin shortfall. For this purpose, from risk management viewpoint, it seems good to allow Margin increase at certain level at the time of steep market fluctuation, and call for Margin to avoid steep fall thereafter. Looking at the result from this viewpoint, a certain level of deterioration in an assessment under this indicator may be inevitable during the data period including the time of steep market fluctuation.

If we only consider suppression of procyclicality, a possible countermeasure would be to introduce a framework of always setting Margin at high level and suppressing Margin decay at the time of volatility fall. However, this countermeasure would cause a deterioration of Clearing Participants' fund efficiency and would undermine Participants convenience. A suppression of procyclicality and Clearing Participants' convenience contradict in part. So, balancing between them is very difficult.

Procyclicality assessment method and suppression method are very difficult and controversial globally. Procyclicality is the area for which technological enhancement on both assessment method and suppression method is desired.

3 Conclusion

This paper summarized the status of the Listed Financial Derivatives associated with the migration of JSCC Margin calculation method from SPAN to JSCC-VaR. Particularly, this paper analyzed what changes the direct measuring of portfolio risk, which was a risk management issue in SPAN, brought from viewpoints of the change in Margin amount in hypothetical portfolio and actual portfolios, Margin efficiency and procyclicality.

We observed the tendency of Margin decrease at many accounts under Clearing Participants with large risk amount (SLOIM) as a result of the migration to JSCC-VaR. This is thought to be a result of an improvement in the area, where SPAN calculated roughly through an application of scenarios with a limited possibility of emergence and the same scenario to short and long, by a natural incorporation of an off-set effect between the products within the portfolio through a realization of direct calculation of portfolio risk based on a lot of historical data.

As to Margin efficiency, portfolio loss and median of divergence ratios in Margin showed a result that the migration to JSCC-VaR brought an enhancement of efficiency to a certain extent.

In procyclicality assessment, we validated the long-term soundness, the short-term soundness and Balancing. Under these validations, although no extreme deterioration was observed, it cannot be said that the migration brought a prominent enhancement. While procyclicality assessment method and suppression method is the area attracting attentions globally, JSCC needs to strive for an enhancement with continued analysis.

Although issues were found in procyclicality assessment method and suppression method, the migration to JSCC-VaR can be valued to have achieved successful result to a certain extent for the initial purpose since an enhancement was observed in the area in which SPAN had issues from a viewpoint of sophistication of risk management.

However, we would like to note that the current method would not necessarily be desirable perpetually in the future. For example, a liquidity of each product varies daily in association with changes in external environment. If there is any change in data obtained from trading status, we need to flexibly adapt our calculation method to such change.

Many of the products currently under AS-VaR as an alternative method for HS-VaR are illiquid. However, as the market matures, we will be able to obtain data that capture prevailing market. If so, a migration to HS-VaR that realizes direct risk calculation at portfolio level may become possible. We need to consider a migration to the calculation method that enables more accurate risk calculation while assessing the level of market maturity.

It is also important to make minor adjustments to various factors, such as method of adopting stress scenarios for suppression of procyclicality and scenario adjustment method to match with current volatility level, while continuously watching market and Margin status.

Since JSCC has developed JSCC-VaR internally, it can flexibly accommodate detailed configuration and expansion according to market conditions and regulations, which is considered to be a strong point of JSCC.

While JSCC introduced JSCC-VaR for the Listed Derivatives from a viewpoint of sophistication of risk management, VaR itself is just one of the statistical models and depends on model assumptions and data existed in the past. So, there are limitations. One cannot avoid these limitations no matter how sophisticated mathematical methodology is implemented. For us to assess such limitations and realize appropriate risk management, an integrated risk management through a combination of various risk management methodologies, such as financial resources sufficiency validation through daily Margin backtesting and model adequacy evaluation, is important.

References

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[3] D. Murphy and N. Vause (2021). Staff Working Paper No. 950, A CBA of APC: analyzing approaches to procyclicality reduction in CCP initial margin models. Bank of England.

[4] ESMA Consultation Paper (2022), Review of RTS No 153/2013 with respect to procyclicality of margin. European Securities and Markets Authority.

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