CCP GLOBAL REPORT

THE YEAR IN CLEARING: 2024

JULY 2025

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CCP GLOBAL
THE GLOBAL ASSOCIATION OF CENTRAL COUNTERPARTIES

MESSAGE FROM THE CHAIRMAN AND THE CEO

As we reflect upon the past year, it is crucial to recognize the pivotal role that central counterparties ("CCPs") play in our financial markets. CCPs serve as intermediaries in financial markets, providing stability, netting efficiencies, and reducing risks associated with trading activities. Their significance has only grown with the increasing complexity and volume of financial transactions globally.

Importance of CCPs

CCPs mitigate counterparty risk by guaranteeing the performance of trades even if one party defaults. This assurance fosters confidence among market participants and enhances overall market stability. Additionally, CCPs offer netting benefits, which reduce the number of transactions between parties, thereby lowering systemic risk and improving operational efficiency. In essence, CCPs are one of the foundations for the stability of the modern financial system.

Recent Developments

In 2024, we witnessed several noteworthy developments in the realm of CCPs. Regulatory advancements have been at the forefront. As illustrated in the case studies, innovation continues to play a significant role, enhancing the efficiency and robustness of CCPs, and bringing new markets and participation options to central clearing. These developments are mirrored in our association; CCP Global continues to expand and broaden its membership, and adapt its capacities.

Stakeholder Engagement

Active engagement enables the CCPs to obtain feedback and respond to various considerations across a variety of stakeholders such as direct/indirect clients, regulatory bodies, service providers, and other interested parties. Throughout the year, CCPs have prioritized open communication and collaboration with market participants, regulatory bodies, and technology providers. Regular forums, the CCP Global International Default Simulation ("CIDS"), the CCP Global Cyber Resilience Exercise ("CRE"), and various consultations have facilitated a deeper understanding of stakeholder concerns and market needs, and improved transparency. This collaborative approach ensures that we remain responsive to the evolving landscape and continue to uphold the trust vested in us.

New Opportunities

Looking ahead, several promising opportunities beckon in the realm of CCPs. Exploring partnerships with technology firms can drive innovation and lead to the development of new products and services that cater to the dynamic needs of market participants. Moreover, we have witnessed record volumes coming into clearing, including within asset classes or markets that benefitted less from central clearing in the past. With the heightened market volatility that we have observed over the past 5 years, CCPs have continued to contribute to maintaining stability in financial markets and support the risk management needs of market participants.

In conclusion, the importance of CCPs cannot be overstated. Their role in mitigating risks, ensuring market stability, and fostering confidence among participants is indispensable. As we navigate the complexities of the financial landscape, CCP Global and its members are committed to resiliency, stakeholder engagement, innovation, and exploring new opportunities to support our markets.

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LIST OF ABBREVIATIONS

3M	Three-month
A.C.M.E.	A Clearing Member Everywhere
ACL	Achieved Coverage Level
AMCC	Affiliate Members Consultative Committee
APAC	Asia-Pacific
APC	Anti-procyclicality
AS-VaR	Alternative method
BA	Banker's Acceptance
BAX	Three-Month Canadian Bankers' Acceptance Futures
BCBS	Basel Committee on Banking Supervision
BdF	Banque de France
BDI	Baltic Dry Index
BIS	Bank for International Settlements
BoC	Bank of China
BoE	Bank of England
BoJ	Bank of Japan
BSBY	Bloomberg Short-Term Bank Yield Index
CAD	Canadian dollar
CBDC	Central Bank Digital Currency
CCA	Covered clearing agency
CCMC	Canadian Collateral Management Service
CCP	Central Counterparty
CDCC	Canadian Derivatives Clearing Corporation
CDOR	Canadian Dollar Offered Rate
CDS	Credit Default Swap
CeFi	Centralized finance
CFTC	Commodity Futures Trading Commission
CIDS	CCP Global International Default Simulation
CIF	Credit Index Future
CM	Clearing member
CMA	Capital Market Authority
CME	Chicago Mercantile Exchange
CMS	Collateral Management System
CORRA	Canadian Overnight Repo Rate Average
CPMI	Committee on Payments and Market Infrastructures
CPSS	Committee on Payment and Settlement Systems
CRA	Three-Month CORRA Futures
CRE	CCP Global Cyber Resilience Exercise
CSD	Central Securities Depository
CSDR	Central Securities Depositories Regulation
DCO	Derivatives Clearing Organization
DeFi	Decentralised finance
DF	Default Fund
DLC	Daily Leverage Certificates
DLT	Distributed Ledger Technology
DMP	Default Management Process

DNDF	Domestic Non-Deliverable Forward
DORA	Digital Operational Resilience Act
DTCC	Depository Trust and Clearing Corporation
ECB	European Central Bank
ECMS	Eurosystem Collateral Management System
EMEA	Europe, the Middle East, and Africa
EMIR	European Market Infrastructure Regulation
ESMA	European Securities and Markets Authority
ESRB	European Systemic Risk Board
ETF	Exchange Traded Funds
ETP	Electronic Trading Platform
EU	European Union
EUR	Euro
FAQ	Frequently Asked Questions
FDIC	Federal Deposit Insurance Corporation
FFA	Forward Freight Agreement
FICC	Fixed Income Clearing Corporation
FMG	Financial Markets Group
FMI	Financial Market Infrastructure
FMO	Fully Marketed Offer
FRTB	Fundamental Review of the Trading Book
FSA	Financial Service Authority
FSB	Financial Stability Board
FSMA	Financial Services and Markets Act
FX	Foreign Exchange
GBL	General Business Loss
GC	General Collateral
GFC	Global Financial Crisis
GSD	Government Securities Division
HK	Hong Kong
HKEX	Hong Kong Exchanges and Clearing Limited
HMT	His Majesty's Treasury
HSBC	Hong Kong and Shanghai Banking Corporation
HS-VaR	Historical Simulation Method
ICMS	Integrated Collateral Management System
IDX	Indonesia Stock Exchange
ILS	Israeli shekel
IM	Initial Margin
IOSCO	International Organization of Securities Commissions
IRS	Interest Rate Swap
ISDA	International Swaps and Derivatives Association
ISO	International Organization for Standardization
ISSBs	International standard-setting bodies
JGB	Japanese Government Bond
JPY	Japanese yen
JSCC	Japan Securities Clearing Corporation
LGI	Lion Global Investors
LNG	Liquefied natural gas

MM	Money market
MXN	Mexican peso
NBFI	Non-bank financial intermediation
NDL	Non-Default Loss
NSE	National Stock Exchange of India
NZX	New Zealand Exchange
OC	Overcollateralisation
OCBC	Oversea-Chinese Banking Corporation Limited
OCC	Options Clearing Corporation
OCR	Options on Three-Month CORRA Futures
ODEX	Osaka Dojima Exchange
OIS	Overnight Index Swap
OTC	Over-The-Counter
OTCD	OTC Derivatives
OWC	Operations Working Committee
P&L	Profit and Loss
PFMIs	Principles for Financial Market Infrastructures
PQD	Public Quantitative Disclosure
PRA	Prudential Regulation Authority
PTTP	Post-Trade Transformation Program
QATL	Quick Access Transparency Links
QTR	Quarterly Trends Report
ReSG	Resolution Steering Group
RFQ	Request for Quote
RMS	Risk Management System
RTO	Recovery time objective
RWP	Recovery and wind-down plan
S&P	Standard & Poor's
SaaS	Software-as-a-Service
SAMA	Saudi Arabian Monetary Authority
SAR	Saudi riyal
SDR	Singapore Depository Receipt
SEBI	Securities and Exchange Board of India
SEC	Securities and Exchange Commission
SFT	Securities Financing Transaction
SFTR	Securities Financing Transactions Regulation
SGC	Secured General Collateral Notes
SGX	Singapore Exchange
SOFR	Secured Overnight Financing Rate
SORA	Singapore Overnight Rate Average
SPAN	Standard Portfolio Analysis of Risk
SSE	Shanghai Stock Exchange
SSO	Single Stock Option
SST	Supervisory stress test
TIBOR	Tokyo Interbank Offered Rate
TMX	Toronto Stock Exchange
TONA	Tokyo Overnight Average Rate
TOPIX	Tokyo Stock Exchange Stock Price Index

TRF	Total Return Future
TW	Turnbull-Wakeman
UK	United Kingdom
USD	United States dollar
UST	US Treasury
VaR	Value-at-Risk
VIX	Chicago Board Options Exchange's Volatility Index®
VM	Variation Margin
VMGH	Variation Margin Gains Haircutting
VSTOXX	EURO STOXX 50® Volatility
ZARONIA	South African Rand Overnight Index Average

EXECUTIVE SUMMARY

2024 was a busy and successful year from the CCPs' perspective. Despite numerous challenges arising from geopolitical tensions, inflationary concerns, central banks' monetary policy decisions, weather patterns affecting commodities, and the resultant increased volatility and risk levels, CCPs fared very well, yet again confirming their resilience and the robustness of their risk management practices.

As demonstrated in Section 1.1, CCPs expanded and diversified their offerings to the benefit of market participants and financial markets' stability and efficiency. CCPs were, as always, proactive and innovative, looking into the latest technological developments and employing some of the new technologies where reasonable and practicable. At the same time, it was interesting and reassuring to see that the central clearing mechanism and the risk management provided by CCPs continued to prove to be capable and advantageous to the market and even the most advanced technological innovations and environments available today cannot replace CCP services or make them obsolete.

The subsequent sections of Chapter 1 outline the most pertinent CCP-related topics that were discussed, consulted on, and further developed by policy makers globally and locally in 2024, including CCP recovery and resolution, clearing mandates, margining practices, stress testing, and settlement cycle. It summarises the most important submissions of CCP Global throughout the year which contributed to public consultations of important market standards and rule proposals. Separate sections are dedicated to vital initiatives of CCP Global undertaken with its members, i.e., the international default simulation and the cyber resilience exercise.

Chapter 2 demonstrates the CCPs' transparency that is ensured, amongst others, by their quarterly publications containing quantitative data provided in a standardised format across the board. The most significant data for all four quarters of 2024 are presented, showcasing CCPs' resilience and overall performance.

The rest of the report (Chapters 4-8) consists of CCP Global members' case studies. In this year's edition, we feature:

- **Eurex Clearing**, which describes participation in the European Central Bank ("ECB") exploratory work on new technologies for wholesale central bank money settlement;
- **IDClear**, which put together a case study describing the implementation of central clearing in Indonesia's Money Market and Foreign Exchange which has been a key milestone;
- **Japan Securities Clearing Corporation ("JSCC")**, providing an overview and impact analysis of its migration to new margin calculation method (JSCC-VaR) in listed financial derivatives;
- **National Stock Exchange of India ("NSE")**, presenting a unique Two-way Software-as-a-Service model among interoperable Indian CCPs to improve operational resiliency, and
- **Singapore Exchange ("SGX")**, which shares insights into managing risk in freight derivatives during market volatility and negative prices.

1. CCP REGULATORY CONTEXT AND MARKET PRACTICES DEVELOPMENTS IN 2024

1.1 NEW ASSET CLASSES AND OTHER ADVANCEMENTS IN CLEARING IN 2024

In 2024, CCPs continued to expand and refine their services and product offerings to meet the risk management needs of their members. Many CCPs have broadened the scope of cleared asset classes and eligible cash and non-cash collateral, proving their operational resilience, resourcefulness, and adaptability. Other changes and enhancements introduced by CCPs have, amongst others, related to changing market conditions, including shortening settlement cycle to T+1 and new reference rates, collateral optimisation, updates to risk management methodologies, and technological innovations, in particular referring to Distributed Ledger Technology ("DLT"), cloud, and payment automation. The following is a non-exhaustive list of examples of such changes at CCPs which could be observed in 2024 and at the beginning of 2025:

- At **Cboe Clear Europe**:
    - In November 2024, Cboe Clear introduced a first-of-its-kind CCP clearing service for European Securities Financing Transactions ("SFTs"). As the only pan-European CCP to offer clearing services for SFTs in European cash equities and Exchange Traded Funds ("ETFs"), Cboe Clear Europe is helping to bring improved capital efficiencies, enhanced risk management, and streamlined operational procedures to this market. The service transforms the current bilateral process between lenders and borrowers into a cleared model whereby the CCP becomes the counterparty in the SFT transaction for both lender and borrower. By removing the bilateral nature of the SFT transactions, the process becomes more efficient, particularly with regards to risk-weighted assets. Given the increased regulatory and operational burdens following the Central Securities Depositories Regulation ("CSDR"), Securities Financing Transactions Regulation ("SFTR"), and planned Basel IV implementation, an efficient, cleared solution for SFTs helps the SFT industry to manage their costs associated with stock borrowing and lending.
- At **CDCC**[1]:
    - Options on Three-Month Canadian Overnight Repo Rate Average ("CORRA") Futures ("OCR") – an additional tool for market participants to manage short-term, Canadian dollar interest rate risk using options. The product was launched on February 12th, 2024 to support the benchmark transition process in Canada and build on the growth observed in the existing CORRA futures (CDCC: Listing of Options on Three-Month CORRA Futures);
    - Transition to T+1 Settlement Cycle – implemented on May 27th, 2024 to support the transition from T+2 to T+1 settlement period for the delivery of the underlying for options and futures products (CDCC: T+1 Settlement Cycle);
    - Benchmark Reference Rate Fallback – in response to the permanent cessation of the Canadian Dollar Offered Rate ("CDOR"), a fallback procedure was executed on April 27th, 2024 to convert the Three-Month Canadian Bankers' Acceptance Futures ("BAX") contracts to Three-Month CORRA Futures ("CRA') contracts (CDCC: Conversion of BAX into CRA contracts);
    - Secured General Collateral Notes ("SGC") – launched on June 10th, 2024. A short-term cash money market discount instrument to provide an opportunity for Canadian money market institutional investors to transit from Banker's Acceptance ("BAs") exposure following the cessation of the CDOR. Strong protection for the basket securing the SGC Notes is offered

[1] Canadian Derivatives Clearing Corporation ("CDCC").

to the investors through active risk management and the leveraging of Toronto Stock Exchange's ("TMX") infrastructure, including the Canadian Collateral Management Service ("CCMS") which allows for automated collateral movements (CDCC: Secured General Collateral Notes).

- At **CME[2]:**
  - In 2024, CME Group and FICC[3] worked together to enhance their existing cross-margining arrangement for the benefit of common members when trading US Treasury securities and CME Group Interest Rate futures that have offsetting risk exposures. The changes expanded the scope and efficiency of the margin offsets that are available to clearing members ("CMs") of CME and FICC/GSD[4], thus reducing margin charges, and allowing for more efficient capital usage. Enhancements to the arrangement focused on expanding the eligible CME Group Interest Rate futures products available for cross-margining and simplifying the overall margin calculation process that would apply to a cross-margining participant's eligible positions and streamlining the default management process by making clear that a joint liquidation would be the preferred method used by FICC and CME Group in the event of a member default.
- At **Eurex Clearing**:
  - Enhancement of the Total Return Futures ("TRFs") suite to include TRFs on MSCI[5] indexes on March 11th, 2024 (Eurex to launch first TRFs on MSCI indexes);
  - General Collateral ("GC") pooling green bond basket introduced on April 29th, 2024 strengthening the European repo market for green bonds (Eurex – new GC Pooling Green Bond Basket);
  - Further integration of Foreign Exchange ("FX") futures into bilateral trading workflows through collaboration with multi-dealer FX and Request for Quote ("RFQ") platforms, such as 360T, RFQ Hub and Eurex EnLight (A growing number of OTC FX market participants using exchange-traded FX futures);
  - Partnership between Eurex, Clearstream, and VERMEG to optimize re-use of collateral to increase clients' central bank credit line within the Eurosystem Collateral Management System ("ECMS") (Eurex, Clearstream & VERMEG partnership);
  - Developments in Distributed Ledger Technology ("DLT"): ECB trials participation to clear a native digital repo transaction (Eurex Clearing – participation in ECB trials), as well as collateral mobilization to fulfill margin requirements through the HQLAx ledger (Eurex Clearing paves the way for digital collateral mobilization);
  - First global offering of Credit Index Futures ("CIFs") offered with the launch of futures on the Bloomberg US Corporate Index and Bloomberg US High Yield Very Liquid Index on September 23rd, 2024 (USD Credit Index Futures);
  - Trade offset workflow with Bloomberg to help users of cleared Interest Rate Swaps ("IRSs") optimize their portfolio by automating the close out process (Eurex launched Bloomberg Trade Offset workflow);
  - European Union ("EC") Commission becomes a member of Eurex Repo to support the creation of a liquid EU bond market in October 2024 (EU Commission on Eurex's repo market);
  - Extension of the Eurex ESG[6] Clearing Compass: Assessment of collateral as well as equity and bond transactions at the Frankfurt Stock Exchange and Eurex Repo with climate metrics (Eurex ESG Compass to cover Cash Market and Repo Transactions);

2 Chicago Mercantile Exchange ("CME").
3 Fixed Income Clearing Corporation ("FICC").
4 Government Securities Division ("GSD").
5 Morgan Stanley Capital International ("MSCI").
6 Environmental, Social and Corporate Governance ("ESG").

- Optimized credit trading with reallocation from the Corporate Bond Liquidation Group to the Listed Fixed Income Liquidation Group (Bond Index Futures reallocation);
- In addition, Eurex published a whitepaper "The role of CCP in a DLT environment", in which it summarized its takeaways from its participation in different DLT-related market initiatives. In particular, Eurex learned that:
  - Robust clearing processes and risk methodology can be applied in both legacy and DLT-based environments;
  - Seamless integration of existing clearing processes with DLT is possible and Eurex proved adaptable to new technological frameworks;
  - Clearing processes and risk frameworks can be applied equally to native digital and conventional assets;
  - Instant settlement through DLT is not considered optimal, as it necessitates pre-funding, thereby increasing liquidity requirements, and operational costs. In contrast, CCPs enable multilateral netting, which not only reduces settlement volumes and transaction costs but also supports more efficient use of collateral and optimises regulatory capital requirements.

- At **HKEX**[7]:
  - As of February 29th, 2024, HKEX welcomed its first listing of covered call ETFs;
  - As of April 30th, 2024, HKEX welcomed Asia's first Spot Virtual Asset ETFs;
  - On May 8th, 2024, HKEX announced its launch of Weekly Single Stock Options;
  - On September 2nd, 2024, HKEX launched Weekly Hang Seng Tech Index Options;
  - On November 21st, 2024, HKEX announced collaboration with Hang Seng Indexes Company to launch Hang Seng HKEX Stock Connect China Enterprises Index.
- At **JSCC**:
  - As of April 1st, 2024, JSCC adopted additional management methods for Japanese yen ("JPY") cash collateral held in trust for Credit Default Swap ("CDS") Clearing Business and IRS Clearing Business;
  - As of August 13th, 2024, JSCC added rice index futures traded on Osaka Dojima Exchange ("ODEX") to the Contracts Subject to Clearing;
  - As of September 23rd, 2024, JSCC obtained from the Ontario Securities Commission an order exempting JSCC from the requirement to be recognized as a Clearing Agency under the Securities Act of Ontario, Canada;
  - As of October 16th, 2024 JSCC collaborated with the Depository Trust and Clearing Corporation ("DTCC") on Digital Assets: A Proof-of-Concept with Collateral using "DTCC Digital Launchpad" (press release);
  - As of November 25th, 2024, JSCC made rule revisions for IRS transactions to address the permanent discontinuation of Euroyen Tokyo Interbank Offered Rate ("TIBOR") publication, that included the elimination of IRS referencing Euroyen TIBOR as a Floating Rate Option from the Eligible Transactions for Clearing and the conversion of IRS Cleared Contracts referencing Euroyen TIBOR into Cleared Contracts referencing Tokyo Overnight Average Rate ("TONA") (Overnight Index Swap, "OIS");
  - As of December 27th, 2024, JSCC started clearing of contracts traded on the proprietary trading system operated by Japan Alternative Market Co., Ltd.;
  - As of January 6th, 2025, JSCC added USD cash to Eligible Collaterals in the IRS Clearing Business;
  - As of March 24th, 2025, JSCC created a system connection with Tradeweb, a trade execution platform, to enable the direct submission of clearing requests from Tradeweb to JSCC;

[7] Hong Kong Exchanges and Clearing Limited ("HKEX").

- As of April 1st, 2025, JSCC abolished the class shares related to the CDS Clearing Business unit and transferred the function of the CDS Clearing Business to the Clearing Business unit related to Cash Products and Listed Derivatives.

- At **LCH**:
  - New USD futures clearing in LCH's Listed Rates service, in partnership with FMX Futures Exchange, launched with three-month ("3M") Secured Overnight Financing Rate ("SOFR") Futures in September 2024 (LCH Listed Rates Clearing Service);
  - New clearing of Mexican peso ("MXN") F-TIIE[8] OISs in November 2024 (SwapClear Clearing Options);
  - Throughout 2024, LCH implemented changes to its MXN contracts (MXN Rate Change Notice, MXN 28D-TIIE Conversion Update, LCH Conversion of Outstanding Cleared MXN 28D-TIIE Contracts), Israeli shekel ("ILS") contracts (Treatment of ILS TELBOR floating rate agreement, ILS PAI, PAA and discounting switch, LCH Conversion of Outstanding Cleared ILS TELBOR Contracts), and USD Bloomberg Short-Term Bank Yield Index ("BSBY") contracts (USD BSBY Cessation June 21st, 2024, USD BSBY Cessation May 1st, 2024, USD BSBY Cessation April 5th, 2024); in June 2024, contractual conversion of Canadian dollar ("CAD") CDOR swaps into CAD CORRA OISs also took place;
  - In September, 2024, LCH was the first CCP to introduce a clearing capability for OISs benchmarked to the South African Rand Overnight Index Average ("ZARONIA") (press release);
  - In April, 2024, LCH SA received regulatory approval to clear Bitcoin index derivatives (press release);
  - In January, 2024, LCH RepoClear SA launched its first €GCPlus green basket (press release);
  - Quantile and LCH ForexClear further developed the FX Smart Clearing service launched in November 2023 (press release);
  - LCH Ltd expanded its range of eligible non-cash collateral to include Fixed Rate Danish Covered Bonds and Additional US Mortgage Backed Securities (press release);
  - As of December 2024, LCH Ltd Equity Clear started offering clearing services for trades executed on Spotlight Stock Market (press release);
  - LCH Ltd updated its methodology determining the amount of the default fund for each of its services, default fund additional margin, and default fund contributions to also include stressed collateral and stressed liquidity elements in respect of the LCH Rates, EquityClear, ForexClear, and RepoClear services (LCH Ltd methodology update);
  - LCH Ltd enhanced its Collateral Management System ("CMS") facilitating real time concentration limit checks (CMS Enhancement);
  - LCH CDSClear became the first CCP to offer clearing for US Sovereign CDSs, quoted in EUR and following the Standard Western European Sovereign transaction type (LCH CDSClear the first CCP to offer clearing for US Sovereign CDS), while LCH RepoClear SA launched clearing for Austrian T-bills (Austrian T-bills now at LCH RepoClear SA);
  - In February 2024, LCH CDSClear announced the expansion of its client clearing services to US credit derivatives market participants (LCH CDSClear onboards BNP Paribas Securities Corporation as its first US FCM).

- At **Muqassa**:
  - Muqassa demonstrated its strength as an innovative and purpose-driven organization, achieving significant milestones that reinforced its role as a cornerstone of Saudi Arabia's capital market infrastructure. The Go-Live of the second phase of the Post-Trade Transformation Program ("PTTP") was a defining achievement, delivering numerous

[8] Tasa de Interés Interbancaria de Equilibrio ("TIIE") – Interbank Equilibrium Interest Rate.

enhancements to the post-trade structure, emphasizing efficiency, market integrity, and adherence to best practices.

- Muqassa played a pivotal role in the smooth execution of the Saudi Aramco Fully Marketed Offer ("FMO"), clearing transactions valued at Saudi riyal ("SAR") 42.1 billion. Muqassa also successfully cleared transactions valued at SAR 3.8 billion related to Saudi Telecom Company Accelerated Bookbuild Offering. This showcased its capabilities in handling large-scale, high-stakes transactions seamlessly.
- Muqassa took steps to expand its market offerings, including the approval from the Capital Market Authority ("CMA") to amend its rules and procedures, paving the way for new functionalities and greater operational efficiency.
- Muqassa received Saudi Arabian Monetary Authority ("SAMA") and CMA approvals for its recovery plan, a critical component for market stability, ensuring the organization can maintain operations during times of crisis and thereby uphold confidence in the financial system.
- Muqassa demonstrated its proactive approach to risk management by establishing a Risk Working Group to support its Risk Management Committee with strategic advisory inputs, ensuring alignment with international best practices.
- Muqassa expanded its portfolio with a range of new offerings, each designed to enhance its value proposition for clients and strengthen its role within the Group. Building on the successful launch of the Single Stock Options ("SSOs") in 2023, Muqassa extended its clearing services to cover six additional SSOs for listed companies. This move reinforced Muqassa's leadership in providing diverse derivative products tailored to market needs.
- Muqassa also made significant developments in expanding collateral options. The acceptance of non-SAR cash collateral, along with extending non-cash collateral to all listed government bonds and sukuks – while doubling the accepted percentage per security from 5% to 10% – increased overall market participation and usage of these options.
- Muqassa joined the International Swaps and Derivatives Association ("ISDA") as part of its ongoing commitment to service excellence and strategic alliances.
- Muqassa also successfully maintained the International Organization for Standardization ("ISO") 9001:2015 certification, underscoring its ongoing commitment to high-quality operational standards.

- At **NZX[9] Clearing**:
  - In December 2024, NZX Clearing introduced cash automation to streamline the cash funding processes, automate payments, reduce operational risk, and improve scalability for future growth (NZX Clearing, Publications, 2024 Annual Report).
- At **OCC[10]**:
  - OCC cleared record-breaking options volume with more than 12.2 billion contracts in 2024, a 10.6 percent increase from 2023 and the highest cleared contract volume in OCC's 51-year history. OCC cleared futures contracts increased by 7.7 percent to 60.1 million contracts.
  - Short-dated options continued to represent a meaningful percentage of all trading activity, approximately 40% of total volume with zero-day options representing approximately 20% in 2024.
  - OCC reached several development milestones in 2024 with respect to Ovation – its new clearing, risk, and data system using cloud technology, which is targeted for launch in 2025. These include completing significant portions of acceptance testing and launching external testing with market participants.

[9] New Zealand Exchange ("NZX").
[10] Options Clearing Corporation ("OCC").

- OCC enhanced its financial risk management framework by strengthening its back-testing framework for margin resources and implementing additional stress scenarios to represent extreme market moves into financial resource sufficiency monitoring.
- OCC achieved certification to ISO 22301 for its Business Continuity Management System, a testament to the strength of its operational resilience and preparedness.
- OCC began to clear for MIAX Sapphire as an additional participant exchange and began to clear options on spot Bitcoin ETFs in 2024.

- At **SGX**:
  - **Securities:**
    - **Lion-China Merchants Emerging Asia Select Index ETF**: Listed in December 2024, this ETF tracks the growth of four of Asia's most vibrant emerging economies, namely India, Malaysia, Indonesia, and Thailand. It follows the iEdge Emerging Asia Select 50 Index created by SGX Index Edge.
    - **Lion-OCBC[11] Securities Asia-Pacific ("APAC") Financials Dividend Plus ETF**: Listed in May 2024, this is the world's first ETF tracking the APAC financial sector. It follows the iEdge APAC Financials Dividend Plus Index, which includes 30 of the largest financial institutions in the region with consistently high and sustainable dividend payouts.
    - **Phillip-China Universal MSCI China A50 Connect ETF**: Listed in March 2024, this ETF provides investors exposure to 50 large and mid-cap stocks across various industries listed in Shanghai and Shenzhen. This product adds to the growing suite of China-focused equity funds under the SSE[12]-SGX ETF Link.
    - **Lion-Nomura Japan Active ETF:** Listed in January 2024, this is the first active ETF in Singapore and is managed by Lion Global Investors ("LGI") and Nomura Asset Management Singapore. This pioneering ETF provides investors exposure to a diversified portfolio of 50 to 100 Japanese companies, tapping into the strong recovery witnessed in the Japan stock market in the past year.
    - **Singapore Depository Receipts ("SDRs")** on Hong Kong ("HK") Stocks: SGX expanded its SDR offerings in October 2024 with the addition of Hongkong and Shanghai Banking Corporation ("HSBC"), Bank of China ("BoC"), BYD, Alibaba and Tencent SDRs. As of today, there are eight HK SDRs (three launched in early 2025 – Ping An, Meituan, and Xiaomi), covering over 40% of the Hang Seng Index across key sectors like financials, technology, and consumer. SDRs allow investors to trade shares of foreign companies on SGX in Singapore dollars.
    - **US Underlying Structured Certificates**: Societe Generale introduced Structured Certificates linked to the US Magnificent Seven stocks listed on SGX in December 2024. The Structured Certificates offer yield enhancement for investors expecting rangebound performance of the underlying assets. These are available for trading during Asian hours.
    - **US Underlying Daily Leverage Certificates ("DLCs")**: In October 2024, SGX Securities introduced DLCs linked to the US Magnificent Seven stocks. Issued by Societe Generale, these DLCs offer three times long or short exposure to single US stocks like Apple, Nvidia, Tesla, Microsoft, Alphabet (Google), Amazon, and Meta Platforms.
  - **Derivatives:**
    - **Interest Rate Derivatives (SORA and TONA Futures)**: Launched in July 2024, these futures are linked to the Singapore Overnight Rate Average ("SORA") and

[11] Oversea-Chinese Banking Corporation Limited ("OCBC").
[12] Shanghai Stock Exchange ("SSE").

TONA as global investors seek more transparent and cost-effective tools to hedge and trade fluctuations in interest rates.

- **Freight Derivatives (Baltic Supramax Futures and Options)**: Launched in October 2024, the Baltic Supramax Time Charter Average (11 Routes) futures and options contracts enable ship owners, charterers, and other market participants to hedge against fluctuations in Supramax dry bulk freight rates.

1.2 CCP GLOBAL ENGAGEMENT IN STANDARDS AND REGULATIONS DEVELOPMENTS IN 2024

In 2024, CCPs remained the subject of on-going developments of international standards and local regulations. CCPs have continued to contribute to financial markets' stability, efficiency, and integrity as described in the following sections of the Report.[13] However, markets are continually evolving and as such, CCPs have remained vigilant in adapting to evolving market structures and technological innovations and continue to provide robust risk management practices and successfully perform in their role as a risk manager. While the Principles for Financial Market Infrastructures[14] ("PFMIs"), adopted by the Committee on Payment and Settlement Systems ("CPSS") (renamed as Committee on Payments and Market Infrastructures ("CPMI") in 2014) and by the International Organization of Securities Commissions ("IOSCO") in 2012, continue to be the foundation of the global standards for CCPs and other Financial Market Infrastructures ("FMIs"), [15] in 2024, international standard-setting bodies ("ISSBs") and local regulators continued to bring forward various topics and proposals with respect to centrally cleared markets.

The following list presents some examples of market consultations to which CCP Global responded in 2024:[16]

- The Regulatory Capital Rule: Large Banking Organizations and Banking Organizations With Significant Trading Activity (the "Basel III Endgame Proposal") issued by the Office of the Comptroller of the Currency, the Board of Governors of the Federal Reserve System ("the Federal Reserve"), and the Federal Deposit Insurance Corporation ("FDIC") (January 2024);
- The Regulatory Capital Rule: Risk-Based Capital Surcharges for Global Systemically Important Bank Holding Companies; Systemic Risk Report (FR Y-15) (the "GSIB Surcharges Proposal") issued by the Federal Reserve (January 2024);
- The Notice of Proposed Rulemaking on Investment of Customer Funds by Futures Commission Merchants and Derivatives Clearing Organizations proposed by the Commodity Futures Trading Commission ("the CFTC") (January 2024);
- The Notice of Proposed Rulemaking on Protection of Clearing Member Funds Held by Derivatives Clearing Organizations proposed by the CFTC (March 2024);
- The Consultative report on Transparency and responsiveness of initial margin in centrally cleared markets – review and policy proposals issued by the Basel Committee on Banking Supervision ("BCBS"), CPMI, and IOSCO (April 2024);
- The Report on Streamlining variation margin in centrally cleared markets – examples of effective practices issued by CPMI and IOSCO (May 2024);
- Consultation report on Liquidity Preparedness for Margin and Collateral Calls issued by the Financial Stability Board ("FSB") (June 2024);

[13] Please refer to CCP Global's 2022 Annual Markets Review for the CCP model description.
[14] CPSS, IOSCO, Principles for Financial Market Infrastructures (April 2012).
[15] Please find more background to PFMIs and resultant local regulations in CCP Global's 2022 Annual Markets Review, at p. 30.
[16] CCP Global Submissions.

- Regulation (EU) 2022/2554 of the European Parliament and of the Council of 14 December 2022 on digital operational resilience for the financial sector and amending Regulations (EC) No 1060/2009, (EU) No 648/2012, (EU) No 600/2014, (EU) No 909/2014 and (EU) 2016/10111 ("EU DORA") (December 2024);
- The Consultation report on Leverage in Non-bank Financial Intermediation issued by the FSB (February 2025).

The work undertaken by the ISSBs and local policy-makers in 2024 continued to be focused on non-bank financial intermediation ("NBFI"), CCPs' recovery and resolution frameworks, operational risk and resilience, including cybersecurity, margining practices, third-party risk management, the extension of the scope of the clearing obligation, CCPs' governance, shortening of settlement cycles, and establishing a regulatory framework for crypto and digital assets and decentralized finance ("DeFi"). Some of these topics are elaborated on in the following sections.

In addition, CCP Global published a primer paper on the topic of portability in October 2024,[17] highlighting various factors that contribute to enhancing the likelihood of successful porting at a CCP; these include the large role regulatory regimes play in shaping the way a CCP approaches the porting process, which makes a standardized approach across CCPs difficult to achieve, as well as the importance of pre-arranging backup CMs and selecting account structures that favor portability.

1.3 ISSBS' WORK RELATED TO CCPS

1.3.1 ISSBs' work programmes for 2024

FSB was the first standard setter to publish its work programme for 2024,[18] which defined its priorities as follows: (1) Supporting global cooperation on financial stability; (2) Completing resolution reforms; (3) Enhancing the resilience of NBFI; (4) Enhancing cross-border payments; (5) Harnessing the benefits of digital innovation while containing its risks; (6) Enhancing cyber and operational resilience; and (7) Addressing financial risks from climate change.

IOSCO published its two-year Work Program in April 2023 which was subsequently updated for 2024 one year later.[19] The revised 2024 Workplan continued to be focused on 5 areas: (1) Protecting investors; (2) Addressing new risks in sustainability and fintech; (3) Strengthening financial resilience; (4) Supporting market effectiveness; and (5) Promoting regulatory cooperation and effectiveness. IOSCO also envisaged establishment of new networks for its members, including a CCP Network for CCP supervisors, serving as a forum for exchanging ideas and experiences. The CCP Network should commence its activity in 2025.

In May 2024, CPMI also published its work programme and strategic priorities for 2024-2025.[20] Its key themes were classified into the following topic groups: (1) Risk management of FMIs; (2) Enhancement of cross-border payments; and (3) Digital innovation in payments, clearing, and settlement.

As can be seen above and in more detail of each of these work programmes, there are areas of common interest across global standard-setters, i.e. FSB, IOSCO, and CPMI, and where topics are overlapping, the ISSBs tend to work together towards common standards or consistent interpretation of the existing recommendations. The key areas of ISSBs' work in 2024 in relation to CCPs related to margining practices (covered in more detail in section 1.7) and Non-Default Losses ("NDLs") (also called General Business Losses ("GBLs")) of FMIs. The latter has been subject to an on-going discussion within CPMI and IOSCO for several years now. It started off with the CPMI and IOSCO discussion paper on CCP practices to address NDLs of

[17] CCP Global Primer on Portability (October 2024).
[18] FSB, 2024 Work programme (January 2024), Link.
[19] IOSCO, 2024 Workplan (April 2024), Link.
[20] CPMI, Work programme (May 2024), Link.

August 2022,[21] followed by the CPMI and IOSCO report on current CCP practices to address NDLs of August 2023 (so called "NDL Stage 1 Report").[22] CPMI and IOSCO have continued working on the topic and extended the scope of the analysis to other types of FMIs. CPMI and IOSCO have been monitoring the implementation of PFMIs, including a Level 3 assessment of PFMI Principle 15 relating to General Business Risk. A new consultation on FMI's management of GBLs/NDLs is expected in the second half of 2025.

As evidenced in the FSB's Global Monitoring Report on Non-Bank Financial Intermediation from 2024,[23] the NBFI sector is growing and as such, it is important that ISSBs and local regulators address any vulnerabilities stemming from this area of the market. The FSB's consultations of 2024 related to NBFI focused on (1) liquidity preparedness for margin and collateral calls[24] and (2) leverage in NBFI and the resultant financial stability risks[25]. While leverage, liquidity, interconnectedness, concentration, crowdedness, and other vulnerabilities of NBFI need to be carefully analysed and regulated, the need for increased transparency and visibility into this sector of the market is paramount. Access to appropriate and meaningful data related to NBFI activities, exposures, and concentration levels would enable authorities to continue to monitor and mitigate systemic risk, while also supporting CCPs in ongoing risk management practices.

ISSBs are also closely analysing climate change-related risks, including sharing views and expertise regarding climate-related risks to explore actions various types of FMIs and authorities are taking to address these risks. In order to share this information, explore to what extent the PFMIs can be utilised to identify and manage these risks, and to agree on areas for further work, CPMI and IOSCO organised two virtual workshops in H1 2024 dedicated to the topic of climate risks.[26] The findings from the workshops combined with subsequent discussions among the authorities will feed into further policy work at the international level. In addition to that, FSB prepared a progress report on climate-related disclosures,[27] according to which a significant progress has been achieved in the last couple of years in setting globally consistent and useful disclosure standards. Notwithstanding that, more progress is viewed as necessary.

1.3.2 CCP Global participation in the work of IOSCO's AMCC

IOSCO's ongoing work is supported by its many committees, including the Affiliate Members Consultative Committee ("AMCC"),[28] of which CCP Global is a member. The membership structure of the AMCC has changed significantly throughout the years, initially being comprised of mainly self-regulatory organizations, later joined by exchange groups, and finally extended to include trade associations and some individual CCPs. With the structure growing, the AMCC is able to provide IOSCO with an expertise and industry views which help to better inform the IOSCO policy making.

The AMCC's objectives are to share experiences and enhance cooperation among its members but also to provide input into the IOSCO policy and standard-setting work. The Committee has its own workstreams, including on FinTech and index providers/asset managers, and establishes task forces to explore topics relevant for AMCC members and IOSCO more broadly (e.g., on AI, cybersecurity, sustainable finance). Throughout 2024, CCP Global was engaged in many discussions at the AMCC and contributed to its several streams of work, including through provision of notes or comments feeding into the 2024 AMCC Market Fragmentation Report and the IOSCO Risk Outlook 2024 Report.

[21] CPMI, IOSCO, A discussion paper on central counterparty practices to address non-default losses (August 2022), Link; CCP Global responded to this discussion paper through the following submission of October 2022: Link.
[22] CPMI, IOSCO, Report on current central counterparty practices to address non-default losses (August 2023), Link.
[23] FSB, Global Monitoring Report on Non-Bank Financial Intermediation (December 2024): Link.
[24] FSB, Liquidity Preparedness for Margin and Collateral Calls; Consultation report (April 2024): Link.
[25] FSB, Leverage in Non-bank Financial Intermediation; Consultation report (December 2024): Link; IOSCO has been actively contributing to the FSB working group undertaking this policy work.
[26] Summary of CPMI-IOSCO workshops on climate risks for financial market infrastructures (December 2024): Link.
[27] FSB, Achieving Consistent and Comparable Climate-related Disclosures; 2024 Progress report (November 2024): Link.
[28] IOSCO, AMCC: Link.

1.4 CCP RECOVERY AND RESOLUTION REGIMES

CCP recovery is the process for addressing default and non-default events with the aim to restore the CCP's financial soundness and to enable the continuation of its critical functions. CCP resolution occurs when its authorities conclude that the CCP in distress should not go through normal insolvency proceedings as it would cause financial instability. For over a decade, CPMI, IOSCO, and FSB have worked on and established a robust set of recommendations on CCP recovery (Link) and resolution (Link).

1.4.1 FSB Final Report on Financial Resources and Tools for CCP Resolution and FSB 2024 Resolution Report

While CPMI and IOSCO focus on standards for CCPs' resilience and recovery, the FSB is leading on the topic of CCP resolution where the FSB Resolution Steering Group ("ReSG") plays a particular role. ReSG had been analysing resolution regimes for systemically important CCPs for several years. This work resulted in a consultation report on financial resources and tools for CCP resolution in 2023[29] and was concluded in 2024 when the FSB published its final report.[30] The latter led to a revision of the FSB Key Attributes of Effective Resolution Regimes for Financial Institutions[31] and an update to the FSB Guidance on Financial Resources to Support CCP Resolution and on the Treatment of CCP Equity in Resolution[32]. The FSB agreed that CCP resolution authorities should have at their disposal resources and/or tools dedicated only to CCP resolution should it ever take place. The "toolbox approach" stipulates that every resolution authority should select at least one resource or tool from the following:

1) Bail-in bonds,
2) Resolution funds (regional/national/supranational),
3) Resolution-specific insurance,
4) Resolution-specific third-party contractual support,
5) Resolution cash calls,
6) Statutory or contractual Variation Margin Gains Haircutting ("VMGH") for resolution,
7) Equity in a first-loss position in resolution.

CCPs have voiced reservations related to some aspects of this workstream, calling for more recognition of the enormous amount of work that has already been done by the FSB and the other ISSBs on CCPs' resilience, recovery, and resolution, pointing to CCPs' overall successful performance, both in supervisory stress tests and the FSB's extreme and implausible scenario analysis, as well as in real market conditions, including in challenging times. Some concerns were also related to the potential negative impact of specific tools identified by the workstream, in particular bail-in bonds, resolution fund, insurance, and equity use, on central clearing and on active and constructive participation of CMs in the default management or recovery. Having said that, CCPs appreciate that there is certain flexibility embedded in the new standard as they believe that resolution authorities should be allowed to continue to employ practices appropriate for their markets.[33]

Jurisdictions which are in scope of the standard should make transparent their approach to calibrating one or more of the chosen resolution tools or resources. According to the FSB 2024 Resolution Report[34] which addresses banks, insurers, and CCPs, there are currently 14 CCPs which have been identified as systemically important in more than one jurisdiction (an increase by one CCP compared to 2023). The 2024 Resolution Report also informed that authorities have begun implementing the new standard, thus disclosures of

[29] FSB, Financial Resources and Tools for Central Counterparty Resolution: Consultation report (September 2023): Link.
[30] FSB, Final Report, Financial Resources and Tools for Central Counterparty Resolution (April 2024): Link.
[31] FSB, Key Attributes of Effective Resolution Regimes for Financial Institutions (April 2024): Link.
[32] FSB, Guidance on Financial Resources to Support CCP Resolution and on the Treatment of CCP Equity in Resolution (April 2024): Link.
[33] The CCP Global response to the FSB consultation report on financial resources and tools for CCP resolution of 2023 can be found here: Link.
[34] FSB 2024 Resolution Report; From Lessons to Action: Enhancing Resolution Preparedness (December 2024): Link.

resolution authorities regarding the calibration of the selected tools or resources are expected in a near future.

1.4.2 Recovery, wind-down, and resolution developments in major jurisdictions

Additional work on CCP recovery and resolution frameworks was conducted in 2024 also by some local regulators, including the U.S. Commissions: the CFTC and the Securities and Exchange Commission ("SEC"). After consulting on the proposed rule on covered clearing agency ("CCA") resilience and recovery and wind-down plans in 2023,[35] the SEC finalised the rule in 2024.[36] The SEC rule provides requirements which need to be met by CCAs' recovery and wind-down plans ("RWPs"), including those related to service providers of core services, scenarios preventing CCAs from being able to provide their core services, criteria triggering the implementation of RWPs, rules, polices, and procedures that CCAs would rely on in a recovery or orderly wind-down, and procedures for annual testing of RWPs. Each CCA's proposed rule changes and advance notices required under the SEC's rule must be effective by December 15th, 2025.

The CFTC consulted on its proposed rulemaking on Derivatives Clearing Organizations ("DCOs") recovery and orderly wind-down plans[37] at a similar time as the SEC (i.e., in 2023), however, has not yet finalised its rulemaking. The new US administration is taking a closer look at this proposal and is comparing the CFTC proposed provisions vis-à-vis the SEC rule, in particular in light of the increasing number of US CCPs pursuing dual recognition.

The Bank of England ("the Bank", "BoE") has been also working on the topic of CCP recovery and resolution, bearing in mind its new powers following the implementation of the Financial Services and Markets Act 2023 ("FSMA 2023").[38] The new regime for resolving CCPs in the United Kingdom ("UK"), which came into effect in December 2023, provides His Majesty's Treasury ("HMT") and the Bank as the UK CCP resolution authority with powers and tools, such as cash calls, VMGH, and tear-up. In line with the FSMA 2023, the HMT produced Central Counterparties Special Resolution Regime Code of Practice,[39] with the objective of providing guidance and clarity on how the different powers within the regime can be used. At the same time, in 2024, the Bank conducted public consultations and eventually issued statements of policy regarding (1) its approach to determining commercially reasonable payments to clearing members whose contracts are subject to a statutory tear up in CCP resolution[40] and (2) its power to direct a central counterparty to address impediments to resolvability.[41]

1.5 REGULATORY DEVELOPMENTS IMPACTING CENTRAL CLEARING

1.5.1 US Treasury Market clearing mandate

The SEC final rule requiring central clearing of US Treasury ("UST") transactions,[42] which will require central clearing of certain UST securities secondary cash market transactions and repurchase and reverse repurchase transactions, was adopted in December 2023, originally with effective dates of 31 December 2025 and 30 June 2026, respectively. Under the new US administration, however, the SEC decided that the industry would benefit from more time for preparation and extended the compliance dates by one year – to 31 December 2026 for eligible cash market transactions and 30 June 2027 for eligible repo market transactions. The US push for the central clearing mandate for UST transactions has encouraged discussions regarding similar provisions in some other jurisdictions. A deep analysis of the topic is conducted in the EU,

[35] SEC, Proposed rule, Covered Clearing Agency Resilience and Recovery and Wind-Down Plans (May 2023): Link.
[36] SEC, Final rule, Covered Clearing Agency Resilience and Recovery and Wind-Down Plans (October 2024): Link.
[37] CFTC, Notice of Proposed Rulemaking, Derivatives Clearing Organizations Recovery and Orderly Wind-Down Plans; Information for Resolution Planning (July 2023): Link.
[38] Financial Services and Markets Act 2023: Link.
[39] HMT, Financial Services and Markets Act 2023: Central Counterparties Special Resolution Regime Code of Practice (January 2024): Link.
[40] The Bank of England's approach to determining commercially reasonable payments to clearing members whose contracts are subject to a statutory tear up in CCP resolution, Statement of policy (December 2024): Link.
[41] The Bank of England's power to direct a central counterparty to address impediments to resolvability, Statement of policy (December 2024): Link.
[42] SEC, Final rule, Standards for Covered Clearing Agencies for U.S. Treasury Securities and Application of the Broker-Dealer Customer Protection Rule With Respect to U.S. Treasury Securities (December 2023): Link.

where the government bond market is very heterogenous, with 27 members states and different actors involved across the board. An example of such an analysis can be found in the European Systemic Risk Board's ("ESRB") paper where the description of the structure of the EU government bond cash and repo markets is provided and which encourages introduction of more incentives for central clearing of these instruments.[43]

1.5.2 US Basel III Endgame proposal and Basel III implementation in other major jurisdictions

After a promising year in 2023 which seemed to be leading to the finalisation of the implementation of the Basel III framework, 2024 saw a considerable slowing-down of the process. The need to complete the Basel III reforms seemed particularly urgent after the banking crisis observed in 2023[44]. In the US, the three federal banking agencies[45] consulted[46] with the industry on how the outstanding parts of the Basel package should be implemented. As a result of a strong pushback (especially from banks' side), the agencies decided to revisit the proposals[47] and were planning to submit a new package for another consultation round. Under the new administration, it appears that the Basel III Endgame proposal in the US will be revisited again. With the delay in implementation in the US, other major jurisdictions are also considering or have already decided to effectuate delays in implementation of the final Basel III framework components. For example, the UK's Prudential Regulation Authority ("PRA") decided to delay the implementation of Basel III in the UK by one year until 1 January 2027.[48] Also the EU, driven by the objective to maintain a level playing field for the European banks, decided to defer the application of the Fundamental Review of the Trading Book ("FRTB") by one year, to January 2026.[49]

1.6 CCP GLOBAL INTERNATIONAL DEFAULT SIMULATION – CIDS

CCP Global coordinated the first industry-led multi-CCP default simulation in 2023.[50] Multiple international regulators were consulted and CCP Global and its members were highly appreciative of their collaboration and further guidance.

The exercise aimed to achieve three objectives:

1. To test the operational viability of and the operational stress faced by CCPs and CMs in the event of a default by a common CM facing multiple CCPs, and the interplay of actions by multiple CCPs and regulators when multiple CCPs were conducting the default management process ("DMP") in a similar period of time.
2. To provide an opportunity to share default management best practices among CCPs through the discussion and the post-exercise workshop.
3. To identify any potential areas for follow-up work and highlight fire drill insights to ISSBs and regulators, demonstrating industry efforts and CCPs' critical role in supporting financial market stability.

During the exercise, participating CCPs conducted their respective default simulations under a high-level common narrative. A hypothetical defaulting CM, whose name was A.C.M.E. ("A Clearing Member Everywhere"), was assumed to be one of the 5 largest CMs as defined by each CCP. CCPs defined their own scenarios and created the defaulting CM's portfolio(s), with the asset classes and scope they would like to include into the simulation. During the drill, CCPs followed their own internal DMP. The aspects tested by each CCP covered their core default management actions, including portfolio evaluation, simulating risk

[43] ESRB, A system-wide approach to macroprudential policy (November 2024): Link.
[44] Basel Committee on Banking Supervision, Report on the 2023 banking turmoil (October 2023)
[45] These agencies were: the Office of the Comptroller of the Currency, the Board of Governors of the Federal Reserve System, and the Federal Deposit Insurance Corporation.
[46] Agencies request comment on proposed rules to strengthen capital requirements for large banks (27 July 2023)
[4747] See the speech of Michael S. Barr, The Next Steps on Capital (September 2024): Link
[48] The PRA announces a delay to the implementation of Basel 3.1 (January 2025): Link.
[49] Commission proposes to postpone by one year the market risk prudential requirements under Basel III in the EU (July 2024): Link.
[50] CCP Global, Default Simulation Exercises by CCPs

reduction and re-establishing a matched book (trading, hedging, and/or auctions), communication channels, and any relevant technical tools. The CIDS exercise assumed the hypothetical CM defaulted during the weekend of 12 November and CCPs acted accordingly to trigger their DMP. All participating CCPs completed their DMP by 22 November 2023.

The result of the exercise was positive. Based on the post-exercise survey prepared by CCP Global to the participating CCPs, the participation rates from CMs and clients, collectively participants, were similar to those of individual default simulation exercises and previous multi-CCP fire drill exercises if applicable, in a few cases even better. Participating CCPs reported that they were able to close out the positions of A.C.M.E. successfully. Notably, most CCPs did not receive requests from participants to extend the bidding windows, indicating that the overlapping of bidding windows did not appear to pose operational challenges in the 2023 CIDS exercise. This was mainly attributed to the diverse nature of auctions across asset classes and markets, aligning with the comments received from participants. CCP Global hosted the CIDS workshop meetings in Madrid on March 20th-21st, 2024 as a forum for CCPs, authorities, and market participants to discuss such potential improvements related to default management practices (feasibilities and potential follow-up actions) and industry best practices. The key takeaways, along with the written feedback received from CCPs and participants, are included in the CIDS report summary published on May 21st, 2024.[51]

The 2025 CIDS Exercise will once again kick off this year with the default of the fictional A.C.M.E. on November 3rd, 2025 and run until the end of the DMP as planned by the CCPs. CCP Global is providing this guidance, in consultation with regulators and CCPG members, to ensure that all CCPs and clearing participants approach the drill in a consistent manner.

A porting module for optional inclusion has been specifically requested by the CIDS co-lead regulators for the 2025 exercise. During this module, CCPs may request relevant CMs to accommodate porting of clients from the defaulted CM, in order to test prospective acquiring CMs' ability to do a full risk assessment of the prospective new clients, while also testing the relevant CCPs' (operational) processes linked to porting.

1.7 CCP MARGINING PRACTICES

Margining practices remain a key topic in the ISSBs' work programs for policy recommendations. Since the market turmoil seen in March 2020, considered the most significant stress test of resilience of financial markets since the Global Financial Crisis ("GFC"), there has been abundance of attention from the markets devoted to CCP margining practices, specifically initial margin ("IM"). Despite the severe market volatility, CCPs remained robust and resilient in their roles to safeguard financial market stability. It is important to underscore that variation margin ("VM") payments far outpaced the IM changes as noted in the Review of margining practices, published by BCBS, CPMI, and IOSCO in September 2022.[52]

In January 2024, CPMI-IOSCO published a consultative report on transparency and responsiveness of IM in centrally cleared markets, pursuant to the review of margining practices work in 2022. The report outlined ten policy proposals which aim to increase the resilience of the centrally cleared ecosystem by attempting to improve market participants' understanding of IM calculations and potential future margin requirements, covering CCP simulation tools and disclosures, measurements of IM responsiveness, governance frameworks and margin model overrides, and CM transparency. A follow-up report was published in January 2025 which further developed the proposals, with the follow-up work expected from CPMI-IOSCO in mid-2025.

With that said, it is important to note that CCPs are already very transparent and provide a wide range of data and information regarding their risk management practices to their CMs and to the public. Public

[51] 2023 CCP Global International Default Simulation (CIDS) Exercise Report (21 May 2024).
[52] BCBS-CPMI-IOSCO, Review of margining practices (29 September 2022).

Quantitative Disclosures ("PQDs")[53] of CCPs are just one way that CCPs provide transparency to market participants. CCP Global plays a crucial role in promoting this transparency through the standardized PQD template, as well as our work on the CCP Global PQD Newsflash, which provides an overview of the risk management provided by CCPs across the globe and complements public statistics, such as the Bank for International Settlements ("BIS") derivatives statistics. The PQDs offer an overview of the key statistics, scale and nature of CCP risk management from a global perspective and allow market participants to gain a clearer view of the CCP ecosystem, while also granting a closer look at the margining practices of CCPs around the globe. CCP Global's work on continuing to develop the PQDs, and margin transparency in general, is a benefit to the wider cleared world, as improved margin transparency allows market participants to better assess the risk of CCPs, the overall health of the financial system, and the effectiveness of risk management practices.

1.8 CCP SUPERVISORY STRESS TESTS

Given their central role in the global financial system, resilience of CCPs is paramount for financial stability. As part of the prudential requirements, CCPs are required to conduct daily stress tests that focus on their own clearing services and business activities of the specific markets they serve.

Building on top of the individual stress tests, supervisory stress tests ("SSTs") are an important tool to create a well-informed and comprehensive picture of how the default of a CM may impact CCPs throughout the system. These exercises inform regulators of CCPs' ability to absorb default losses and maintain liquidity resources in extreme but plausible market conditions. These exercises also allow supervising authorities to identify any potential areas of follow-up work.

In July 2024, the CFTC published the results of their fourth SST (previous tests occurred in 2016, 2017, and 2019). The 2024 SST was a reverse stress test, meaning it began with a predetermined end point at which prefunded resources are consumed, and worked backward to find stresses that could reach that point. Among other findings, the 2024 report concluded all individual DCOs hold sufficient financial resources to withstand many extreme and often implausible price shocks, along with multiple defaults of their CMs. In some cases, the DCOs tested can withstand the default of all CMs that have losses resulting from highly implausible price shocks.

In November 2024, the BoE published the results of their third public UK CCP SST, which centered on the credit resilience of UK CCPs. Unlike previous exercises, the 2024 CCP SST did not include consideration of CCPs' liquidity resilience or the impact on CCPs' members and clients; instead, the focus of the exercise was on credit and concentration stress tests, as well as reverse stress and sensitivity testing. In the core credit stress test, which did not include the incremental costs of liquidating concentrated positions, the BoE found that all the UK CCPs have adequate pre-funded resources to cover a severe stress scenario and the default of the two largest CMs, although in doing so drew from a greater amount of the mutualized resources than in previous exercises; this was due to the inclusion of substantial shocks to products with large and concentrated positions.

1.9 SETTLEMENT CYCLE

Equity and bond transactions are subject to a trade settlement cycle, which defines the timeline for the exchange of securities between trading parties. This settlement cycle is a key to the proper functioning of the international markets, despite the non-standardized settlement times set in financial jurisdictions around the world. The lack of standardization is in part due to both the benefits and drawbacks found at any settlement time: the credit, market, and liquidity risk mitigation that comes with a shorter settlement cycle may be offset by increased operational risks, such as those arising from the time constraints of trading

[53] CPMI-IOSCO: Public Quantitative Disclosure Standards for Central Counterparties (February 2015).

on opposite ends of the globe; the increased efficiency and reduction of required margin for next day settlement also means a reduced settlement window and a potential increase of pressure on technology.

With several countries in the Americas recently shortening the settlement time of securities and/or bonds to T+1, and several other countries around the world already at the shortened settlement period, CCP Global released a primer paper which explored the key points, challenges, and other observations from the recent discussion on the seemingly trending global shortening of the settlement cycle, including three main takeaways:

1. A move to T+1 is not dependent on any one technological approach; some relatively new approaches may be slow (e.g. true distributed checking), while other "older" tech has been used for T+1 (or even T+0) settlement for years. Automation is advantageous if not a critical necessity as settlement cycles compress, but a *particular* technology is not a requisite or a precondition to a particular cycle. However, general updates to existing systems may be required for the change.
2. A shorter settlement cycle concludes trades faster, potentially reducing credit and market risk; however, a shorter settlement cycle also reduces operational leeway and necessitates greater preparedness on participants to position liquidity and securities, potentially increasing operational and liquidity risk. There is always a trade-off and faster settlement means more liquidity pressure.
3. Settlement across time zones already reduces the available time to resolve issues, such as the pre-positioning of liquidity and securities; this would only be exacerbated by a move to a shorter settlement cycle. This is particularly pronounced for currencies with what may be conceived as inconvenient time zones, opening times or even exchange controls; it has been noted that several jurisdictions in the eastern APAC region are not planning the switch to T+1 for the next several years, and this is heavily driven by the time zone factor facing these countries.

The shift to a T+1 settlement cycle marks a significant advance toward a more agile and responsive capital market. A continued implementation of the shortened settlement cycle over the next few years would see wider implementation of T+1 settlement in Europe, the Middle East, and Africa ("EMEA") by the end of 2027, with certain countries in the eastern region of APAC possibly becoming the last to move. While it does come with its challenges, especially for legacy platforms, it also paves the way for the exploration of even shorter settlement cycles, potentially leading to standardized same-day settlement of T+0. This represents a pivotal moment in the evolution of capital markets, and market participants must adapt their operations and strategies to thrive in this accelerated settlement landscape.

1.10 CCP GLOBAL CYBER RESILIENCE EXERCISE ("CRE")

As part of the CCP Global Operations Working Committee's ("OWC") plan for an operational resilience exercise amongst CCPs, on September 17th, 2024, CCP Global successfully held a coordinated cyber tabletop exercise with nineteen participating CCPs worldwide across the CCP Global membership.[54]

The event brought together CCPs to strengthen the overall resilience against cyber threats and to better align the typical response, recovery, and reconnection ("3Rs principles") to an impacted CM. The purpose of the CRE tabletop was to highlight strengths in CCP's operational readiness and business continuity during a particular material cyber event, while also sharing best practices amongst the CCP Global membership.

In the run up to the tabletop, participants engaged in a realistic scenario designed by the CCP Global CRE Working Group and OWC which simulated a specific type of potential cyber-attack on a CM. The CRE Working Group focused on communication strategies, incident response coordination, decision-making processes under pressure, and reconnection to the impacted CM.

[54] CCPs participate in an international Cyber Resilience Exercise ("CCP Global CRE")

The overall insights gained from this exercise will enhance the global financial sector's preparedness, ability to respond to evolving cyber threats, and make improvements to the CCP to CM reconnection phase. The exercise also provided a valuable opportunity for participants to benchmark their practices and collaborate on improving cybersecurity and response measures.

Following the CRE, CCP Global convened during the Special General Meeting in Chicago in November 2024 to have a post-CRE discussion amongst the membership. CCPs aligned on best practices to further strengthen the collective resilience against cyber threats. In parallel, on November 21st, 2024, the Federal Reserve Bank of Chicago's Financial Markets Group ("FMG") and CCP Global brought together around 50 participants from FMIs, central banks, regulators, and industry associations for a half-day seminar on Operational Resilience in Exchange Traded and Cleared Markets. The seminar was held under the Chatham House Rule, with no press in attendance.[55]

[55] FMG & CCP Global Operational Resilience Seminar: Event Summary.

2. CCP DATA AND RESILIENCE IN 2024

2.1 CCP TRANSPARENCY

Transparency is a cornerstone of global financial market stability, fostering trust, reducing systemic risks, and enhancing market integrity. In the time since the 2008 financial crisis, the role of CCPs in improving transparency has been instrumental in strengthening financial market resilience. By providing clear, standardized, and timely disclosures on risk management practices, margin requirements, and financial resources, CCPs enhance market participants' understanding of potential exposures and systemic interdependencies.

CCPs transparency provides market participants with the information necessary to assess and ensure that risk management frameworks are well maintained, and that CMs and regulators can assess financial stability. This has been further reinforced by international regulatory initiatives, particularly those led by CPMI-IOSCO.

IOSCO, in collaboration with CPMI, developed the PFMIs, a set of global standards designed to ensure the safety and efficiency of FMIs. A key component of these principles is the requirement for CCPs to publish PQDs, providing market participants with standardized data on credit risk, liquidity, margin, and stress-testing; in addition, the public qualitative disclosures[56] provide information on stress testing frameworks, margin methodologies, and overall risk management practices. These disclosures enable investors, regulators, CMs, and other market participants to assess CCP's financial health and operational robustness.

Throughout the years, CCPs have provided additional resources to help market participants understand and access the comprehensive list of documents to support CCP transparency. The "Quick Access Transparency Links" ("QATL") document was one of the updates from CCP Global to further enhance clearing participants' existing access to the CCPs' disclosures and other frequently requested information.

By enforcing stringent transparency requirements and aligning with international best practices, CCPs play a pivotal role in reinforcing financial stability, reducing systemic risk, and ensuring the smooth functioning of global markets. As transparency continues to evolve, CCPs remain at the forefront of fostering confidence and trust in an increasingly interconnected financial system. The following sections present a selection of the most important PQDs with analysis for 2024.

CCP PQDs

In 2015, CPMI-IOSCO published PQD standards for CCPs as an important component of the set of PFMI public disclosure requirements, while also encouraging CCPs to use a common PQD template. CCP Global supports CPMI-IOSCO's efforts to improve the level of standardization and transparency of CCP disclosures.

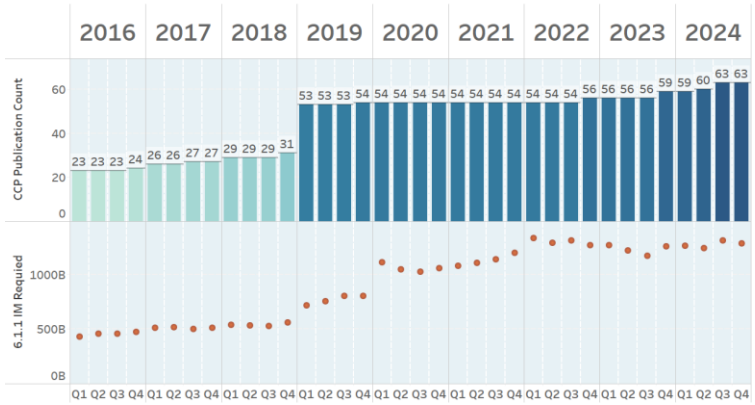
CCPG PQD Publication Timeline – Two months lag after the quarter-end

In light of CCP Global's ongoing market engagement with CCP Global members, global market participants, and regulators, a change in the PQD publication timeline from three to two months after the quarter-end was made in May 2022 which has been recognised as a positive step to aiding market participants' ability to obtain PQD data more quickly, without compromising the CCPs' requirements for data accuracy, internal approvals, and, in some cases, regulatory approvals.

This is part of CCP Global's ongoing efforts with the industry to enhance and accommodate market views to ensure better risk management practices.

[56] CPMI,IOSCO, PFMIs: Disclosure framework and Assessment Methodology (December 2012).

2.1.1 CCP PQD TEMPLATE PUBLICATION RATE



The chart opposite (CCP PQD Template Adoption Rate vs. 6.1.1 (IM Required): 2016 - 2024) provides a summary of the PQD template adoption from 2016 Q1 to 2024 Q4.

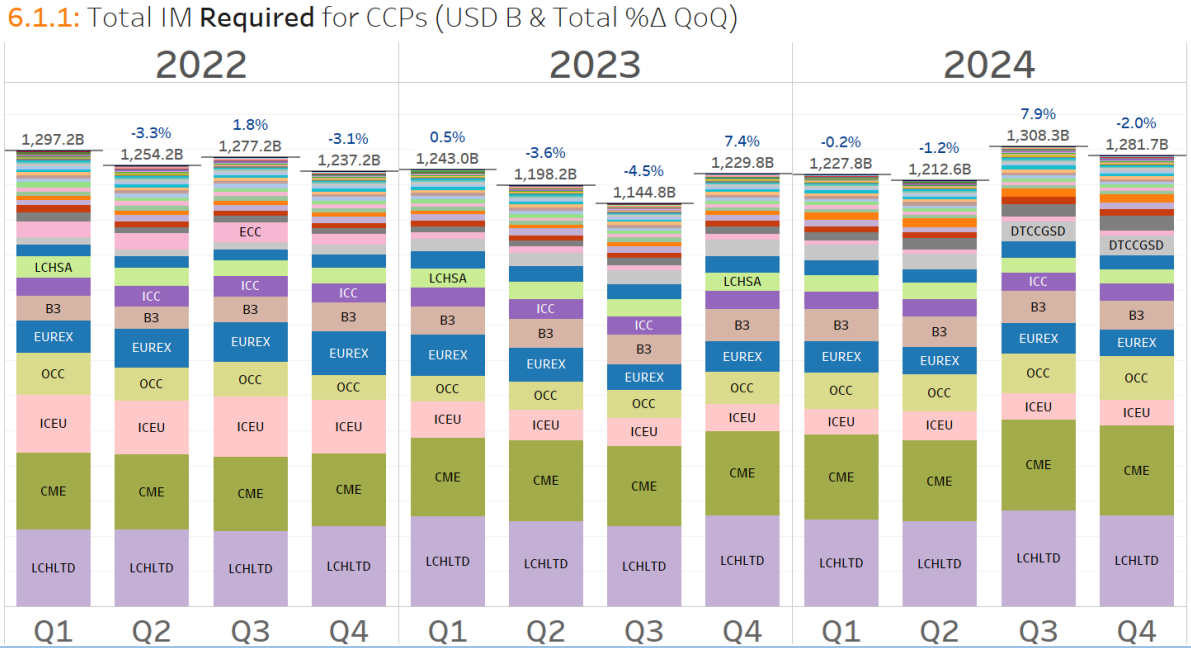
CPMI-IOSCO entrusts CCP Global to maintain the standardized PQD Template and CCP Global drives its adoption with members. The template not only plays a critical role to ensure transparency, but is also a mechanism for market participants to analyse key CCP metrics for risk management.

As of 2024 Q4, 63 CCPs published PQDs in the standardized CCP Global PQD format.[57]

2.2 IM, VM, AND DEFAULT FUND ANALYSIS

The PQDs provide market participants with a high level of transparency into the cleared markets through various disclosures. The standardization across the disclosures makes it straightforward for market participants to analyze cleared markets across each CCP.[58,59,60] In the following sections, we explore the trends across IM, VM, and Default Fund ("DF") data, and analyze developments from 2022 Q1 to 2024 Q4 across all CCP Global members who are publishing their PQDs, including some non-member PQDs. Therefore, for charts within this section "*all CCPs*" refer to all CCP Global members, plus certain non-members who are publishing PQDs and are included in the aggregation for analysis; this currently amounts to 60 CCPs in total globally.

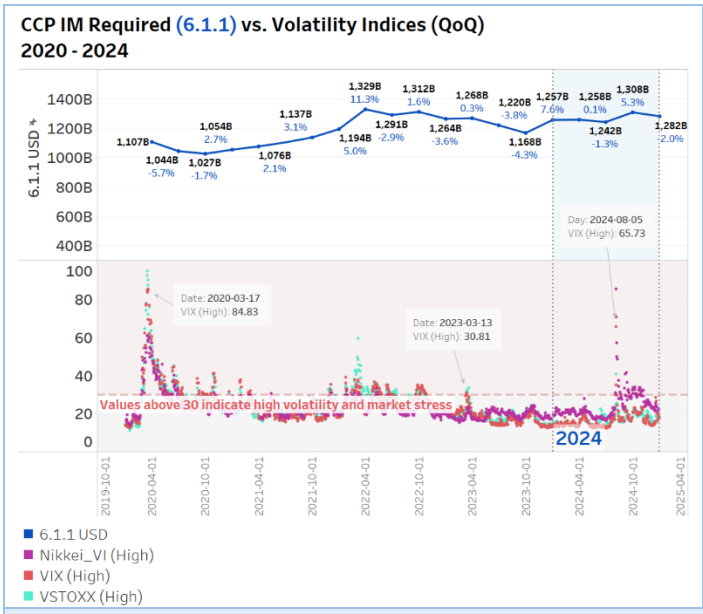
2.2.1 TOTAL IM (REQUIRED) ANALYSIS – DISCLOSURE 6.1.1

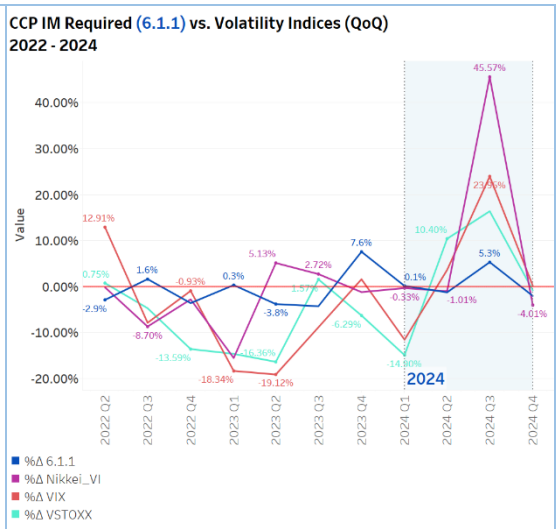


The chart above *(6.1.1: Total IM Required for CCPs (USD B & Total %Δ QoQ))* provides an overview of the Total IM (Required) levels for CCPs between the years 2022 and 2024. For the year under review, IM levels remained stable between USD 1.2 – 1.3 trillion.

[57] Non-CCP Global member PQDs included in the collation: Cassa di Compensazione e Garanzia S.p.A. (Euronext Clearing) (CC&G), Izba Rozliczeniowa Giełd Towarowych S.A. (IRGiT), Viet Nam Securities Depository and Clearing Corproration (VSDC). Excluded PQDs: Central Counterparty National Clearing Centre (NCC).
[58] CPMI-IOSCO: Public Quantitative Disclosure Standards for Central Counterparties (February 2015).
[59] CCP Global PQD Template.
[60] CCP Global PQD FAQ.

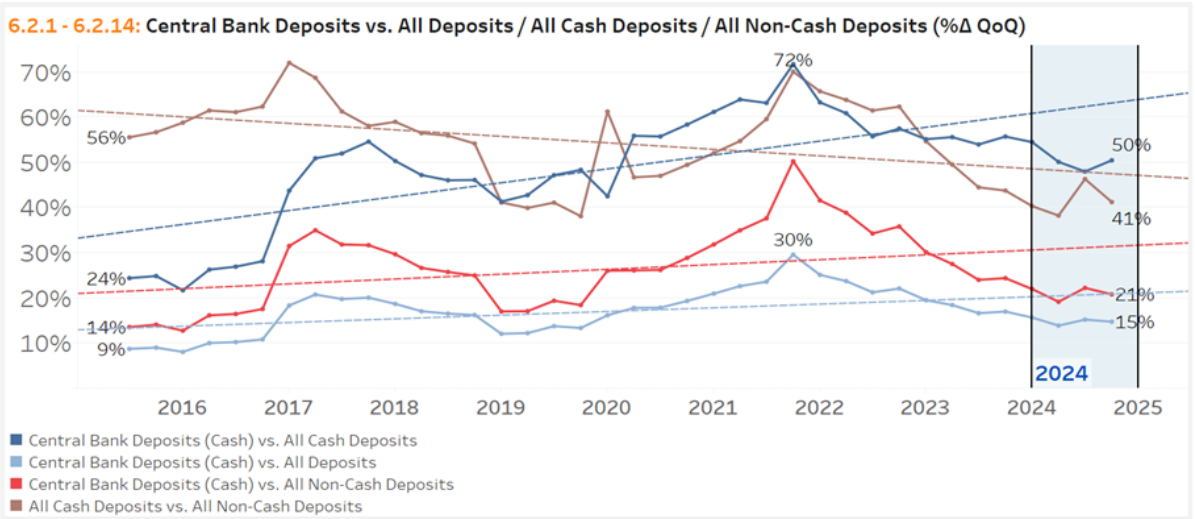
2.2.1.1 IM (REQUIRED) VS. VOLATILITY INDICES





The charts above *(CCP IM Required (6.1.1) vs. Volatility Indices* and *Change in IM Required (6.1.1) vs. Change in Volatility Indices, (%, QoQ))* provide a sense of how market volatility over the last several years has changed in comparison to the change in IM required. In August 2024, the Chicago Board Options Exchange's Volatility Index® ("VIX") surged to a record high (~66, +24% increase), alongside sharp increases in global volatility indices: EURO STOXX 50® Volatility ("VSTOXX") (Europe) and the Nikkei Volatility Index (Japan).[61] This was driven by a market sell-off, economic uncertainty, and widening bid-ask spreads in Standard & Poor's ("S&P") options. Despite these extreme conditions, CCP IM requirements remained stable, demonstrating the resilience of CCP margin models. CCPs employ procyclicality controls, stress testing, and dynamic risk adjustments to prevent excessive margin spikes that could exacerbate liquidity stress. Additionally, anti-procyclicality buffers ensured that margins remained appropriate even as global volatility surged. Netting efficiencies across participants further reduced systemic risk. The ability of CCPs to pre-fund collateral requirements and enforce rigorous risk frameworks allowed them to absorb such shocks effectively. This episode underscored the importance of transparent, adaptive margin methodologies in mitigating global market turbulence and reinforced CCPs' role in maintaining financial stability across multiple regions.

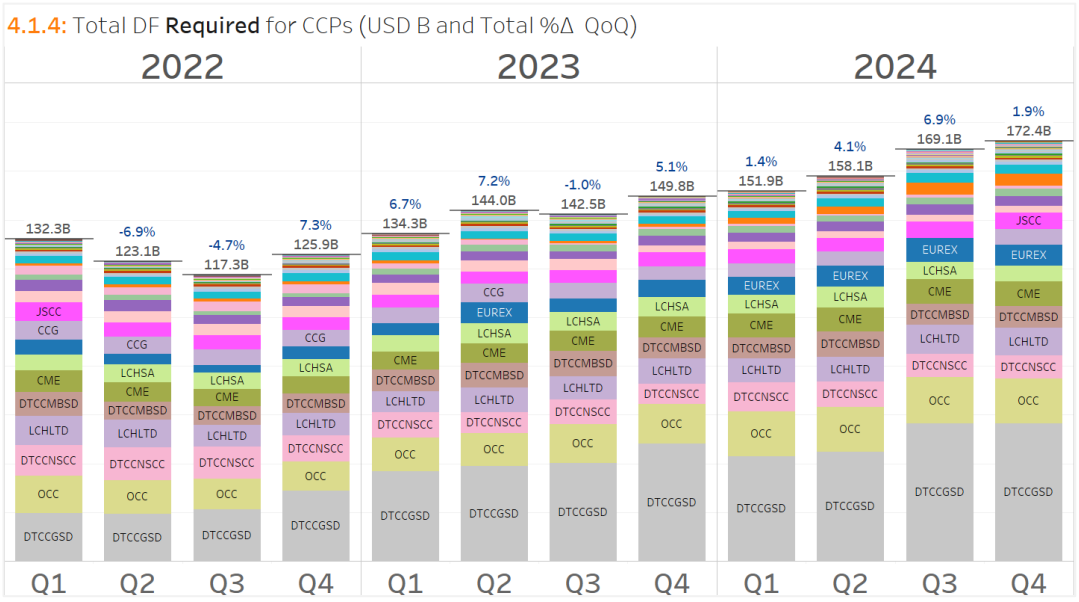
2.2.2 IM (HELD) - CENTRAL BANK CASH DEPOSIT RATIOS[62]



The chart above *(6.2.1 - 6.2.14: Central Bank Deposits vs. All Deposits / All Cash Deposits / All Non-Cash Deposits (%Δ QoQ))* provides in percentage terms several comparisons of central bank cash deposits. Since 2016, CCP central bank deposits have played an increasing role in financial stability, allowing CCPs to safeguard cash collateral in risk-free assets. The 2016-2025 period saw greater emphasis on CCPs accessing central bank deposit facilities, particularly after/during market stress events such as the COVID-19 crisis (2020) and the VIX spike (August, 2024). Access to central banks enhances liquidity resilience, reduces exposure to potential commercial bank failures, and strengthens the safety of margin holdings.

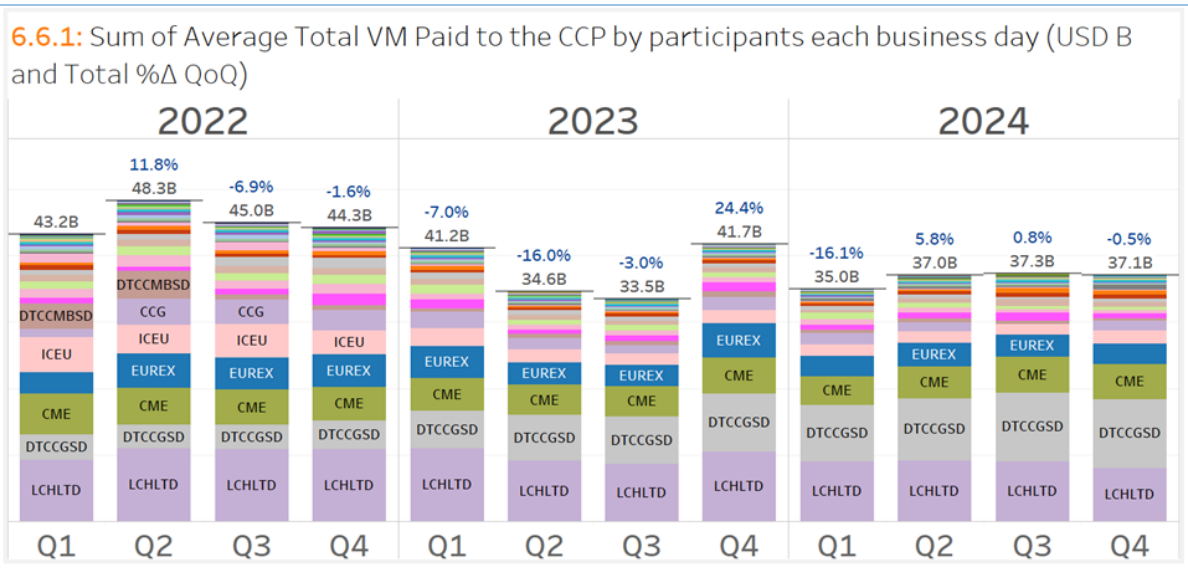
[61] Anatomy of the VIX spike in August 2024
[62] FSOC Financial Stability Oversight Council – 2024 Annual Report

2.2.3 TOTAL DF (REQUIRED) ANALYSIS - DISCLOSURE 4.1.4



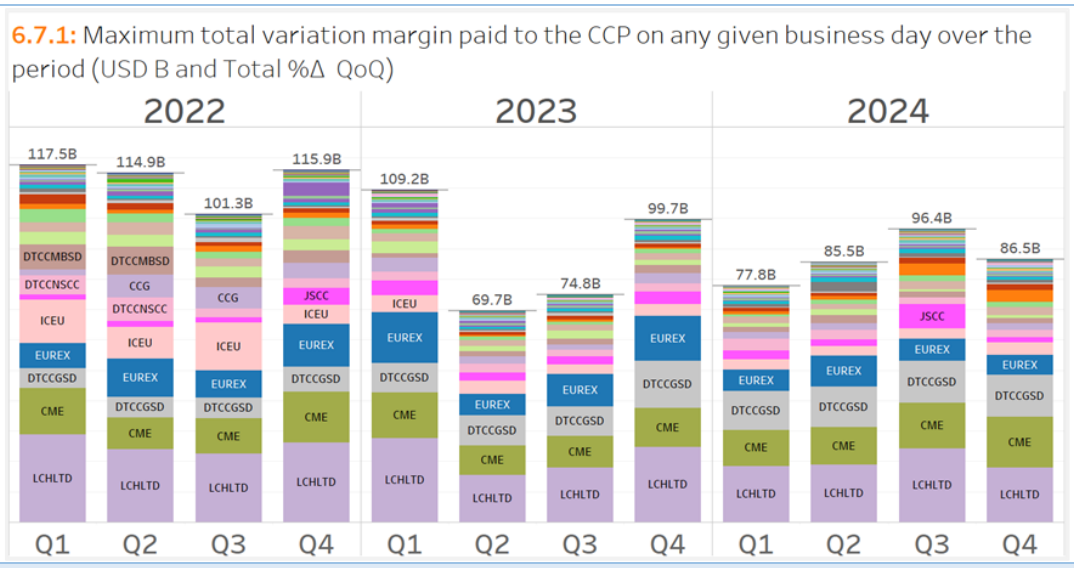
The chart above (*Total DF Required for CCPs (USD B and Total % QoQ)*) provides an overview of the DF levels from 2022 to 2024. A CCP DF (Required) is a financial safeguard used by CCPs to absorb losses if a CM defaults. It acts as a second line of defence after IM but before the CCP's own capital is used. Contributions to the DF are mutualized, meaning all CMs share the risk. DF sizes are calculated based on stress tests, considering extreme but plausible market scenarios. They typically cover the largest two member defaults (Cover 2) for CCPs. Over the last three years (2022-2024), DF requirements increased steadily due to heightened market volatility, such as the 2022 energy crisis, 2023 global government bond market sell-off, and 2024 VIX surge. CCPs often refine their stress testing models, introducing dynamic sizing to better align funds with CM risk exposure. This ensures continued financial stability and resilience in the cleared markets.

2.2.4 TOTAL VM ANALYSIS - DISCLOSURE 6.6.1



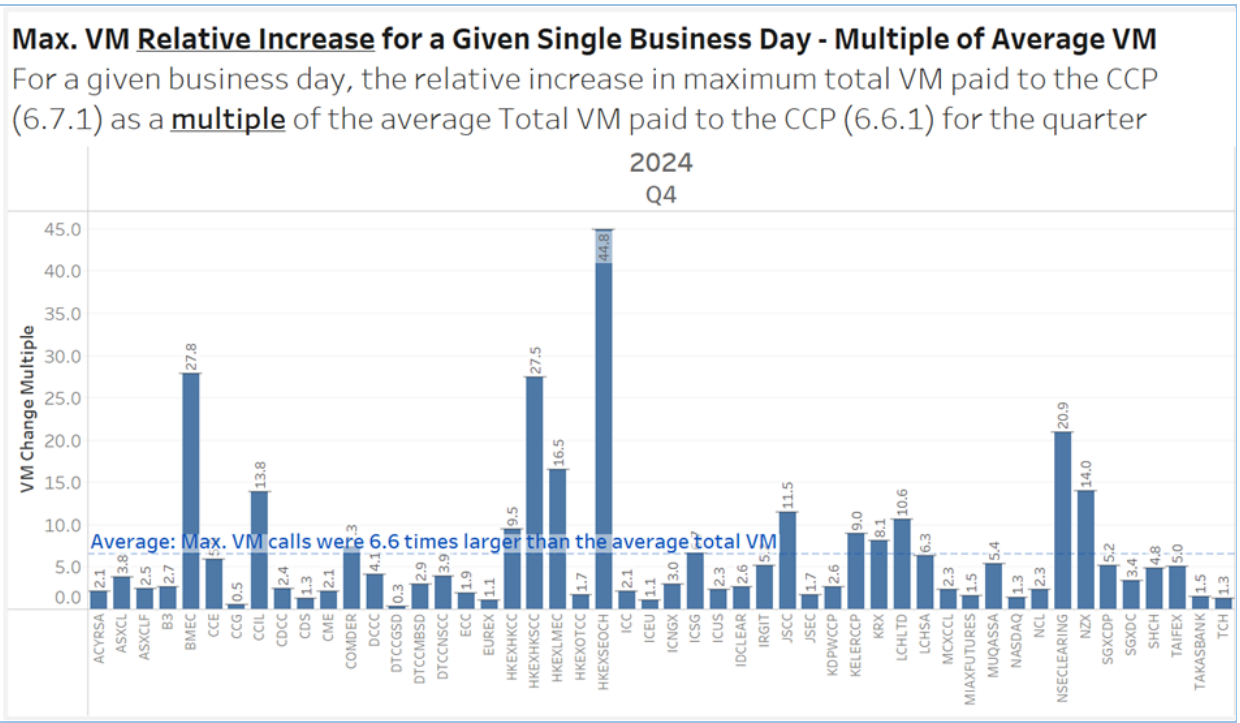
The chart above provides an overview of disclosure 6.6.1 in the PQDs *(6.6.1: Sum of Average Total VM Paid to the CCP by participants each business day (USD B and Total %Δ QoQ))*. VM is a key risk management mechanism used by CCPs to manage daily market fluctuations. Unlike IM, which covers potential future exposure, VM is exchanged daily (or intraday) to settle mark-to-market losses and gains among CMs. Over 2024, VM payments increased somewhat and then plateaued. Volatility events can cause sharp asset price swings, leading to larger intraday and end-of-day margin calls. CCPs have adapted by enhancing intraday risk monitoring, increasing margin call frequency, and expanding eligible collateral to maintain liquidity. Despite such stresses, CCPs have remained stable, demonstrating their resilience in managing counterparty risk. Effective VM frameworks ensure that market disruptions do not translate into systemic financial instability.

2.2.4.1 MAX VM CALL ANALYSIS - DISCLOSURE 6.7.1



The chart above *(Maximum total variation margin paid to the CCP on any given business day over the period (USD B and Total %Δ QoQ))* provides us with a sense of how market volatility impacted the mark-to-market exchange of VM through CCPs globally on a quarterly basis. VM payments at CCPs reached record highs over the past years due to extreme market volatility. The highest VM outflows occurred during the 2022 energy crisis, the 2023 bond market sell-off, and the equity volatility spike in August 2024 (VIX, VSTOXX, Nikkei Volatility Index). In these periods, intraday and end-of-day margin calls were made. Despite this volatility, CCPs remained stable, ensuring systemic resilience.

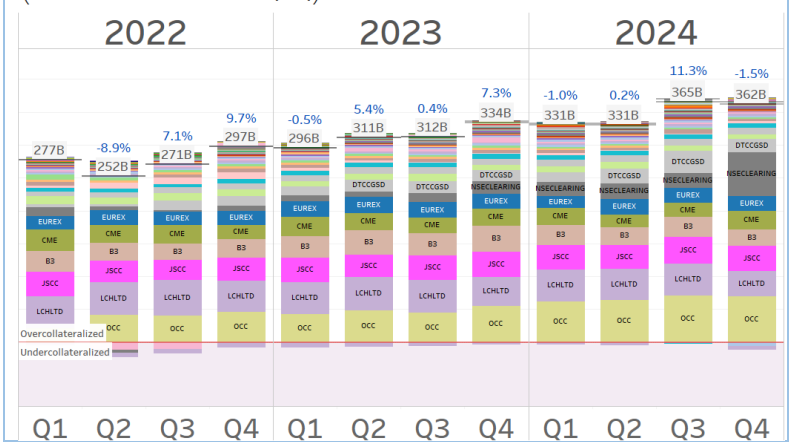
2.2.4.2 MAX. VM RELATIVE INCREASE AS A MULTIPLE – DERIVED CALCULATION[63]



The above chart (*Max. VM Relative Increase for a Given Single Business Day - Multiple of Average VM)* for 2024 Q4 provides us with a derived calculation from the PQDs. This chart gives us a sense of how many times greater the maximum VM call (6.7.1) was for a particular business day when compared to the average total VM for the quarter (as a relative increase), per CCP. A higher multiple indicates heightened market volatility or stress, highlighting significant price fluctuations in CM portfolios based on particular trading activities and exposures. For 2024 Q4, globally, CCPs on average experienced their maximum VM call of 6.6 times the average VM call for a particular business day in the quarter.

[63] $Max. VM\ paid\ to\ the\ CCP\ as\ a\ multiple\ of\ the\ average\ VM\ \frac{\sum(6.7.1-6.6.1)}{(6.6.1)}$

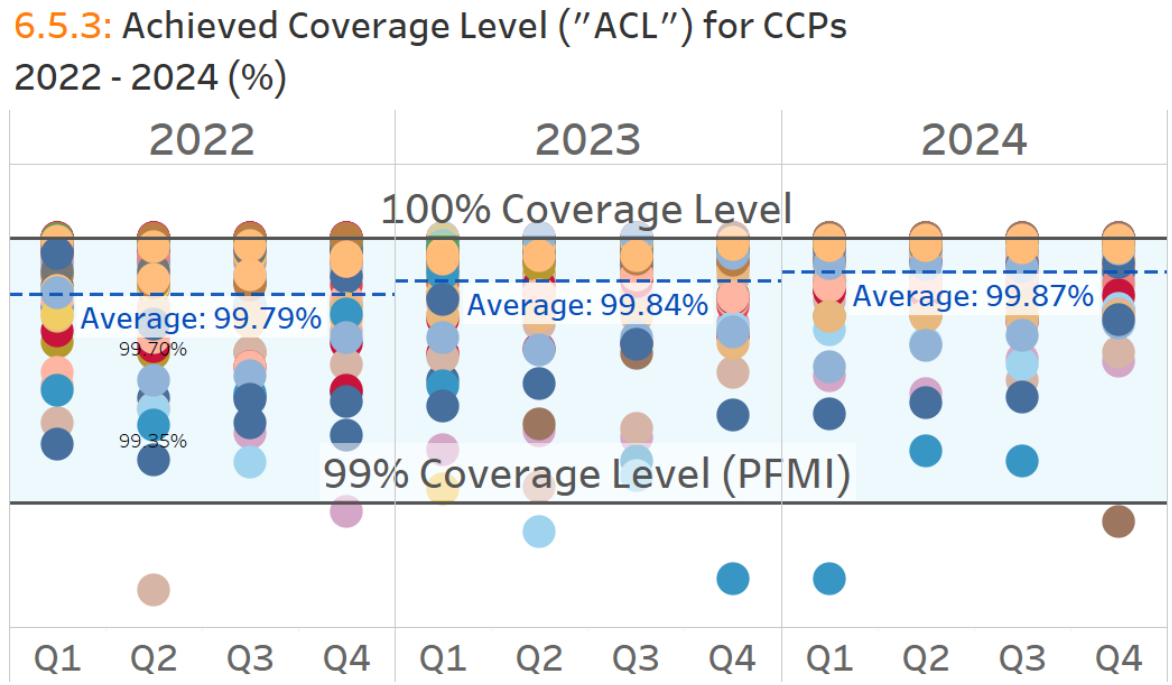
2.2.5 TOTAL IM AND DF OVERCOLLATERALISATION[64]



The chart opposite *(Total IM & DF Overcollateralization for CCPs (USD B and Total %Δ QoQ))* indicates an overview of the total overcollateralization ("OC") across CCPs, reported at the quarter-end.

CCP OC occurs when held collateral exceeds required levels for IM and DF, providing an extra risk buffer. As can be seen, almost all CCPs hold a sufficiently larger portion of collateral. Having more IM and DF held than required ensures that the CCP can absorb sudden market volatility without immediate calls for additional collateral from CMs. This reduces reliance on emergency liquidity measures during crises.

2.2.6 RESULTS OF BACKTESTING OF IM – ACHIEVED COVERAGE LEVEL



The chart above *(Results of backtesting of IM – Achieved Coverage Level ("ACL") for CCPs, 2022 – 2024 (%))* indicates how the ACL for all represented CCPs changed over time from 2021 to 2024. The blue dashed line indicates the average percentage per year across all CCPs combined: 99.79% for 2022, 99.84% for 2023, and 99.87% for 2024. This has consistently increased year-over-year.

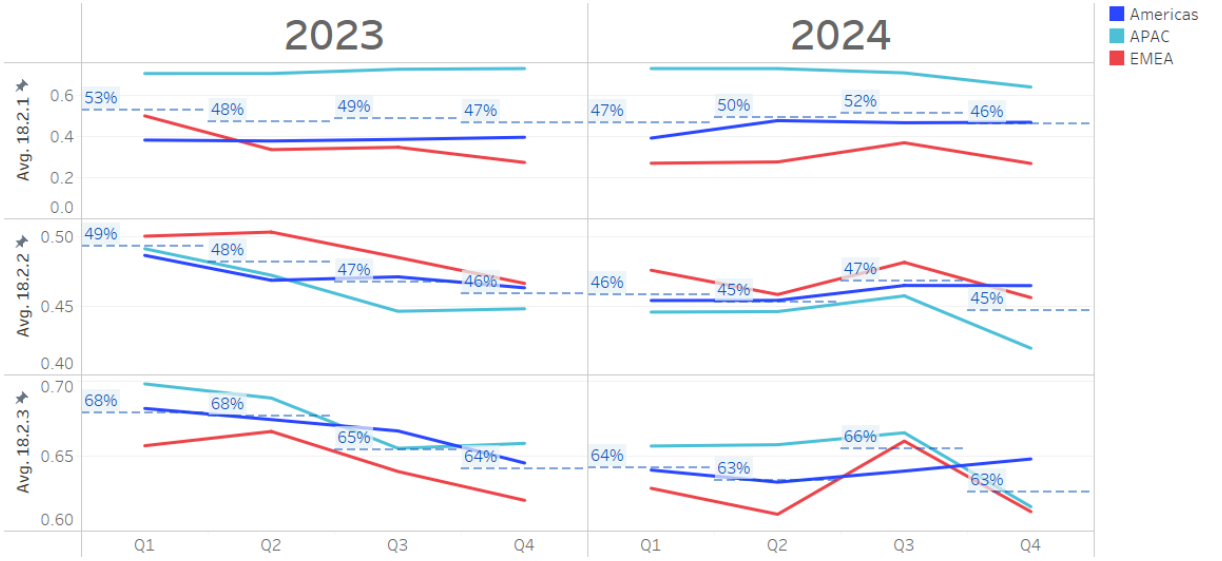
Backtesting is an important technique that a CCP utilizes to affirm that its IM model is performing as expected and that the assumptions within the model are appropriate. A CCP should assess its IM coverage by performing an ex-post comparison of observed profit and loss ("P&L") moves of a given portfolio against the IM required. According to the PFMIs, a 99.00% coverage standard is used for backtesting of a CCP's IM model, however, a CCP may use a higher (percentile) benchmark. As can be seen from the above metrics, CCPs globally achieved on average levels above 99.00% in all instances from recent years indicating the appropriateness of their margin models. For 2024, CCPs achieved an ACL of 99.87%, the highest in the last three years.

For further information, please see the CCP Global White Paper – Primer on Initial Margin.

[64] Total OC = $(IM_{Held} + DF_{Held}) - (IM_{Required} + DF_{Required}) =$ Disclosures (6.2.15 + 4.3.15) – (6.1.1 + 4.1.4). Only PostHaircut values are used for Held values.

2.2.7 PERCENTAGE OF IM POSTED BY THE LARGEST CMs

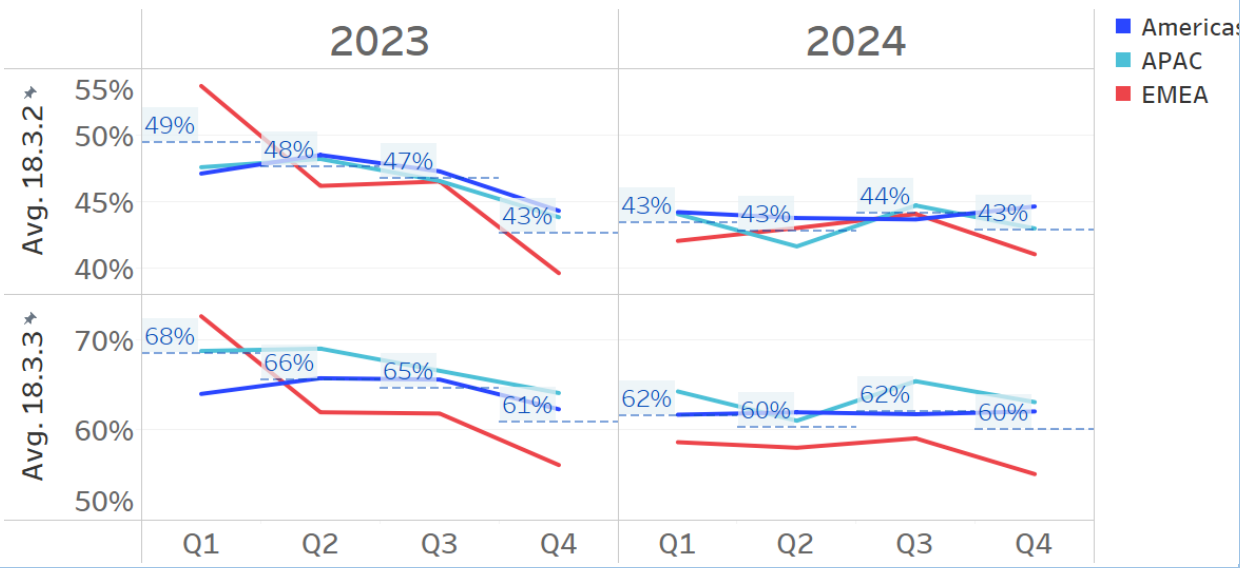
18.2.1, 18.2.2 & 18.2.3: Percentage of open positions held by the largest 5 (18.2.1 & 18.2.2) and 10 (18.2.3) clearing members, including both house and client, in aggregate. **Average of all CCPs per region per quarter.**



This chart shows us the percentage of open positions held by the largest five and ten CMs. This metric provides market participants the ability to monitor a CCP's resilience. It helps CCPs design risk controls and ensures they can reallocate positions without triggering contagion, ultimately strengthening confidence in the clearing system. Since 2023 Q1 to 2024 Q4, the percentages for 18.2.1 – 18.2.3 all decreased, indicating a lower concentration of open positions with the top five or 10 CMs at a CCP on average.

2.2.8 PERCENTAGE OF IM POSTED BY THE LARGEST CMs

18.3.2 & 18.3.3: For each clearing service with 25 or more clearing members. Percentage of IM posted by the largest 5 (18.3.2) and 10 (18.3.3) CMs, including both house and client, in aggregate. **Average of all CCPs per region per quarter.**



This chart shows the percentage of IM posted by the largest five and ten CMs for each clearing service with 25+ members, averaged across CCPs per region per quarter. A declining trend over the last two years suggests a reduction in margin concentration, meaning IM contributions are becoming more evenly distributed among CMs indicating less reliance on a few large firms and a more balanced IM distribution which enhances CCP resilience, and indicates broader participation and better risk-sharing among CMs.

2.3 CCP CORE SYSTEM AVAILABILITY AND OTHER STATISTICS

As part of the PQDs, CCPs report the quantity and duration of operational failures affecting their core clearing systems over the previous 12-months on a quarterly basis, where:

- **Core Systems:** enable the acceptance and novation of trades and provide the calculation of margin and settlement obligations.

- **Loss of Availability:** an incident resulting in an interruption of the CCP's ability to perform its own functions in relation to trade acceptance and novation or calculation of margin and settlement obligations. An incident that compromises the CCP's ability to correctly perform the aforementioned functions is also considered a 'loss of availability', even if there is no actual outage. Failure to a back-up site without interruption to services would not count as a loss of availability.

For PQD disclosure 17.4, all 60 CCPs collectively (on average) reported a **99.98% core system availability** for the previous 12-month period spanning January 1st, 2024, to December 31st, 2024. This demonstrates the high degree to which CCPs globally remained operationally resilient during 2024 and were able to meet the demands of the clearing processes without the need to suspend or reduce any operations.

2.4 CCP GLOBAL PQD QUARTERLY TRENDS REPORT

Since 2022, CCP Global has been publishing the PQD Quarterly Trends Report ("QTR") which provides a detailed insight into the global CCP PQD landscape through various charts and analyses. The report offers market participants a view of the distribution of collateral across the Americas, APAC, and EMEA. In addition, the report provides key summaries and trends captured from the PQD data through a variety of selected disclosures. Readers are invited to view the CCP Global PQD QTRs online – further details can be found at: https://ccp-global.org/pqd/.

2.5 CCP GLOBAL – PQD FAQ GUIDE

CCP Global members collaboratively worked to create a common PQD template in 2015 and officially released the CCP Global PQD Template in 2017. Several updates of the template have been provided over the years, notably the latest CCP Global PQD template was published in February 2021, along with the PQD Frequently Asked Questions ("FAQ") Guide.

The PQD FAQ Guide provides details of the CCP Global PQD Template such as 'Disclosure Title', 'Reference', 'Description' and 'Reporting Frequency', as well as an FAQ section for each disclosure, to give additional guidance to market participants when evaluating a CCP's PQDs. CCP Global will continue their efforts to improve the PQD FAQ Guide to support market participants' interpretation of the CCP PQDs.

2.6 CCP GLOBAL – PQD RETENTION AND INQUIRY PERIOD

On November 6th, 2024, as a best practice, CCP Global issued an update to the PQD FAQ Guide, whereby CCPs should retain publicly available PQDs for up to a maximum of 5 years on their website. As new PQDs are made available, the older PQDs will be rolled off. Internally, however, CCPs should retain PQDs from the point at which they first began publishing as a full record. PQDs beyond 5 years can be made available to market participants upon request.

Furthermore, as a best practice, CCPs should only respond to questions concerning PQDs within a maximum of 3 years due to evolving CCP methodologies and revised metrics. As practices and standards change over

time, and to ensure the reliability and relevance of responses, market participants who have such questions should only focus their inquiries on the most recent PQDs, specifically and ideally those within 12 quarters.

The above PQD retention and inquiry period will offer both market participants and the CCP a balance between retrievable PQDs and questions, without any issues related to much older PQD data.

2.7 CCP GLOBAL – QATL

As mentioned at the start of this chapter in section 2.1, in order to enhance clearing participants' existing access and for ease of reference to CCPs' disclosures, CCP Global officially announced the release of the QATL template in February 2024.

This document provides a series of hyperlinks to CCPs' rulebooks and disclosures in accordance with CCP Global's template format – the "QATL template". The information contained in this document will be compiled by CCPs for general informational purposes to enhance the accessibility of information from CCPs' documents. While some relevant CCP rules may be discussed, hyperlinked to, or referred to in the QATL template, all matters and information provided is subject to, and superseded by, the specific CCP's rules and disclosures. It is advised that the current versions of the CCP's rules and disclosures should always be consulted and are those that should be relied upon by the CCP's participants.

The QATL template is a result of ongoing industry discussions with market participants and includes direct hyperlinks to disclosures such as those covering NDLs, the CCP's default waterfall, CM approval and oversight, the CCP's public quantitative and qualitative disclosures (the PFMI disclosures), margin add-ons, and anti-procyclicality ("APC") measures, as applicable.

The QATL aims to support existing documentation and disclosures by being a gateway to the well-established availability of CCPs' disclosures, rules, and other CCP resources.

3. CASE STUDIES

CCP	CASE STUDY
Eurex Clearing	Participation in ECB exploratory work on new technologies for wholesale central bank money settlement
IDClear	The Implementation of Central Counterparty in Indonesia's Money Market and Foreign Exchange: A Key Milestone
JSCC	Japan Securities Clearing Corporation Migration to New Margin Calculation Method (JSCC-VaR) in Listed Financial Derivatives Brief Overview and Impact Analysis
NSE Clearing	A unique Two-way Software-as-a-Service model among interoperable Indian CCPs aimed at improving operational resiliency
SGX	Managing Risk Amidst Extreme Volatility and Negative Prices in Freight Derivatives

Disclaimer: *The following case studies reflect the views and opinions of the authors from the respective CCPs and do not necessarily represent the position of all CCPs which are members of CCP Global.*

4. EUREX: PARTICIPATION IN ECB EXPLORATORY WORK ON NEW TECHNOLOGIES FOR WHOLESALE CENTRAL BANK MONEY SETTLEMENT

Abstract

Eurex Clearing participated in a 2024 European Central Bank ("ECB") market-wide initiative exploring new technologies for wholesale central bank money settlement. Driven by the need for increased efficiency, resilience, and innovation, the initiative examined Distributed Ledger Technology ("DLT') and Central Bank Digital Currency ("CBDC') applications. Eurex Clearing actively participated in two waves of experimentation, testing real-life use cases such as intraday and overnight cleared repo and margin calls. Leveraging both the Bundesbank Trigger Solution and the Banque de France ("BdF") Interoperability Solution, Eurex gained valuable practical experience, which informs the recommendations presented.

Key findings confirm the continued importance of Central Counterparties ("CCPs") in maintaining market integrity and safety within a rapidly evolving digital financial landscape. CCP core functionalities and risk methodologies remain effective regardless of the underlying technology. The study also highlights the seamless integration of traditional and digital assets within existing CCP workflows, underscoring their adaptability. Further, DLT's impact on risk management does not introduce new risk types but emphasizes cybersecurity risks, necessitating robust frameworks. DLT demonstrated the potential to significantly improve settlement efficiency, especially in cross-border transactions, though asset availability remains crucial for settlement success.

Finally, the exploratory work emphasized the importance of interoperability between different DLT settlement platforms and traditional systems. CCPs are uniquely positioned to bridge centralized and decentralized finance ecosystems, ensuring a smooth transition to a digital environment. Standardization of protocols and ongoing collaboration with regulators are crucial to mitigate fragmentation risks and effectively integrate DLT within the broader financial system.

4.1 INTRODUCTION

In 2024, the ECB organised a market wide initiative to explore new technologies for wholesale central bank money settlement, driven by the need for increased efficiency, resilience, and innovation in the financial system. This exploration encompassed various cutting-edge technologies, including DLT and potential applications of a CBDC in wholesale markets. Eurex, as a leading European exchange and Clearing House, has actively participated in these exploratory initiatives with real life and concrete use cases, including intraday cleared repo, overnight cleared repo, and margin calls. Furthermore, Eurex has actively tested two of the three available technical solutions: the Bundesbank Trigger Solution and the BdF Interoperability Solution. This hands-on involvement has provided invaluable practical knowledge and insights. This paper describes Eurex's experiences in these endeavors, focusing specifically on the valuable lessons learned that can inform future development and implementation of new technologies for wholesale central bank money settlement, not only for Eurex but also for the broader financial market ecosystem.

4.1.1 Eurex's Involvement

The ECB exploratory work involved two waves of experimentation. Eurex Clearing participated in both waves. The first wave successfully tested a centrally cleared intraday special repo transaction using native digital

commercial paper[65]. Trading occurred on Eurex Repo´s F7 platform. The native digital instrument was issued and settled in Clearstream´s D7 digital platform. Clearstream being a Central Securities Depository ("CSD") under the European Central Securities Depositories Regulation ("CSDR") acted as a DLT market operator. The cash leg settled in the T2-UTEST environment via the Deutsche Bundesbank Trigger Solution.

The second wave focused on cleared repo transactions and margin calls within live production environments, leveraging a fully DLT solution. Eurex Clearing instructed its own and clearing members' digital wallets on BdF's ledger. The cleared instruments were natively digital, issued and settled on Clearstream´s D7 digital platform.

4.2 KEY INSIGHTS

Key findings demonstrate the resilience of Eurex Clearing's existing risk management framework within a DLT environment, the seamless integration of DLT with traditional processes, and the crucial role of interoperability at the settlement layer for broader market adoption. The results reinforce the importance of CCPs in maintaining market integrity and safety within a rapidly evolving digital financial landscape. Concretely:

- CCPs remain essential in a DLT environment: The exploratory work confirmed that the core functionalities and risk methodologies employed by CCPs remain effective and value adding regardless of the underlying technology. CCPs maintain their critical role in ensuring market stability by providing consistent risk management practices and serving as a "golden source" of truth, guaranteeing transaction processing integrity. This underscores their agility and continued relevance in a digital financial ecosystem.
- Clearing of native digital assets: The exploratory work demonstrated that clearing and settlement procedures for native digital assets can mirror those used for traditional assets. Both asset types can be seamlessly integrated into existing CCP workflows, including margining and reporting processes. This highlights the robustness and adaptability of established clearing frameworks.
- DLT's impact on risk management: The fundamental nature of risks managed by CCPs, such as counterparty credit risk, liquidity risk, and market risk, remain unchanged in a DLT environment. While DLT itself does not introduce new risk types, the exploratory work emphasized the increased prominence of cybersecurity risks within DLT-based systems. Existing regulatory frameworks, such as the European Market Infrastructure Regulation ("EMIR") and the Digital Operational Resilience Act ("DORA") in the European Union, remain applicable regardless of the technology.
- Settlement efficiency and delivery reliability: DLT can significantly improve settlement efficiency, particularly in cross-border transactions where current settlement systems lack interoperability, with near-instantaneous settlement potential. However, the trials evidenced that asset availability remains a prerequisite for successful settlement, irrespective of the underlying technology. The trials successfully demonstrated the concept of delivery reliability, achieved through CCP interposition, with DLT-based securities, reinforcing CCPs' importance in mitigating counterparty risk. Furthermore, the trials showed that settlement finality provisions of CCPs apply in a DLT environment, providing legal certainty.
- Interoperability and standardization: The exploratory work revealed the importance of addressing the challenge of interoperability between different DLT settlement platforms and traditional financial systems. CCPs are uniquely positioned to act as a bridge between centralized finance ("CeFi") and decentralized finance ("DeFi") ecosystems, facilitating a smooth transition to a digital financial environment while maintaining the robustness of existing infrastructure. Standardization of protocols and collaborative engagement with regulators are crucial for addressing fragmentation risks and ensuring the effective integration of DLT.

[65] **Native Digital Instrument:** A financial instrument issued and managed entirely digitally on a DLT platform.

4.3 CONCLUSION

Eurex Clearing's participation in the ECB exploratory work offered a pragmatic perspective on the transformative potential of DLT within financial markets. The exploratory work confirmed the enduring relevance of CCPs in a digital ecosystem and identified areas where DLT can contribute to enhanced efficiency. Continued collaboration, innovation, and strategic planning are essential for navigating the evolving landscape and fully realizing the benefits of DLT while safeguarding the integrity of the financial system. More details can be found in Eurex´s whitepaper The role of Central Counterparties in a DLT environment.

5. IDCLEAR: UNLOCKING NEW MILESTONES: IDCLEAR'S EXPANSION ON INDONESIA'S MONEY MARKET AND FOREIGN EXCHANGE

Abstract

Following the 2008 GFC, G20 initiated reforms in Over-The-Counter ("OTC") Derivatives ("OTCD") transactions. In 2009, G20 country members agreed that OTCD transactions should be cleared through a Central Counterparty ("CCP") to mitigate the potential systemic risks. Aligned with this effort, Bank Indonesia, in its role as central bank was mandated to support this initiative by the government. The central bank appointed IDClear, which had been serving as a CCP in Indonesia's capital market for over twenty years, to serve the money market ("MM") and foreign exchange ("FX").

Regarding this appointment and after a long preparation, IDClear officially marked the expansion of its role, becoming the CCP of Indonesia's MM and FXs markets on September 30th, 2024. The presence of IDClear as a CCP in the MM and FX markets will mitigate the risks of settlement failures between involved parties. The preparation and the implementation process started in 2019 and stretched into 2024, involving significant efforts to navigate various aspects, including regulations, operational systems, risk management, human capital, and related aspects.

Becoming a CCP for Indonesia's MM and FX markets is a transformation that enhances IDClear's position as a pivotal pillar in supporting the integration and deepening of the Indonesia's financial market. In the long term, IDClear's function as a CCP within the market is anticipated to boost market liquidity, mitigate interbank credit risks, and enhance transaction efficiency through the netting of obligations among market participants. This approach is expected to foster a more inclusive market that allows banks to engage in transactions with a broader range of parties without concerns over the related counterparty risk.

Implementing IDClear's role as a CCP in the MM and FX markets involved a comprehensive process, with numerous steps, and challenges that must be considered in the short and long term, including the legal framework, the dynamics of system development, and timeline/punctuality management. Furthermore, IDClear engaged with Indonesia's financial authorities, defining necessary regulations and operational adjustments, while also incorporating clearing members' ("CMs") involvement as part of the success of this implementation.

This case study provides an overview on how IDClear implemented their expanding role as a CCP in MM and FX markets, and the critical aspects, steps, and adjustments required for implementation as well as highlights the ways central clearing can strengthen the financial industry.

5.1 THE IMPLEMENTATION PHASES

The implementation of IDClear as a CCP in Indonesia's MM and FX markets was divided into two major phases. The first phase, which began in 2019 and continued into 2022, began with conducting research on how to establish the implementation of central clearing in Indonesia's MM and FX markets. The second

phase, which began in 2021 and finished in 2024, focused on system development and the implementation of the elaborated concepts from the first phase.

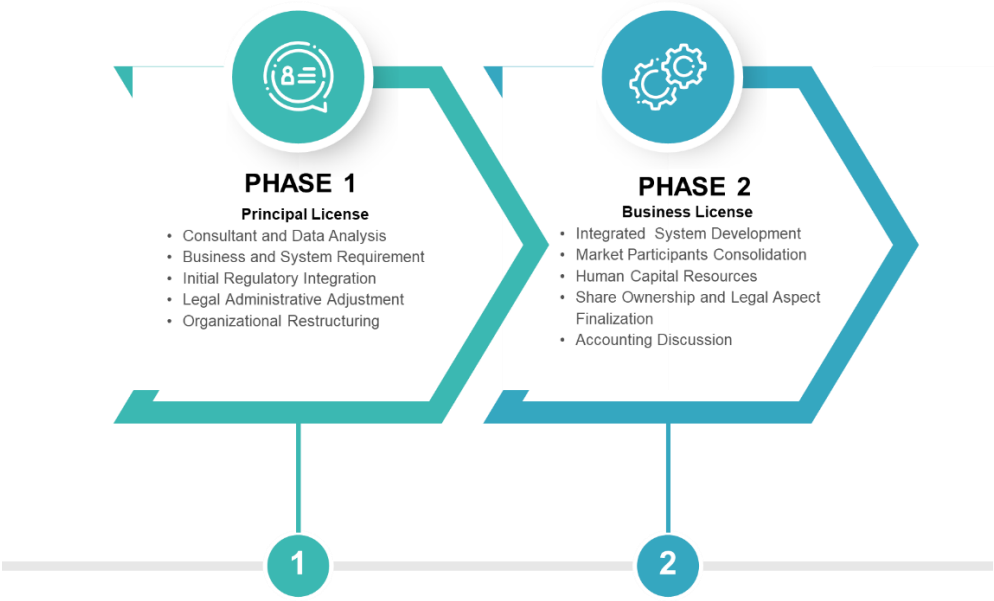


Figure 1. The Overview of Implementation Steps

The first phase focused primarily on analyzing the concept of related business mechanisms. During this phase, IDClear developed a comprehensive prerequisite document to be submitted to the central bank to obtain the principal license. To complete the necessary documentation, IDClear had to restructure and implement a new board framework, including the appointment of an independent commissioner and an independent director for the CCP function. Furthermore, IDClear also had to make adjustments regarding the company's type of business and capital in the Deed of Establishment. Indonesia Stock Exchange ("IDX"), which, at that time, was the only shareholder required to increase the paid-up capital for IDClear to meet the requirements for submission to the central bank.

As part of the requirement from the central bank, IDClear had to submit comprehensive documentation covering the related adjustments, including the information about risk management, collateral management, proposed business plan, and the long-term corporate strategies planned for this new role. The documentation needed to provide a comprehensive overview of system development, shareholder structure, implementation timeline, and the underlying business concept regarding the new role. This documentation was required by the central bank in its role as a regulator and a market authority to grant the license and as a way to asses IDClear's commitment to carry out its new role and long term business objectives.

In the second phase, the focus shifted to obtaining the business license from the central bank and to developing a new system that accommodated the concept formulated through extensive discussions with market participants, the central bank, and Financial Service Authority ("FSA"). In this phase, to establish a reliable interconnection system between all relevant stakeholders, IDClear invited CMs to engage in the onboarding process and to finalize the system integration. During this phase, IDClear also finalized the regulatory framework which serves as a set of rulebooks, that will be used as an operational guideline under the new role. These rulebooks were developed closely with market participants, the central bank, and the FSA to accommodate various inputs and feedback to ensure compliance and relevance.

IDClear also had numerous discussions with the accounting association to discuss how to execute accounting entries for the transactions that would be cleared through the CCP. The discussions with the FSA particularly concerned the regulations, including the uncleared margin rules and capital requirements for bank exposures to the CCP, as outlined in the Basel Framework published by the Basel Committee.

Another pivotal step in the second phase was the restructuring of the new market positioning within IDClear and determining the new shareholders' ownership. IDClear involved the central bank and the commercial banks to be part of the new shareholders, in order to strengthen the engagement of the market participants and enhance their confidence in IDClear as the CCP and to be used as a channel to spread initial awareness to the industry and gather more exposure to invite their participation.

5.2 THE INTEGRATED BUSINESS PROCESS

At the time of its launch, IDClear only executed clearing for Domestic Non-Deliverable Forward ("DNDF") products with a T+1 settlement cycle. In the future, IDClear plans to expand the clearing services to Interest Rate Swap ("IRS") transactions, Interbank Repos, and Overnight Index Swap ("OIS") transactions, with the settlement cycle to be developed further to accommodate the market.

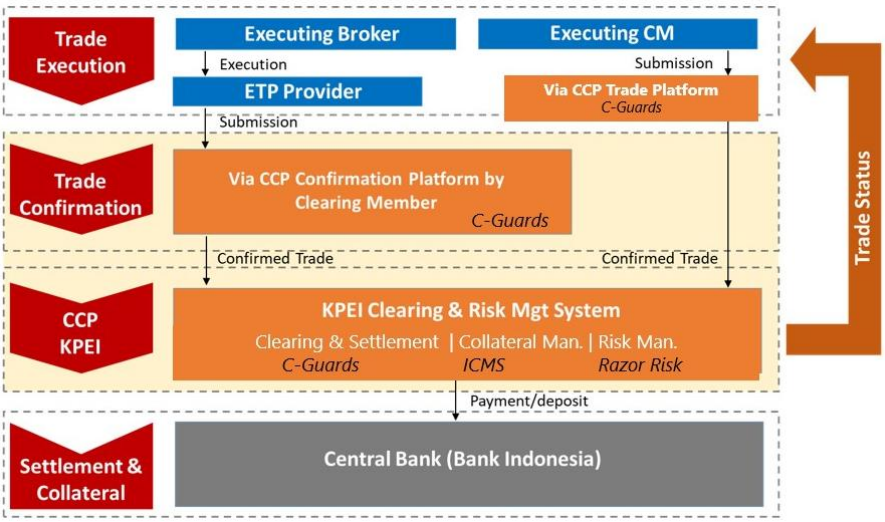


Figure 2. The Business Process of IDClear as CCP in Indonesia's MM and FX

As portrayed in Figure 2, the transaction's instruction being dealt by CMs had to be input to the CCP Trade Platform known as C-Guards. After the trade is confirmed, IDClear will continue the role of clearing and settlement through C-Guards. IDClear implements the netting process to simplify the transaction. Following these steps, the CM will create settlement instructions through the CCP Trade Platform, which will be executed in the central bank's system. As instructed by central bank regulation, in the near future, IDClear must shift this current instruction trading platform to an Electronic Trading Platform ("ETP") provider, to ensure the transparency and related risk mitigation

Furthermore, IDClear also functions to manage the impact of any potential risks which might occur from the transaction settlement process. IDClear has implemented a particular framework for risk, collateral, and default management system which refers to the related international principles and best practices. The risk management processes include the management of pre- and post-trade risks. For the pre-trade part, IDClear uses the C-Guards to validate the trading limit, while for the post-trade part, it uses a platform known as Razor, to calculate risk exposure and validate the trading limit. The collateral management takes place through the Integrated Collateral Management System ("ICMS") platform.

5.3 THE BENEFITS & CHALLENGES

Central clearing being utilized in MM and FX market benefits market participants, particularly by enhancing the efficiency of their transaction process. With this new role, IDClear will be able to provide netting efficiency and improve operational processes through the multilateral netting function.

CCPs also provide the opportunity for capital efficiency, specifically cost reduction. With IDClear in the market, CMs can lower their operational cost due to the netting process and the aggregation of clearing

activities across multiple participants. Furthermore, IDClear will also help to reduce legal risks through the usage of centralized rules within the market. CMs will also benefit from access to an integrated transaction cycle monitoring through a platform provided by IDClear which ensures better transparency within the market.

IDClear had to navigate various challenges in implementing their role as a CCP, including issues from timeline adherence to system development concerns. During the preparation phase, the main challenge was prioritizing the readiness of each system for all stakeholders. IDClear engaged in numerous discussions with regulators and market participants to clarify the system's development requirements and the integration of regulations.

IDClear also faced challenges with regards to education for market participants on how centralized clearing will work in the market. For years, Indonesian banks utilized bilateral processes for their MM and FX transactions. Therefore, an extensive communication effort between all stakeholders and market participants was essential to deepening the market's knowledge and to build their confidence in IDClear services.

Concerns related to the cost associated with the implementation of central clearing for MM and FX transactions was also a significant consideration. IDClear has endeavoured to overcome this challenge by educating participants on how central clearing is ultimately able to create cost savings opportunities as compared to bilateral markets. As previously emphasized, an extensive communication and education effort were essential to addressing these challenges.

After the launch, financial account challenges became clear to IDClear. Practically, each bank has its own rules for maintaining their accounting documentation and there is no standardized format for banks to comply. This lack of standardization raises concerns regarding the bank's provision of its accounting reporting method for both bilateral and centrally cleared transactions. This matter has been escalated to the regulator, who will facilitate the discussion with the related parties in aligning the perspective and determining the best approach to address this concern.

Despite the efforts described above, unforeseen issues have still emerged after the implementation of central clearing, emphasizing the need for ongoing collaboration with regulators and market participants. Communication between all market participants is essential to align their input throughout the collaboration and development process.

5.4 THE KEY SUCCESS

In the pursuit of successful implementation, fundamental principles have served as guiding factors. Among these, the following key points were essential in implementing central clearing for Indonesian MM and FX markets, including:

1. **Extensive communication between all market participants**. As IDClear had previously only been involved with securities companies for over twenty years, this new market requires more attention from IDClear to understand the unique characteristics and accommodate the needs presented by such markets. Through intensive and extensive communication, IDClear can tailor and adjust their services to best accommodate the banks and related stakeholders.
2. **A strong and reliable system to accommodate the clearing and risk management process** in Indonesia's MM and FX markets. To accommodate the market, IDClear intends to ensure the integration system between IDClear and all parties is well interconnected. In anticipation of an increase in transaction frequency, IDClear will prioritize preparing sufficient settlement system capacity.
3. In order to build confidence among the market participants to be the CMs, IDClear has established a strategy regarding a **shareholder structure to attract awareness in the market.** IDClear restructured the company's shareholders and involved the central bank and commercial banks to be part of the new

shareholders. Through this strategy, IDClear was able to create an initial stage to spread awareness and build the confidence for CCP's existence in the industry.

5.5 CONCLUSION

Becoming the CCP in Indonesia's MM and FX markets is a significant milestone for IDClear's role expansion. This marks the beginning of efforts to build resilience in Indonesia's financial industry. This IDClear milestone highlights Indonesia's commitment as a member of G20 to implement centralized clearing for the market. Ultimately, aligning with the global vision, the implementation of central clearing within the Indonesian market is expected to increase transaction efficiency, improve risk management, reduce complexities between market participants, and enhance the market's transparency.

As IDClear expands, it faces various challenges and must continuously adjust to the market's dynamics and needs. Remaining open and ready for continuous communication are key strategies to accommodate new market's inquiries. Since IDClear previously only provided services for the capital market, the new market presents broader challenges. For over twenty years, IDClear worked with securities companies, which have significantly different business behaviors compared to commercial banks. Therefore, to understand them better, IDClear involves the banks from the initial process of the implementation, engaging them in early discussions and including them as part of the shareholders to raise awareness in the industry from the beginning.

IDClear is committed to providing the best services to market participants through an integrated business process that engages the central bank and regulators. IDClear is resolute in complying with the global best practices and the regulators in the near future, and aims to align their current business process with ETP Providers.

6. JSCC: JAPAN SECURITIES CLEARING CORPORATION MIGRATION TO NEW MARGIN CALCULATION METHOD (JSCC-VAR) IN LISTED FINANCIAL DERIVATIVES – BRIEF OVERVIEW AND IMPACT ANALYSIS

Abstract

This paper provides a brief overview of the migration of JSCC's Listed Derivatives Margin calculation method from the Standard Portfolio Analysis of Risk ("SPAN") to a new Value-at-Risk ("VaR") method implemented on November 6th, 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. Lastly, the report presents the results of the analysis on the changes seen in the Margin level for Index Futures/Options Group and Japanese Government Bond ("JGB") Futures/Options Group under Japan Securities Clearing Corporation's ("JSCC") 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.

6.1 INTRODUCTION

6.1.1 Background

Financial institutions in the US and Europe have been using VaR since the 1990s, as one of the means for quantitative assessment of market risk. JSCC adopted the margin calculation method using VaR for its OTC derivatives for CDS in July 2011, IRS products in October 2012, and for cash equity trades in January 2016.

Momentum has been building for the introduction of VaR margin methodologies among CCPs, largely driven by Chicago Mercantile Exchange's ("CME") announcement of migrating its margin calculation method from SPAN to VaR-based model. JSCC, which at the time employed SPAN[66] (hereinafter referred to as JSCC's previous margin methodology) to calculate margin for its Listed Derivatives, started its study for an implementation of a VaR-based model in order to realize the sophisticated risk management benefits provided by such a model, which led to JSCC migrating its margin calculation method for its Listed Derivatives to a new VaR-based method.

The following sections provide a brief description of VaR as calculation method, key points of JSCC's new VaR-based model and its enhancements, and an overview of 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.

6.1.2 What is VaR

VaR[67] is a standard for financial institutions' risk management benchmark, in which market risk is measured using a 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

[66] Margin parameters related to SPAN were specified by JSCC at its discretion.

[67] A. J. McNeil, R. Frey and P. Embrechts (2015). Quantitative Risk Management: Concepts, Techniques and Tools. Princeton University Press.

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.

The new Margin calculation method in JSCC's Listed Financial Derivatives is 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. 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 considering the trading status and Clearing Participants' comments (see Table 1).

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 1: Product Classification by Calculation Method related to Listed Financial Derivatives

In HS-VaR method, as a 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.

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.

6.2 ANALYSIS

6.2.1 Comparison of Margin Amount for Hypothetical Portfolio

In this section, we will confirm what outcome the migration to JSCC-VaR achieved in the Margin per unit of long and short 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 the Tokyo Stock Exchange Stock Price Index ("TOPIX") Futures (1st Contract Month).

We compared margin calculated by JSCC's previous margin methodology and JSCC-VaR Margin for the period from November 1st, 2022 to October 31st, 2024.

Moreover, in August 2024, Margin shortfall occurred several times due to steep market fluctuations partly because of the policy decision of the Bank of Japan ("BoJ"). We will confirm Margin shortfall improvement status comparing to the case of JSCC's previous margin methodology. For Financial Derivatives, Margin Shortfall refers to the status of "Margin amount on Day t" $<$ "Portfolio Loss from Day t to Day $t+2$."

(i) 1 Unit of long and short Nikkei 225 Futures (1st Contract Month)

Throughout the observation period, JSCC-VaR Margin was slightly higher than margin calculated under JSCC's previous margin. Especially, we can tell that, at the time of a steep market fluctuation in August 2024, JSCC-VaR Margin increased more than JSCC's previous margin methodology, though the JSCC-VaR Margin decayed in a more modest manner than did JSCC's previous margin methodology.

Margin shortfalls occurred during the observation period 6 times for JSCC's previous margin methodology(July 23rd, July 31st, August 1st, August 5th, September 3rd, and September 25th, 2024) and 3

times for JSCC-VaR (July 31st, August 1st, and August 5th, 2024). At the time of steep market fluctuation in August, Margin shortfall occurred under both JSCC's previous margin methodology and JSCC-VaR, and, after steep market fluctuation in August, Margin shortfall occurred twice only with the previous margin methodology.

In August 2024, there was a steep market fluctuation that went 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%. Other than such tail risk, since JSCC-VaR Margin captured the following large fluctuations after that, the migration to JSCC-VaR is considered to have worked as intended.

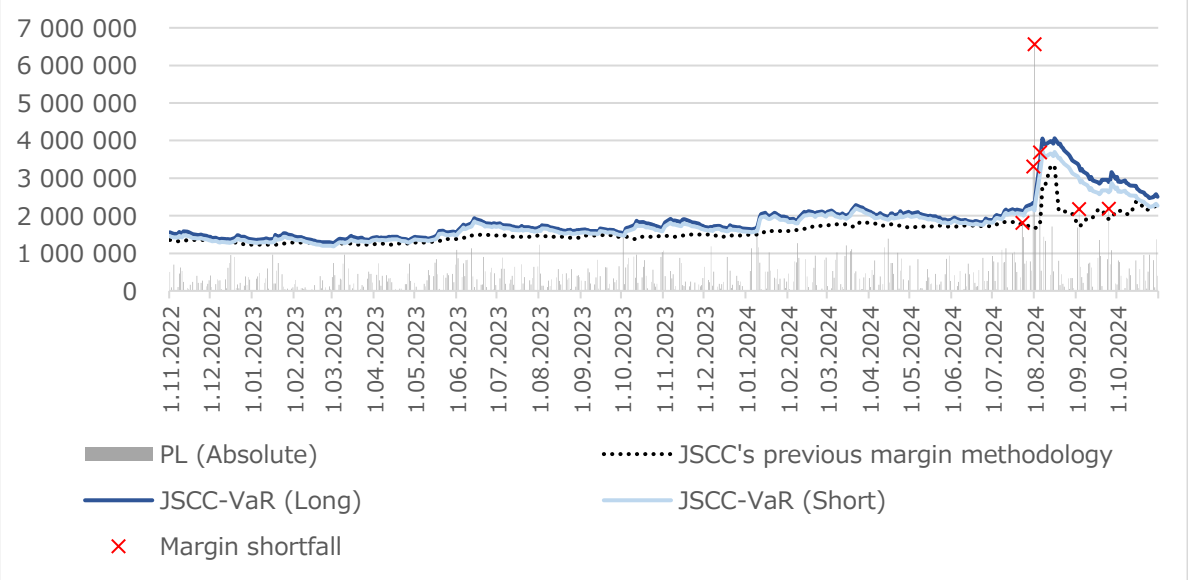


Figure 1: 1 Unit of Nikkei 225 Futures (1st Contract Month) (vertical axis: yen)

(ii) 1 Unit of long and short 10-year JGB Futures (1st Contract Month)

While JSCC's previous margin methodology and JSCC-VaR Margin (Long) showed mostly the same level of margin throughout the observation period, JSCC-VaR Margin (Short) was below that calculated using JSCC's previous margin methodology. At the time of steep market fluctuation in August 2024, no significant difference was observed in the trend of JSCC's previous margin methodology and JSCC-VaR Margin.

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

In a comparison of JSCC's previous margin methodology and JSCC-VaR (aggregated short and long), Margin shortfall occurrence was 1 time more with JSCC-VaR than the previous methodology. This was because short risk could be estimated more tightly in JSCC-VaR. In JSCC's previous margin methodology, 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.

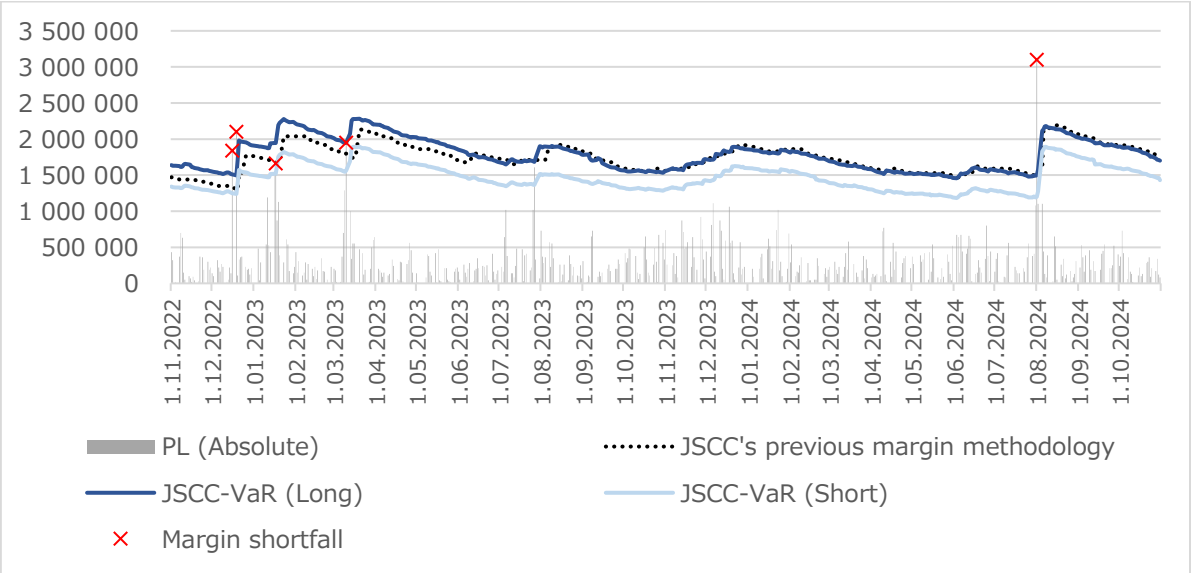


Figure 2: 1 Unit of 10-year JGB Futures (1st Contract Month) (vertical axis: yen)

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

We can confirm that, while JSCC's previous margin methodology and JSCC-VaR Margin showed mostly the same level throughout the observation period, at and after the steep market fluctuation in August 2024, JSCC-VaR Margin decayed more modestly than JSCC's previous margin methodology.

Margin shortfalls occurred during the observation period 3 times for JSCC's previous margin methodology (August 1st, September 1st, and September 25th, 2024) and once for JSCC-VaR (August 1st, 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.

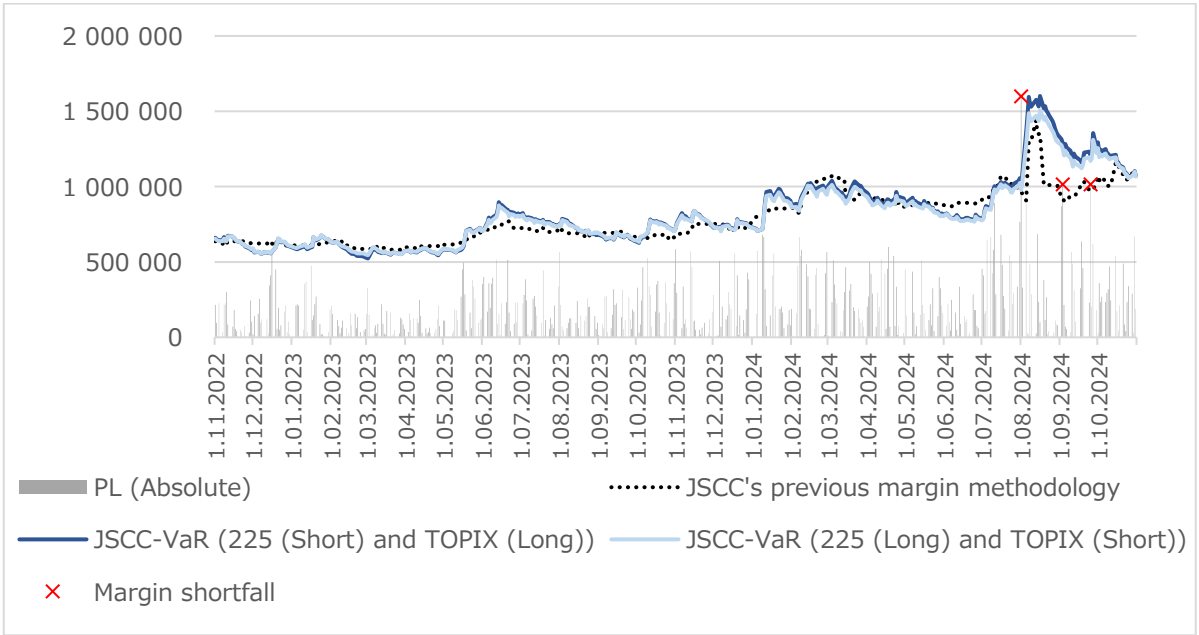


Figure 3: 1 Unit of Nikkei 225 Futures (1st Contracts Month)-TOPIX Futures (1st Contract Month) Spread (vertical axis: yen)

6.2.2 Comparison of Margin for Actual Portfolio

In this section, we compare increase/decrease trend of margin calculated under JSCC's previous margin methodology and JSCC-VaR Margin for actual portfolios using scatter diagram.

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

The scatter diagram shows JSCC's previous margin methodology 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 are presented.

Clearing Participants with top risk amounts are Clearing Participants included in the group of accumulated Stress Loss Over IM over 95% as of October 31st, 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 calculating the clearing fund.

(i) Scatter Diagram for All Accounts

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

i) Index Futures/Option Group

- Number of Samples: 23,573, ratio of JSCC-VaR ≤JSCC's previous margin methodology: 44.06%

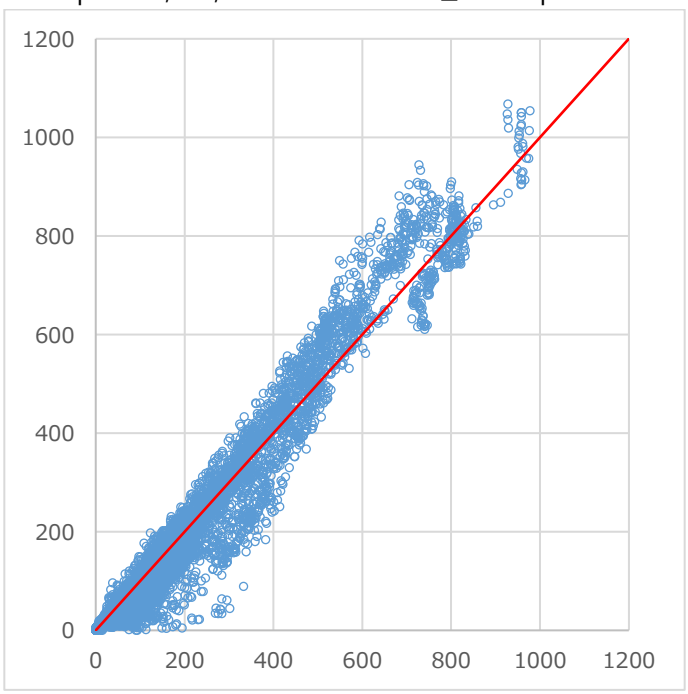


Figure 4: Index Futures/Option Group (horizontal axis: JSCC's previous margin methodology, vertical axis: JSCC-VaR, unit: in JPY 0.1bil)

ii) JGB Futures/Option Group

- Number of Samples: 18,296, ratio of JSCC-VaR ≤ JSCC's previous margin methodology: 68.34%

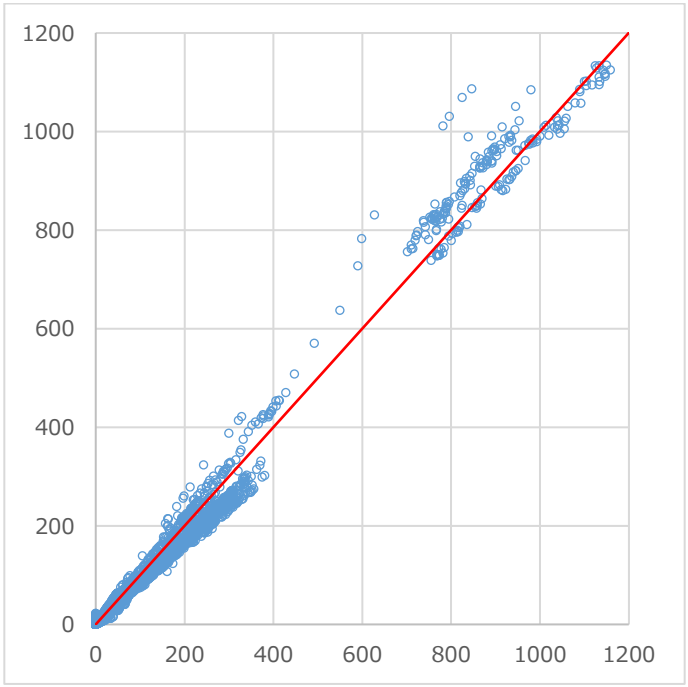


Figure 5: JGB Futures/Option Group (horizontal axis: JSCC's previous margin methodology, vertical axis: JSCC-VaR, unit: in JPY 0.1bil)

(ii) 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.

i) Index Futures/Option Group

- Number of Samples: 1,988, ratio of JSCC-VaR ≤ JSCC's previous margin methodology: 74.94%

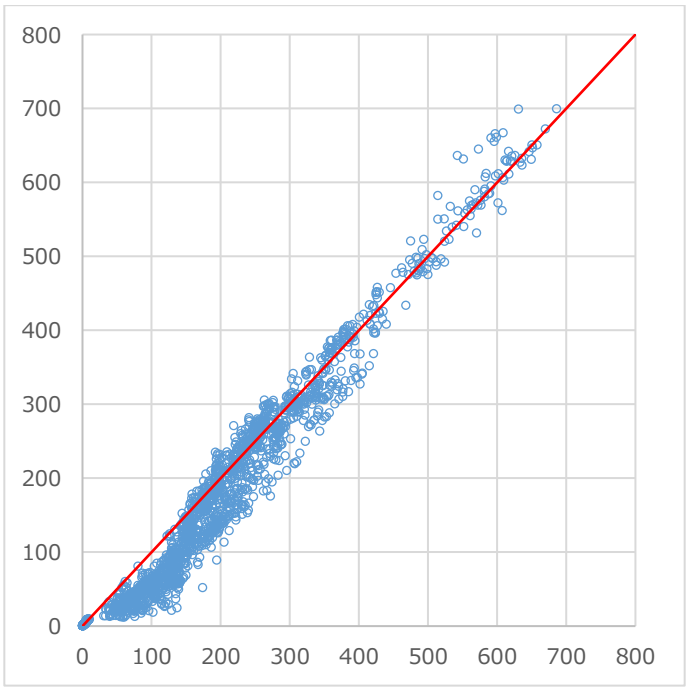


Figure 6: Index Futures/Option Group (horizontal axis: JSCC's previous margin methodology, vertical axis: JSCC-VaR, unit: in JPY 0.1bil)

ii) JGB Futures/Option Group

- Number of Samples: 1,989, ratio of JSCC-VaR ≤ JSCC's previous margin methodology: 68.22%

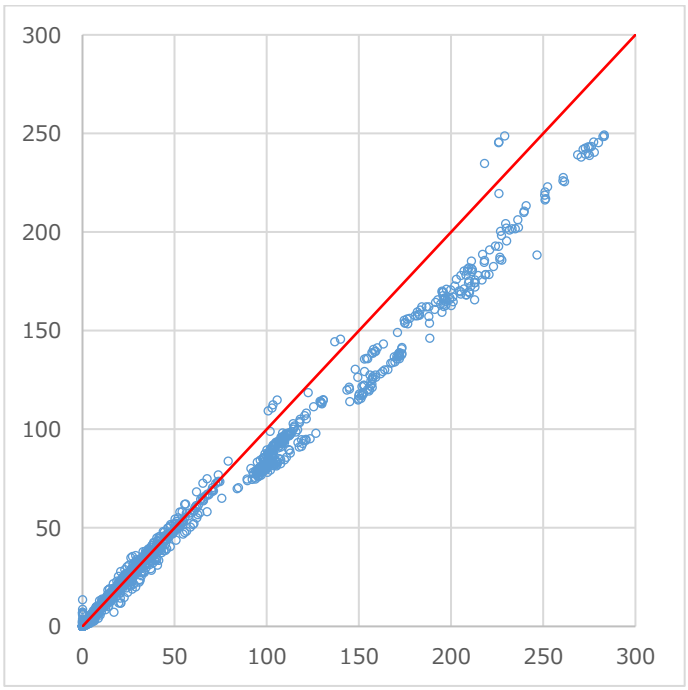


Figure 7: JGB Futures/Option Group (horizontal axis: JSCC's previous margin methodology, vertical axis: JSCC-VaR, unit: in JPY 0.1bil)

(iii) Scatter Diagram of Foreign Leading Clearing Participants with Top Risk Amounts

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

i) Index Futures/Option Group

- Number of Samples: 7,095, ratio of JSCC-VaR ≤ JSCC's previous margin methodology: 52.37%

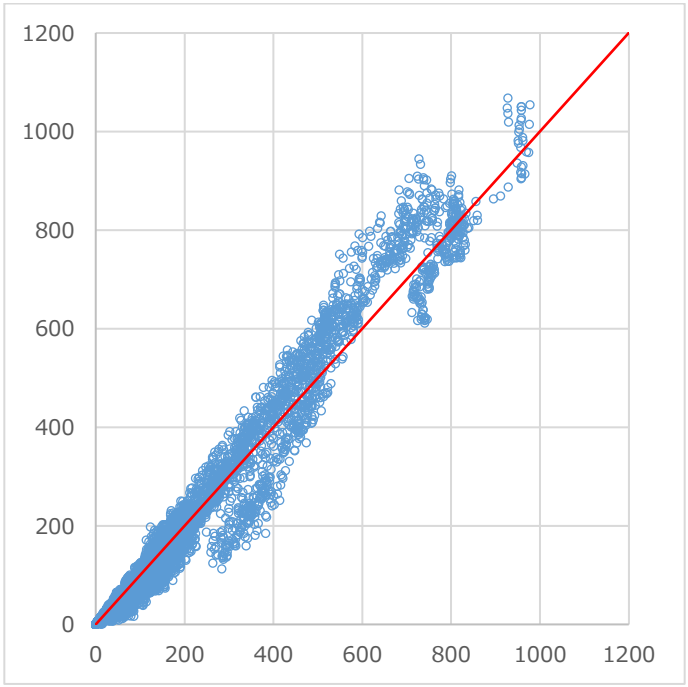


Figure 8: Index Futures/Option Group (horizontal axis: JSCC's previous margin methodology, vertical axis: JSCC-VaR, unit: in JPY 0.1bil)

ii) JGB Futures/Option Group

- Number of Samples: 9,196, ratio of JSCC-VaR ≤ JSCC's previous margin methodology: 58.50%

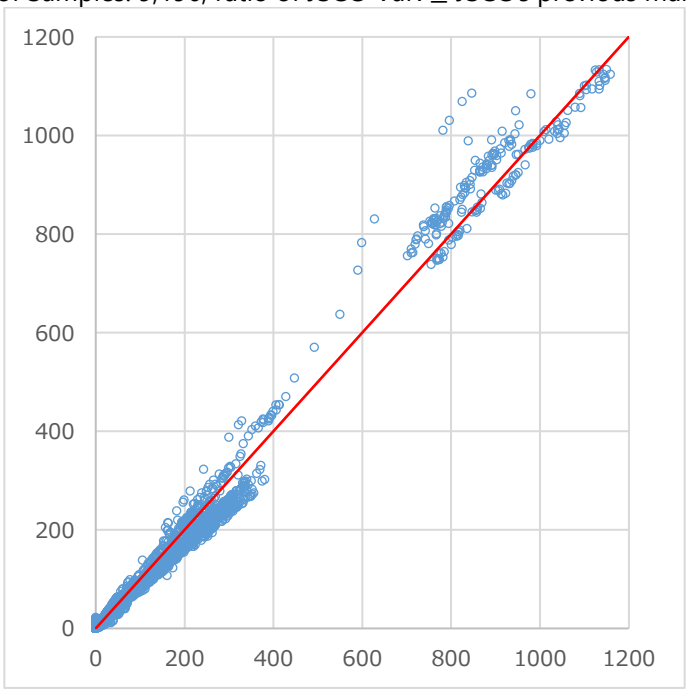


Figure 9: JGB Futures/Option Group (horizontal axis: JSCC's previous margin methodology, vertical axis: JSCC-VaR, unit: in JPY 0.1bil)

(iv) 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.

i) Index Futures/Option Group

- Number of Samples: 14,490, ratio of JSCC-VaR ≤ JSCC's previous margin methodology: 35.75%

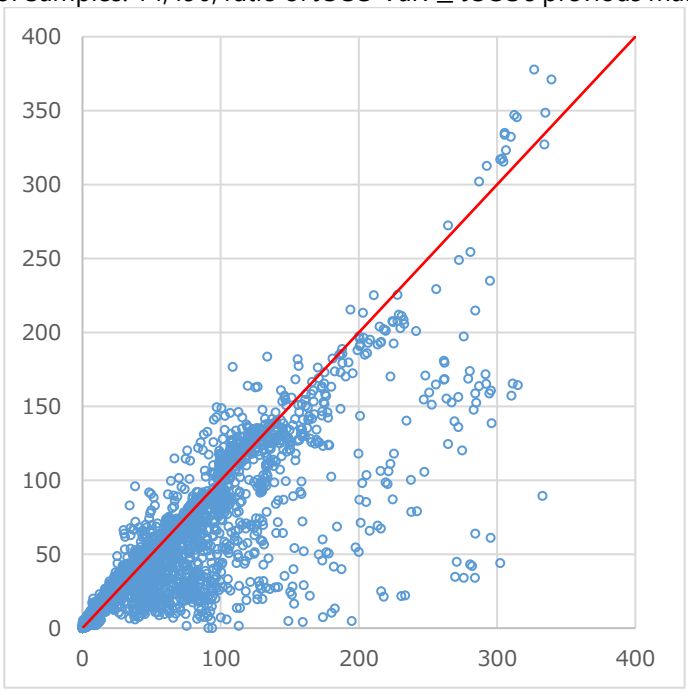


Figure 10: Index Futures/Option Group (horizontal axis: JSCC's previous margin methodology, vertical axis: JSCC-VaR, unit: in JPY 0.1bil)

ii) JGB Futures/Option Group

- Number of Samples: 7,111, ratio of JSCC-VaR ≤ JSCC's previous margin methodology: 81.11%

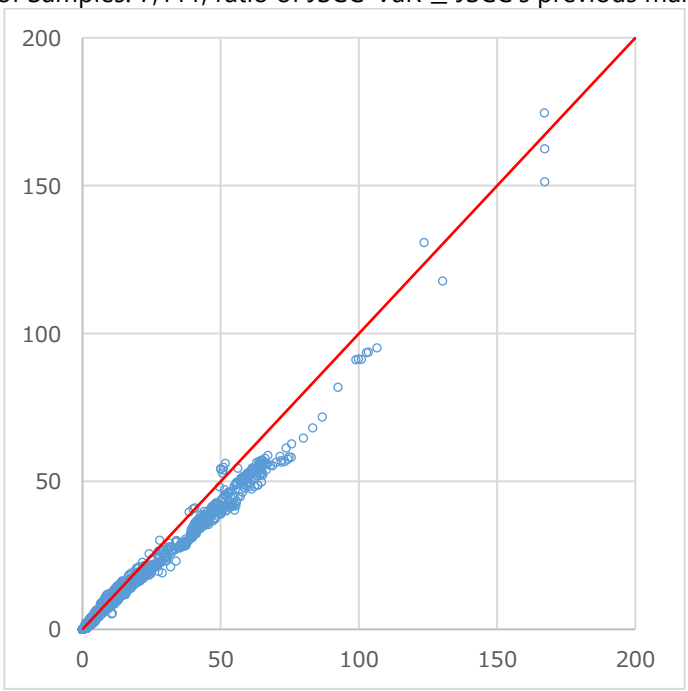


Figure 11: JGB Futures/Option Group (horizontal axis: JSCC's previous margin methodology, vertical axis: JSCC-VaR, unit: in JPY 0.1bil)

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 JSCC's previous margin methodology 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 JSCC's previous margin methodology was very limited. In JSCC's previous margin methodology 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 JSCC's previous margin methodology 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 because 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, JSCC's previous margin methodology Margin tends to be high Margin in strong short trend. This also is an improvement as a result of JSCC-VaR enabling an accurate calculation of asymmetric nature of the price fluctuation risk.

In JSCC-VaR, an offset 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 JSCC's previous margin methodology calculated roughly through an application of scenarios with a limited possibility of emergence and the same scenario to short and long.

6.2.3 Margin Calculation Efficiency

In this section, we analyse whether or not the migration to JSCC-VaR achieved a more efficient Margin collection closer to the reality of the portfolio loss.

The observation period is from November 1st, 2022 to November 2nd, 2023. 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:

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

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.

(i) All Accounts Aggregate

Looking at median, the divergence ratios were smaller with JSCC-VaR as compared to JSCC's previous margin methodology 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.

i) Index Futures/Option Group

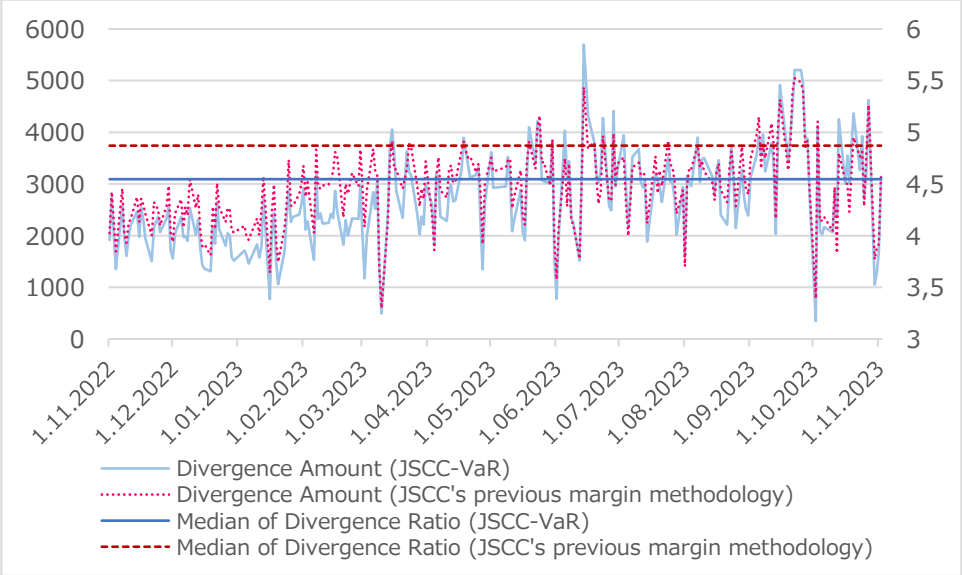


Figure 12: Index Futures/Option Group (vertical axis: in JPY 0.1bil)

ii) JGB Futures/Option Group

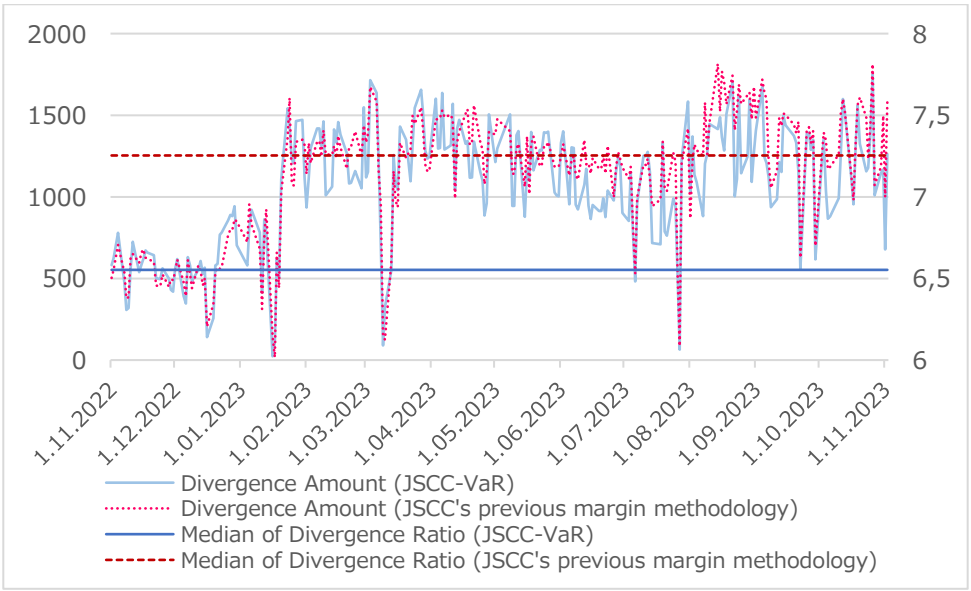


Figure 13: JGB Futures/Option Group (vertical axis: in JPY 0.1bil)

	JSCC-VaR	JSCC's previous margin methodology
Index Futures/Option Group	4.54	4.87
JGB Futures/Option Group	6.55	7.25

Table 2: Median of Divergence Ratio in All Accounts Aggregate

(ii) Domestic Leading Clearing Participants with Top Risk Amounts

Looking at median, the divergence ratios were smaller with JSCC-VaR compared to JSCC's previous margin methodology in each of the Index Futures/Option Group and the JGB Futures/Option Group.

i) Index Futures/Option Group

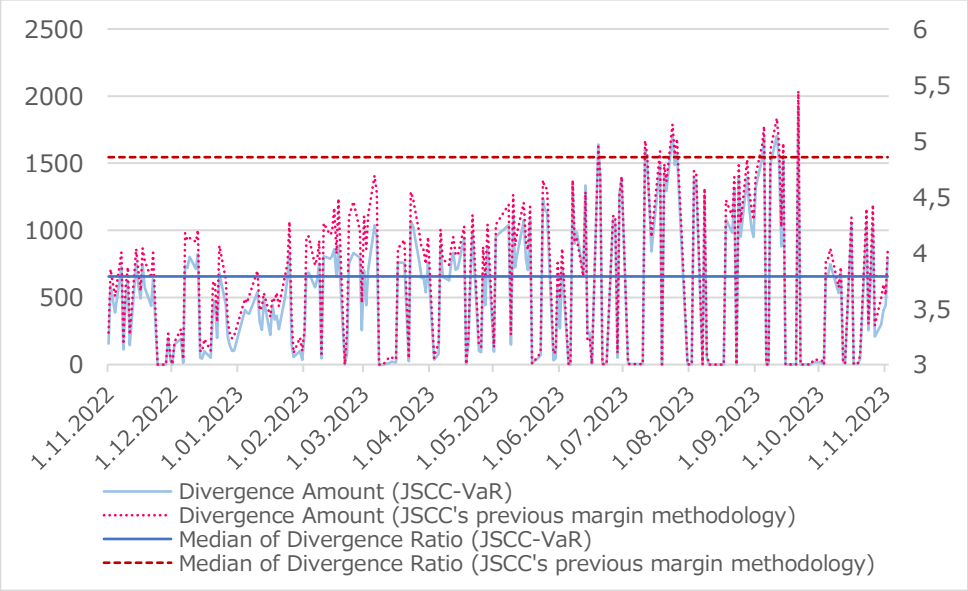


Figure 14: Index Futures/Option Group (vertical axis: in JPY 0.1bil)

ii) JGB Futures/Option Group

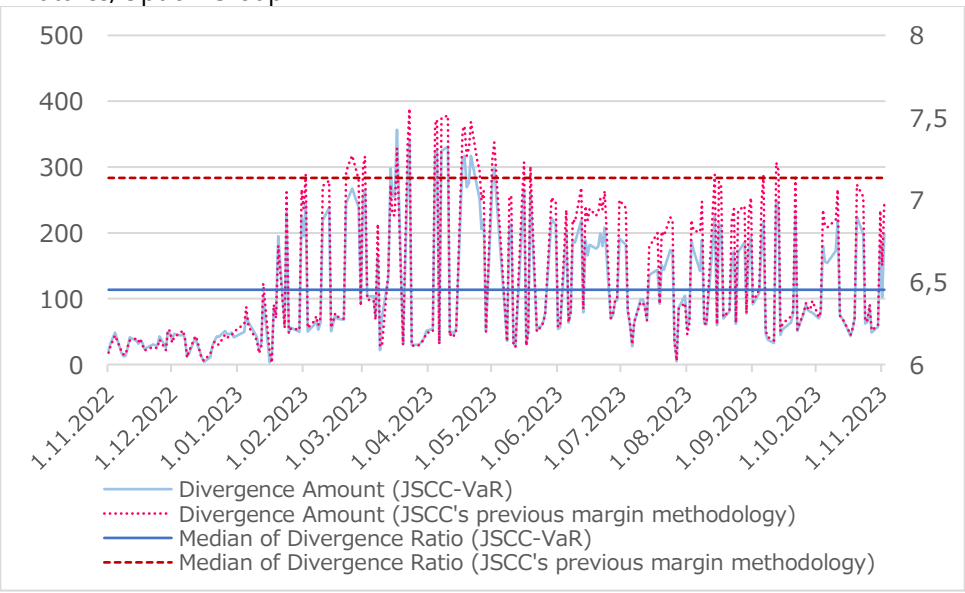


Figure 15: JGB Futures/Option Group (vertical axis: in JPY 0.1bil)

	JSCC-VaR	JSCC's previous margin methodology
Index Futures/Option Group	3.78	4.85
JGB Futures/Option Group	6.45	7.13

Table 3: Median of Divergence Ratio in Domestic Leading Clearing Participants with Top Risk Amounts

(iii) Foreign Leading Clearing Participants with Top Risk Amounts

Looking at median, the divergence ratios were smaller with JSCC-VaR compared to JSCC's previous margin methodology in each of the Index Futures/Option Group and the JGB Futures/Option Group. The difference was insignificant for the Index Futures/Option Group.

i) Index Futures/Option Group

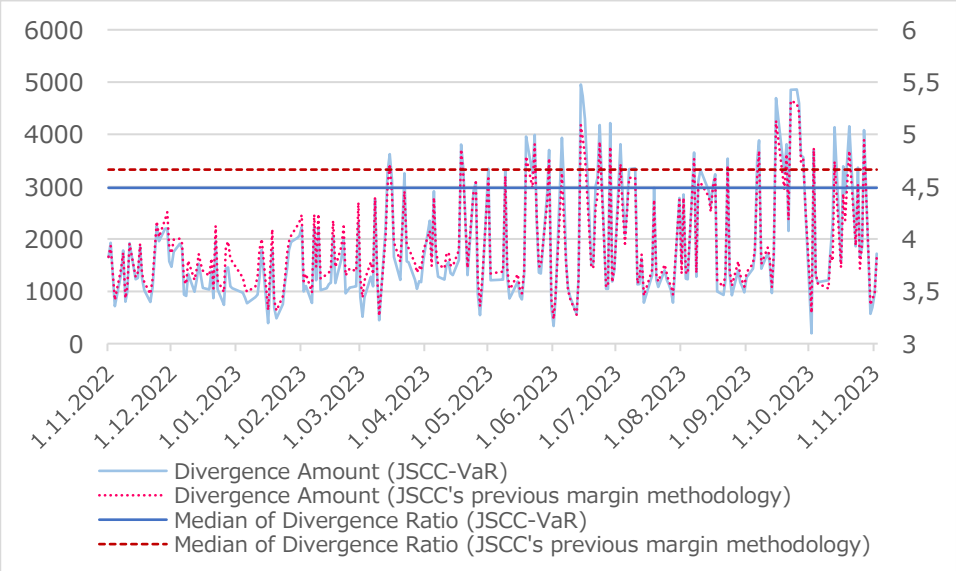


Figure 16: Index Futures/Option Group (vertical axis: in JPY 0.1bil)

ii) JGB Futures/Option Group

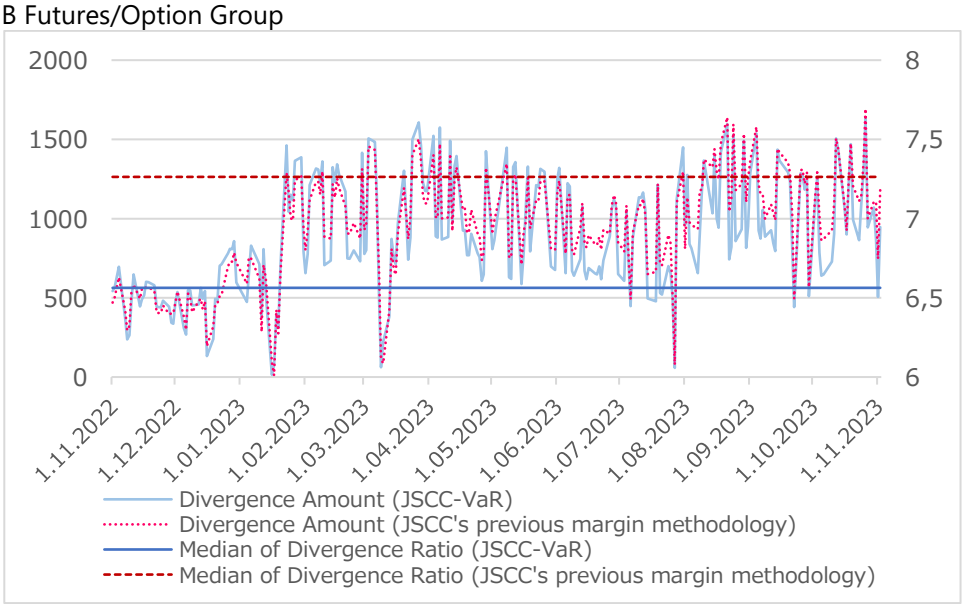


Figure 17: JGB Futures/Option Group (vertical axis: in JPY 0.1bil)

	JSCC-VaR	JSCC's previous margin methodology
Index Futures/Option Group	4.48	4.66
JGB Futures/Option Group	6.56	7.26

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

(iv) Other Clearing Participants

Looking at median, the divergence ratios were smaller with JSCC-VaR compared to JSCC's previous margin methodology in each of the Index Futures/Option Group and the JGB Futures/Option Group.

i) Index Futures/Option Group

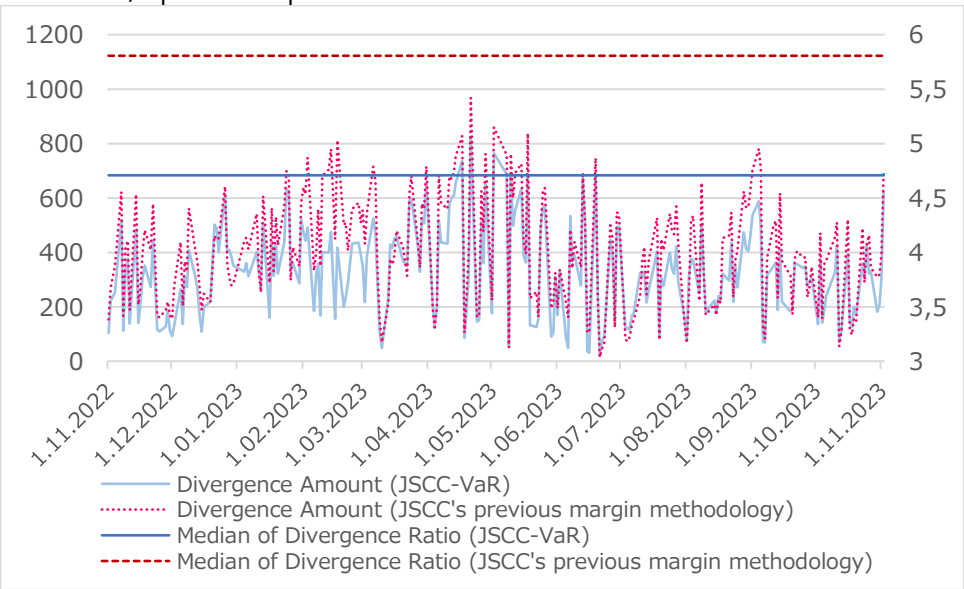


Figure 18: Index Futures/Option Group (vertical axis: in JPY 0.1bil)

ii) JGB Futures/Option Group

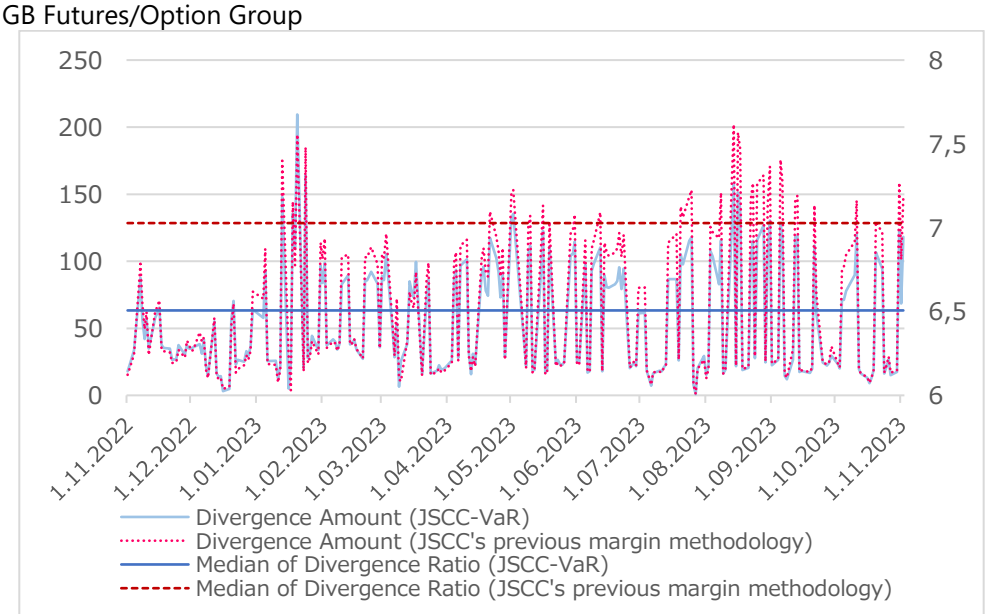


Figure 19: JGB Futures/Option Group (vertical axis: in JPY 0.1bil)

	JSCC-VaR	JSCC's previous margin methodology
Index Futures/Option Group	4.70	5.80
JGB Futures/Option Group	6.50	7.02

Table 5: Median of Divergence Ratio in Other Clearing Participants

In terms of the 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 6.2.2 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.

6.2.4 Margin Methodology Assessment

In general, the highest concern of the CCP Margin framework is to cover potential losses arising from cleared positions when liquidated due to a Clearing Participant's default, which is presented as "Margin Shortfall Occasions" in this section; the lesser Margin Shortfall Occasions is the more conservative Margin framework. From this point of view, JSCC-VaR prevails over JSCC's previous margin methodology. On the other hand, suppression of procyclicality is one of the discussion points relevant when assessing a Margin calculation method. Procyclicality is a phenomenon where a steep rise in Margin because of volatile market conditions causes further market fluctuations. CCPs are required to introduce measures to limit procyclicality in the design of their margin frameworks and ensure that margin frameworks are both robust and risk sensitive.

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 JSCC's previous margin methodology and JSCC-VaR for the period from November 1st, 2022 to October 31st, 2024 as a means to analyse the anti-procyclicality measures. Also presented in this section is the number of Margin Shortfall Occasions during this observation period as an indicator of margin methodology's conservativeness.

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[68]. 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[69].

As to Balancing, by reference to the European Securities and Markets Authority ("ESMA") publication[70], 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 $\frac{\text{VaR}}{\text{JSCC's previous margin methodology}} - 1$. 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).

(i) 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.

	JSCC's previous margin methodology	JSCC-VaR (Long)	JSCC-VaR (Short)
Largest Margin	JPY 3,330,000	JPY 4,060,319	JPY 3,720,799

[68] D. Murphy, M. Vasios and N. Vause (2016). Staff Working Paper No. 597, A comparative analysis of tools to limit the procyclicality of initial margin requirements. Bank of England.
[69] 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.
[70] Consultation Paper, Review of RTS No 153/2013 with respect to procyclicality of margin. European Securities and Markets Authority.

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

From perspective of Balancing in Figure 20 and Table 8, only efficiency of JSCC-VaR was worse for both short and long than JSCC's previous margin methodology, while its conservativeness was better for both due to its higher margin.

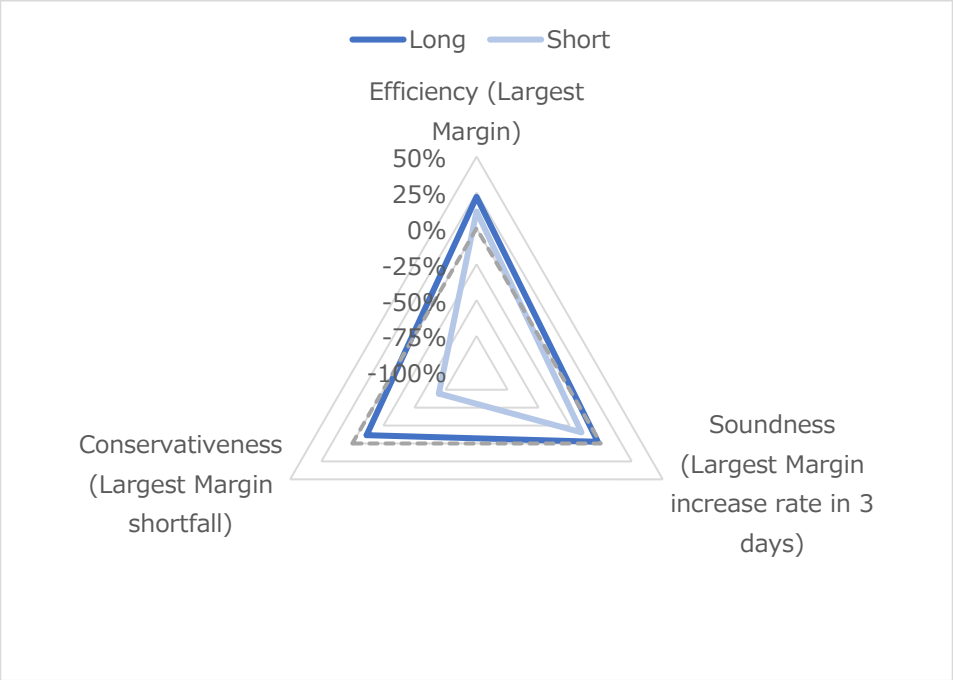


Figure 20: Balancing in 1 Unit of Nikkei 225 Futures (1st Contract Month)

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

(ii) 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.

	JSCC's previous margin methodology	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 8: Soundness in 1 Unit of 10-year JGB Futures (1st Contract Month)

For Balancing in Figure 21 and Table 9, the result shows the efficacy only in conservativeness for Long and only in efficiency for Short.

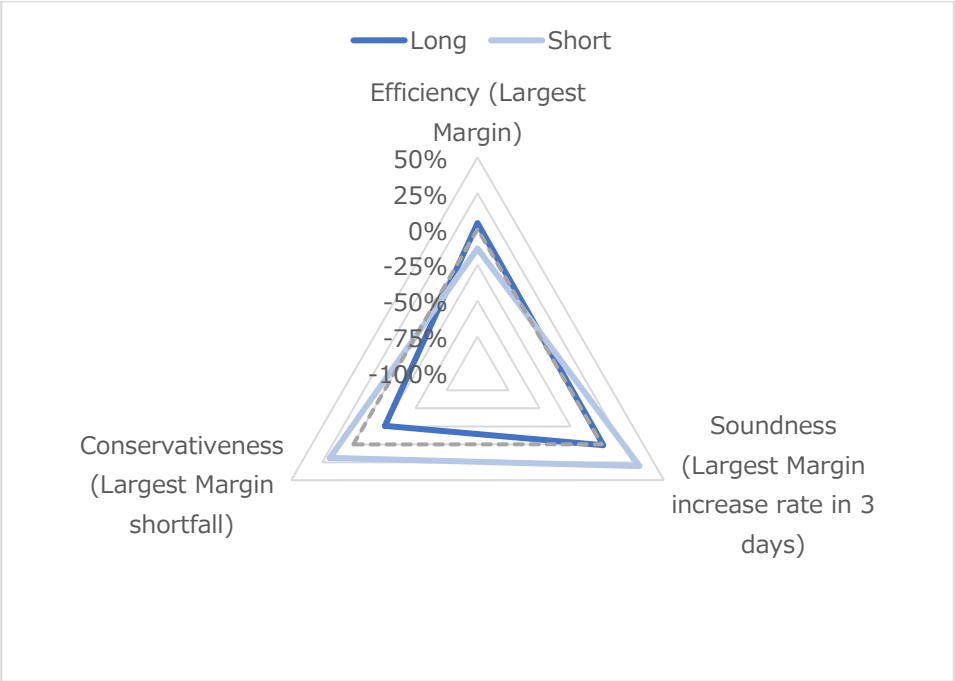


Figure 21: Balancing in 1 Unit of 10-year JGB Futures (1st Contract Month)

	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 9: 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 show meaningful improvements. This is 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 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 6.2.1, the reason for this result in Short is an impact of Margin decreases through reflection of an 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 under JSCC's previous margin methodology, 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 a Margin shortfall. For this purpose, from a risk management viewpoint, it seems good to allow Margin increases at certain levels at the time of steep market fluctuation. Looking at the results 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.

6.3 CONCLUSION

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

We observed the tendency of decreases in Margin at many accounts for Clearing Participants with large risk amount (Stress Loss Over IM) because of the migration to JSCC-VaR. This is thought to be an improvement in the Margin calculation method, where JSCC's previous margin methodology calculated roughly through an application of few scenarios with a limited possibility of emergence and the same scenario to short and long, by a natural incorporation of an offset effect between the products within the portfolio through a realization of direct calculation of portfolio risk based on many historical scenarios.

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

In assessing the Margin Methodology, we validated the long-term soundness, the short-term soundness, and Balancing. Under these validations, Margin Shortfall Occasions were reduced by JSCC-VaR, while the migration did not necessarily bring a prominent enhancement from the long-term and short-term soundness perspective. The migration to JSCC-VaR can be valued to have achieved a successful result to a certain extent for the initial purpose since an enhancement was observed in the area in which JSCC's previous margin methodology had issues from a viewpoint of sophistication of risk management.

Many of the products currently margined 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 the method of adopting stress scenarios for suppression of procyclicality and scenario adjustment method to match with the 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 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 which existed in the past, and as such there are limitations. However, these limitations are unavoidable regardless of how sophisticated the mathematical methodology is. JSCC assesses such limitations and implements appropriate risk management to address such limitations through a combination of various risk management methodologies, such as financial resources sufficiency validation through daily Margin backtesting and model adequacy evaluation.

7. NSE CLEARING: A UNIQUE TWO-WAY SOFTWARE-AS-A-SERVICE MODEL AMONG INTEROPERABLE INDIAN CCPS TO IMPROVE OPERATIONAL RESILIENCY

Abstract

Central Counterparties ("CCPs") place significant emphasis on operational resilience and implement multiple safeguards to prevent and/or recover from outages. Despite these safeguards, software malfunctions remain a critical vulnerability as alternative software is typically not available in the event of a critical software malfunction, necessitating a real-time fix in the production environment. The Indian market structure, characterized by interoperable CCPs with similar risk management frameworks provided a unique opportunity to overcome this challenge.

NSE Clearing established availability of a redundant Risk Management System ("RMS") in the form of a solution offered under Software-as-a-Service ("SaaS") model by its interoperable CCP. In a mutual arrangement, NSE Clearing also reciprocally provides a SaaS RMS to its interoperable CCP. The mechanism allows NSE Clearing to activate and use the RMS offered under SaaS in case of any critical issues with its primary RMS. This initiative, implemented over a span of two years between 2022 and 2024, has enhanced the scope of redundancy to software solutions.

The solution has been successfully tested in special live trading sessions, demonstrating seamless switchover from primary RMS to SaaS RMS. This innovative solution, the only one of its kind, has significantly strengthened the operational resilience of Indian market infrastructure.

7.1 MITIGATING THE RISK OF SOFTWARE MALFUNCTIONS FOR OPERATIONAL RESILIENCE

Operational resilience of the critical information systems of Central Counterparties ("CCPs") is crucial for a well-functioning financial market infrastructure. Operational disruptions can not only damage reputation or perceived reliability but may also lead to financial losses, regulatory consequences, and affect market integrity and confidence of investors. CCPs have in place multiple preventive controls and consequence management measures to ensure operational resiliency. Disaster recovery mechanisms are a crucial component of operational resiliency planning for timely resumption of critical services of the CCPs in case of an outage.

CCPs consider a secondary, and sometimes a third site, for business continuity management, with appropriate staffing arrangements to ensure that they will not be affected even in the case of a large-scale disruption. A CCP can face a wide range of crisis scenarios including hardware failures, physical attacks, natural disasters, software malfunctions, and cyber-attacks. Preventive controls should be implemented to reduce the likelihood of a disruption, and recovery mechanisms should be put in place to resume provision of critical services within a short span of time. The use of multiple sites for business continuity management is a strong disaster recovery mechanism for hardware failures, physical attacks, natural disasters etc. However, they typically have no utility in recovering from software malfunctions as the same software is deployed at alternative sites.

CCPs put in place several preventive controls such as code reviews, quality checks, and comprehensive testing mechanisms to reduce the likelihood of outage due to a software malfunction. If a critical software malfunction were to occur, the only recovery mechanism typically available would be debugging and

applying the fix in the production environment. Given the complex procedures and business functions of CCPs, adhering to the recovery time objectives ("RTO") may be challenging in such a scenario.

7.2 A UNIQUE OPPORTUNITY IN INDIA

India has a vibrant equities market with wide participation. National Stock Exchange of India ("NSE") is the largest derivatives market in the world in terms of number of contracts traded. NSE Clearing Ltd. is a subsidiary of NSE and is the largest CCP in India.

Indian markets are characterized by multiple exchanges, CCPs and Central Securities Depositories ("CSDs") that are fully interoperable. There are three exchanges, two CCPs, and two CSDs in India. The interoperability is achieved mainly by the linkages of CCPs with other Financial Market Infrastructures ("FMIs"). The CCPs provide clearing services for trades executed on all exchanges and maintain a peer-to-peer link to clear and settle inter-CCP obligations which may arise due to buy/sell legs of a given trade being settled on different CCPs.

The Indian regulations have three key requirements with regards to risk management: i) mandatory fully segregated account structure for all customers, (ii) real-time risk management, and (iii) upfront margin collection by CCPs from CMs as well as by CMs from customers. These features make high availability of RMS of the Indian CCPs very crucial to ensure correct utilization of customer level margins and collateral and carrying out real-time risk management. Any downtime of the RMS of CCPs will result in market disruption if real time risk management cannot be performed. In India, the minimum standards for margin models are stipulated by the market regulator Securities and Exchange Board of India ("SEBI"), in due consultation with the relevant stakeholders. While the CCPs may have more conservative practices based on their own perception of risk, the RMS of both the CCPs must implement the minimum regulatory standards. In practice, the differences in the risk management practices of interoperable CCPs are not substantial.

Regarding interoperability, the exchanges and CCPs have necessary linkages in place to transmit and consume trades from any exchange to any CCP and their risk management can be carried out in a broadly similar manner and ensure adherence to regulatory requirements. This allows for offering of a two-way portability between CCPs under an SaaS model whereby in case of a software malfunction of the RMS of one CCP, such CCP can use the RMS of the other interoperable CCP to continue to carry out risk management of trades for its CMs and avoid disruption to the market.

NSE Clearing has put in place such a framework to enhance its operational resiliency in coordination with its interoperable CCP using such SaaS model. The salient features of the two-way portability model are as follows:

1. Provides critical failover support in case of RMS failure of any interoperable CCP to maintain business continuity and uninterrupted operations;
2. Enhances availability of core RMS of the CCP ecosystem;
3. Switchover from the primary RMS to the SaaS RMS can be implemented within a short span of 30 minutes; and
4. Can manage high-capacity volumes of the largest equity derivatives market in the world in terms of number of contracts.

According to NSE Clearing, this initiative is the first of its kind in the world and its implementation has made NSE Clearing more resilient to outages due to software malfunctions. The framework has been extended to all stock exchanges and interoperable market segments (i.e., cash equities market, equity derivatives market, currency derivatives market, etc).

7.3 TWO-WAY PORTABILITY MODEL EXPLAINED

7.3.1 High level architecture

The two-way portability SaaS model allows business continuity for Indian CCPs in the event of critical software malfunction with their own RMS ("Primary RMS"). In the SaaS set-up, NSE Clearing maintains its own hardware in the data centre of its interoperable CCP. The RMS application of the interoperable CCP is deployed on such hardware ("SaaS RMS"). On occurrence of a critical software malfunction with its primary RMS, NSE Clearing can process trades using the SaaS RMS. Conversely, NSE Clearing also provides a SaaS RMS to its interoperable CCP.

Key design aspects of the SaaS model are as follows:

1. Trades to be cleared by NSE Clearing are electronically sent by all exchanges to the SaaS setup in addition to the primary RMS of NSE Clearing.
2. The primary RMS of NSE Clearing transmits other additional information, such as client level collateral details, depository instructions, give-up/take-up instructions, etc. to the SaaS RMS setup.
3. The SaaS application provides real-time risk management including calculation of positions and margins. These functions are carried out in a passive mode until the SaaS application is made the primary instance. In other words, while the SaaS application is equipped to take necessary actions in case of margin shortfalls, the same is activated only upon designating SaaS instance as the primary RMS. In the normal course of business, only the primary RMS of NSE Clearing takes any actions based on real-time risk management.
4. When activated, the SaaS application also provides an interface to CMs to carry out all regular business functions (e.g., collateral submissions, retrieving margins data, trade give-up/take-up, etc.).
5. Mirroring this arrangement, NSE Clearing also offers its RMS as a backup under the SaaS framework to its interoperable CCP.

Figure 1 provides a high-level depiction of the SaaS framework. It depicts how each exchange sends trades to be cleared by a CCP to its primary RMS within its data centre as well as its SaaS RMS hosted in the interoperable CCP's data centre.

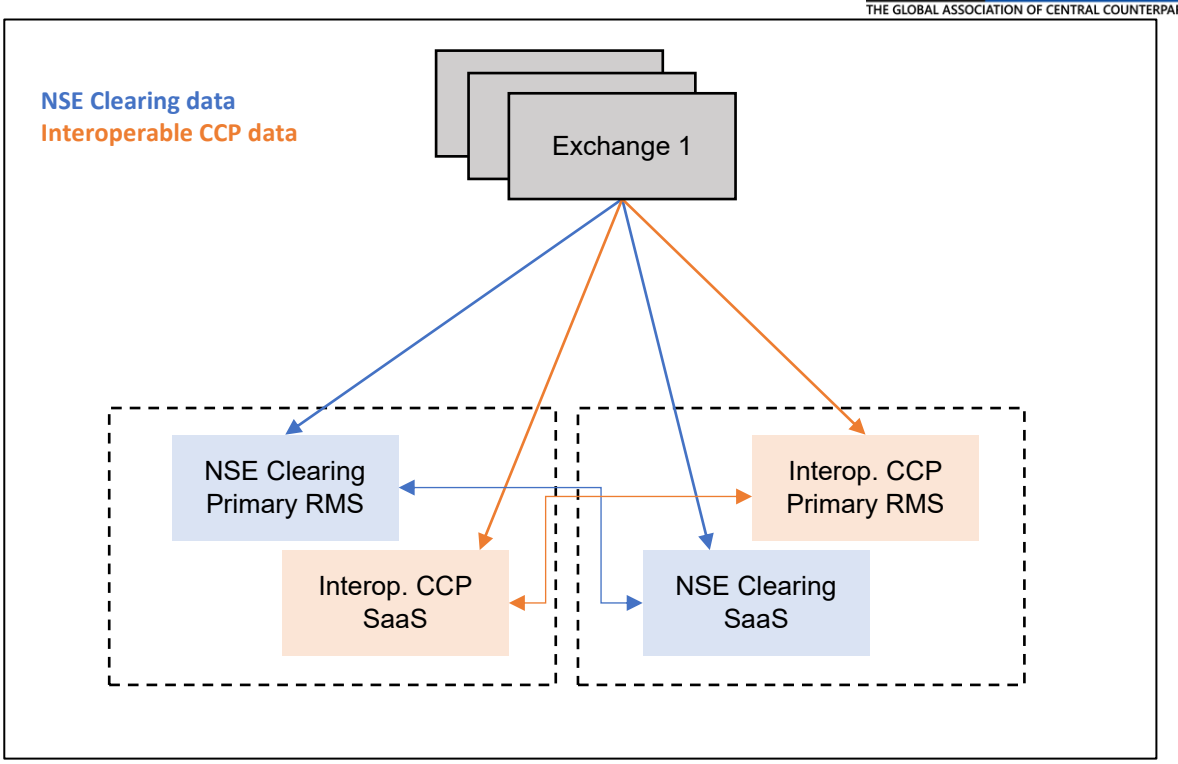


Figure 1: High level depiction of SaaS framework

7.3.2 Switchover from primary RMS to SaaS RMS

Figure 2 depicts the protocol for switchover from primary RMS to SaaS RMS in case of a decision to activate the SaaS RMS.

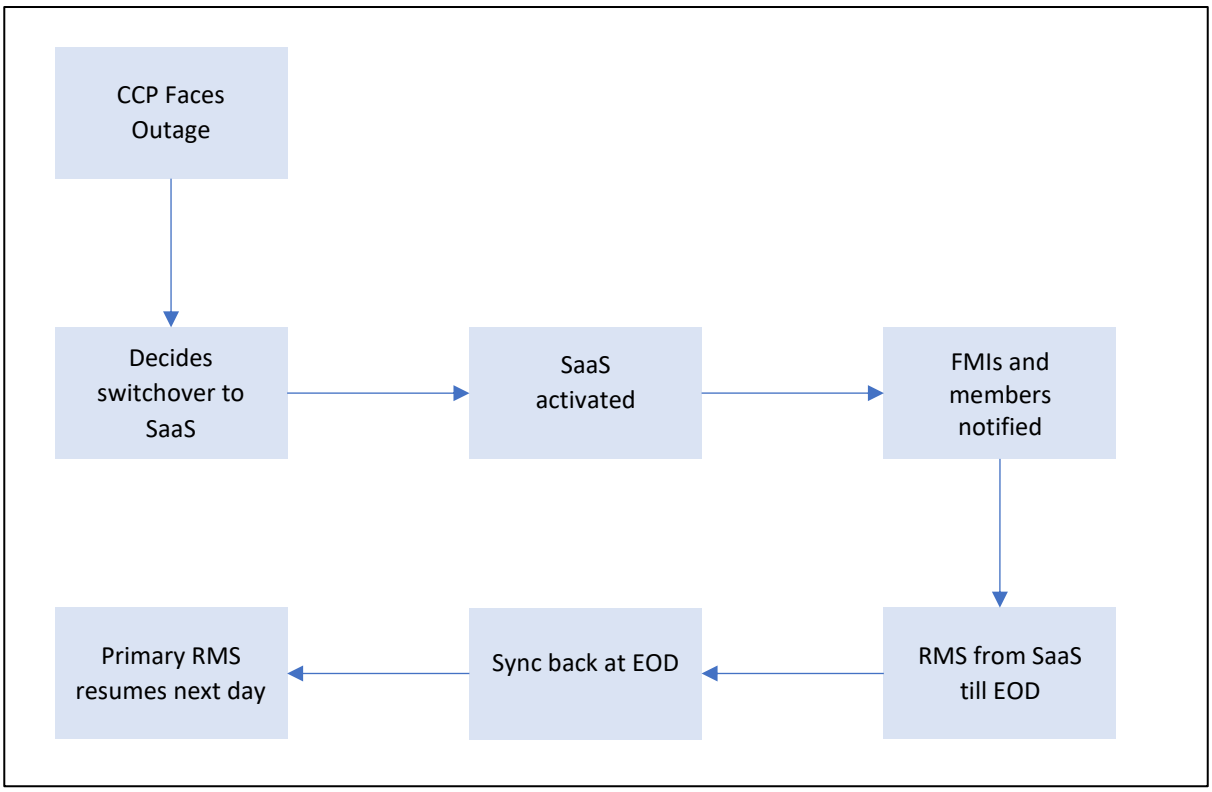


Figure 2: Invocation of SaaS model

If a CCP's primary RMS is halted due to critical software malfunction, it may decide to switch over to the SaaS. In such a scenario, the CCP shall communicate to all its members and other FMIs regarding its decision to activate the SaaS RMS. The members of the affected CCP will need to switch to the relevant interfaces provided through the SaaS RMS.

The affected CCP will continue to carry out risk management using the SaaS RMS until the close of market hours. After market hours, such CCP can receive all relevant information from the SaaS RMS to the primary RMS and/or its other offline clearing and settlement systems to complete post-market activities. The affected CCP can switch back to the primary RMS from the next business day.

7.4 OVERCOMING IMPLEMENTATION HURDLES

7.4.1 Standardisation and integration

NSE Clearing and its interoperable CCP used native formats within their applications. To transmit and consume information from Primary RMS to SaaS RMS, a new standardised message structure and a new interface was developed.

7.4.2 Reconciliation of data

As a part of implementation, reconciliation of risk-related parameters and data to members (margin utilisations, positions, etc.) is crucial. While the Indian CCPs broadly follow similar risk management frameworks, there were some differences which posed additional challenges in reconciliation of data between the primary RMS and the SaaS RMS.

7.4.3 IT Security policies

Each CCP desired that their own IT security policies be applicable to their respective SaaS setups which hosted the software solutions of the other CCP. The same was implemented under the SaaS framework.

7.4.4 Scalability

NSE Clearing has a market share of about 95% under interoperability. Therefore, the load handled by the primary RMS of NSE Clearing is about 20 times more than the other interoperable CCP. Accordingly, the SaaS setup of the interoperable CCP had to be scaled up to handle the volumes of NSE Clearing. Multiple mock sessions were conducted to perform load testing and validate system performance including throughput and latency.

7.4.5 Member training

As a part of SaaS implementation, each CCP had to provide an interface to CMs to carry out regular business functions (e.g., collateral submissions, retrieving margins data, trade give-up/take-up, etc.). The members of NSE Clearing needed to be familiarised with the alternative member interface and vice versa.

7.4.6 Ensuring Collaboration and Data Privacy

Under the SaaS framework, competing CCPs worked together to enhance operational resiliency, recognizing the broader market benefits of their collaboration. To maintain data privacy, the SaaS setup is managed by each CCP's own staff, with access to the other CCP's systems limited to exceptional technical support needs. This approach, supported by both regulators and senior leadership, ensured a seamless and secure implementation.

7.5 IMPLEMENTATION AND TESTING

The overall project timeframe, including architecture design, implementation, testing, and special live sessions spanned across two years from July 2022 till May 2024. The following approach was adopted:

1. The design and implementation of architecture, interfaces, etc. was completed in a period of 9 months between July 2022 to March 2023.
2. After implementation, the core solution was made live in passive mode from April1st, 2023. After the live implementation, appropriate reconciliations and checks were carried out on a continuous basis by both the CCPs – which involved business validations as well as monitoring of technical parameters like throughput and latency, etc. Additionally, an alerting mechanism was also put in place for timely warning of any deviation in performance.
3. Between April 2023 to June 2023, additional features were introduced in the SaaS solution for the implementation of the entire scope of the project.
4. During this period, switchover mocks were conducted every week without external participation to ensure the switchover protocol for invocation of SaaS portability can be seamlessly executed.
5. Between July 2023 to December 2023, mocks with external participation by CMs were conducted in order to familiarise them with the member interfaces and the switchover protocol.
6. Special live sessions were conducted where CCPs demonstrated their capability to switchover from primary RMS to SaaS RMS intraday during live market. In February 2024, a live session involving switchover of primary RMS of interoperable CCP to the SaaS setup provided by NSE Clearing was carried out. In a similar manner, in May 2024, a live session was conducted involving switchover of primary RMS of NSE Clearing to the SaaS setup provided by interoperable CCP.
7. After successful live trading, the solution is operated daily in passive mode and switchover is tested by each CCP in mock sessions on a quarterly basis.

7.6 CONCLUSION

CCPs are a crucial pillar of financial market stability, ensuring seamless clearing and settlement of transactions. Their operational resilience, i.e. their ability to prevent, withstand, and recover from disruptions is essential for the stability of financial markets.

The unique opportunity in India due to its interoperable market structure and broadly similar risk management framework of CCPs allowed for a one-of-its-kind novel solution to address a key concern of alternate system unavailability in case of a critical software malfunction.

The model has further strengthened the capabilities of NSE Clearing in ensuring:

1. High availability,
2. Additional disaster recovery mechanism,
3. Robust risk management,
4. Reliability by building trust in the ecosystem.

8. SGX: MANAGING RISK IN FREIGHT DERIVATIVES AMID MARKET VOLATILITY AND NEGATIVE PRICES

Abstract

The shipping industry plays a crucial role in global trade. From time to time, the freight market can experience bouts of extreme volatility, which underscores the importance of hedging tools like Forward Freight Agreements ("FFAs") and its fungible futures. With Singapore recognized as a top maritime center, Singapore Exchange ("SGX") operates a vibrant FFA market, including the dry bulk, liquefied natural gas ("LNG"), and container ships, which has evolved and grown significantly to serve the increasing risk management needs for both physical shipping sector participants and financial institutions alike.

An intriguing pricing observation seen in the FFA market is where freight rates could venture into negative territory. This potentially arises from supply and demand imbalances in the global shipping market, and highlights the necessity for robust risk management systems. SGX's approach to manage negative asset prices involves close market monitoring, recalibrating risk models to use absolute returns, and switching option pricing models. To price Asian-style options in the context of negative asset rates, SGX has developed a modified Bachelier option model using the Haug approximation. When asset prices approach zero or negative, the commonly used Turnbull-Wakeman ("TW") model fails to price options, and the modified Bachelier model provides more accurate valuations. The switching between models is configured to ensure consistent option pricing, with the modified Bachelier model used for low or negative prices and the TW model for higher prices.

8.1 SHIPPING MARKET AND FREIGHT DERIVATIVES

Shipping serves as a critical barometer to global trade, facilitating approximately 90% of cargo flow[71]. The maritime industry is influenced by a myriad of macroeconomic and commodity factors, including cargo seasonality, economic uncertainties, geopolitical tensions, and trade disruptions. Since its establishment in 1985, the Baltic Dry Index ("BDI") has become a key maritime industry indicator, reflecting the cost of shipping raw materials such as coal, iron ore, and grains. It is often touted as a form of economic indicator[72] and proxy to trade activities, highlighting key macroeconomic events such as the 2007-2008 financial crisis and the COVID-19 pandemic.

[71] *"Shipping and World Trade: World Seaborne Trade", International Chamber of Shipping.*

[72] *"Baltic Dry Index as a Major Economic Policy Indicator: The relationship with Economic Growth", Procedia - Social and Behavioral Sciences, Volume 210, 2 December 2015, Pages 416-424.*

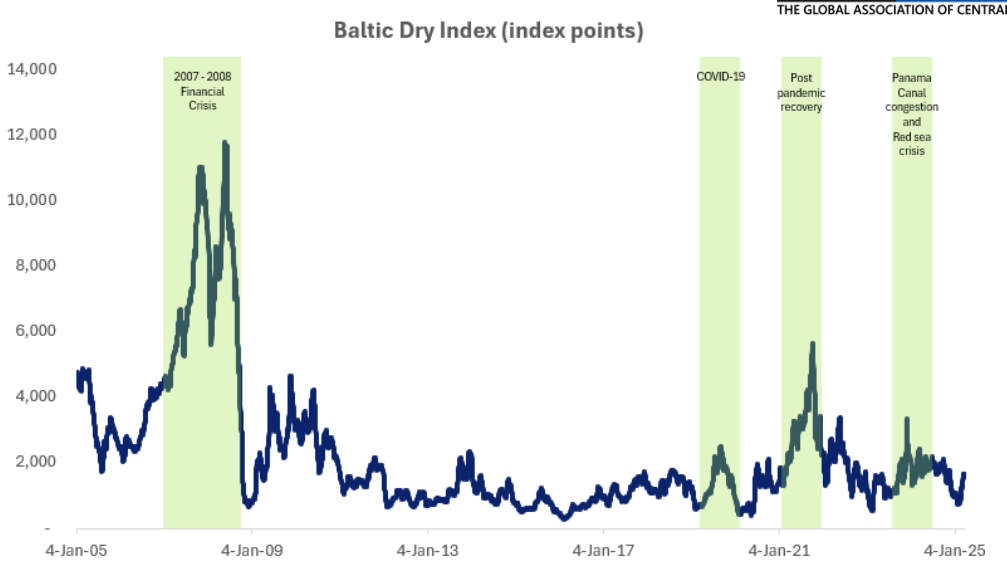


Figure 1: The BDI trends during major economic events

The BDI derives its value from three key dry bulk vessel types – Capesize, Panamax, and Supramax. During the COVID-19 pandemic, these vessels experienced significant price fluctuations with an exponential increase in freight rates, driven by port congestions and pent-up demand for goods. The volatile nature of the dry bulk shipping market underscores the importance of hedging, using tools like FFAs. FFAs are financial instruments in the form of futures and options, and are typically cash settled. They are commonly used by supply chain participants such as ship owners, charterers, and traders, to lock in freight rates for future periods, providing a hedge against the uncertainty of freight rates.

Traditionally, the dry bulk shipping market operated largely as an uncleared market. Post the 2007-2008 GFC, the market has transitioned promptly from a sub-30% cleared market to an almost-100% cleared market today using FFAs that reference Baltic Exchange's dry bulk shipping indices.

Singapore has been recognized as the top maritime center globally for 11 consecutive years by the Xinhua-Baltic International Shipping Centre Development Index[73]. SGX complements Singapore's leadership in the shipping sector, through the offering of derivatives in three key shipping sectors – dry bulk, LNG, and containers. Within the dry bulk sector, SGX lists two categories of FFAs: (i) time charter, akin to renting a vessel for a specific period, and (ii) single voyage route, akin to single trip between ports, covering different vessel types such as Capesize, Panamax, Supramax, and Handysize.

[73] *"Singapore announced top maritime centre for 11th consecutive year", 21 Aug 2024, Baltic Exchange latest news.*

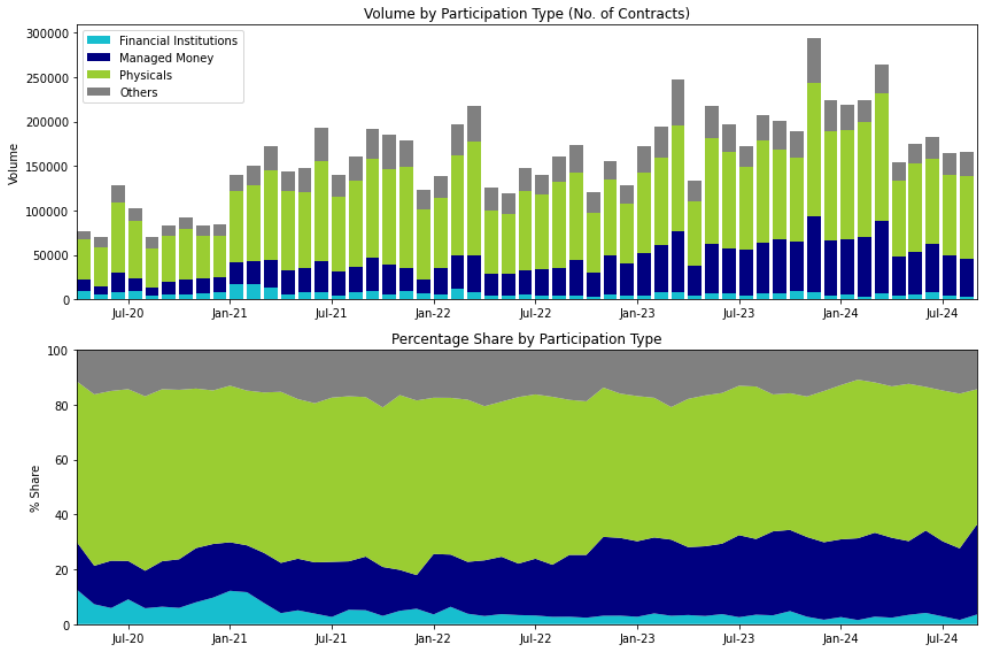


Figure 2: Statistics of SGX FFA Market Participants

Historically, the SGX FFA market has primarily attracted participants from the physical shipping sector. Increased freight volatility has driven market demand for FFAs to protect profits, enable price transparency, stabilise cash flow, and mitigate counterparty risks. While physical demand still commands a larger volume market share, rising interest from Managed Money participants depicted in Figure 2 highlights FFAs' value as portfolio diversifiers due to their low correlation with other asset classes. These participants are also pursuing opportunities from structural shifts in global trade and seeking access to key macroeconomic themes through FFAs.

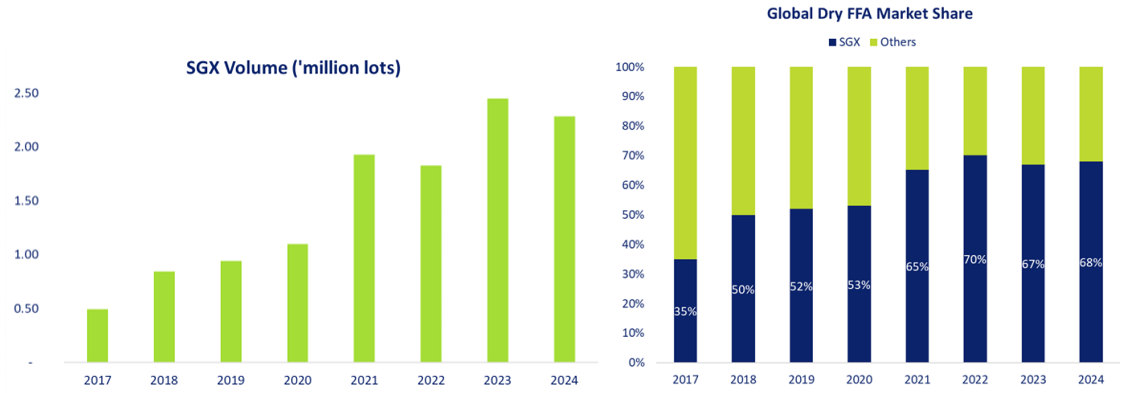


Figure 3: SGX FFA volumes and market share

With strong market support, SGX has built and maintained a global leadership position in the dry bulk FFA sector since 2019. The growth in volumes and market share over the years highlights the industry's need for a liquid and efficient hedging platform.

8.2 RISK MANAGEMENT OF NEGATIVE FFA PRICES

The FFA market is characterized by notable price fluctuations, with the freight rates being highly sensitive to global economic conditions, geopolitical events, and changes in supply and demand, etc. During the COVID-19 pandemic, the Capesize freight rate experienced a steep decline of 94% on the back of a sudden

drop in demand. Negative freight rates may even occur in response to supply and demand imbalances. For example, in February 2022, the spot rate for trans-Atlantic LNG carriers on the BLNG2g, US Gulf to Continent Round Voyage, plummeted to a record low of -$14,489 USD/day. The FFA prices also turned negative. These negative prices took place as the LNG shipping sector grappled with a significant vessel overhang and high gas inventories in Europe. The negative prices did not persist and prices rebounded sharply after the Ukraine-Russia war as demand for US gas surged following sanctions on Russian gas. More recently in January to February 2025, negative prices were again observed for LNG spot and FFAs, which was attributed to delays in the development of LNG export facilities in the US.

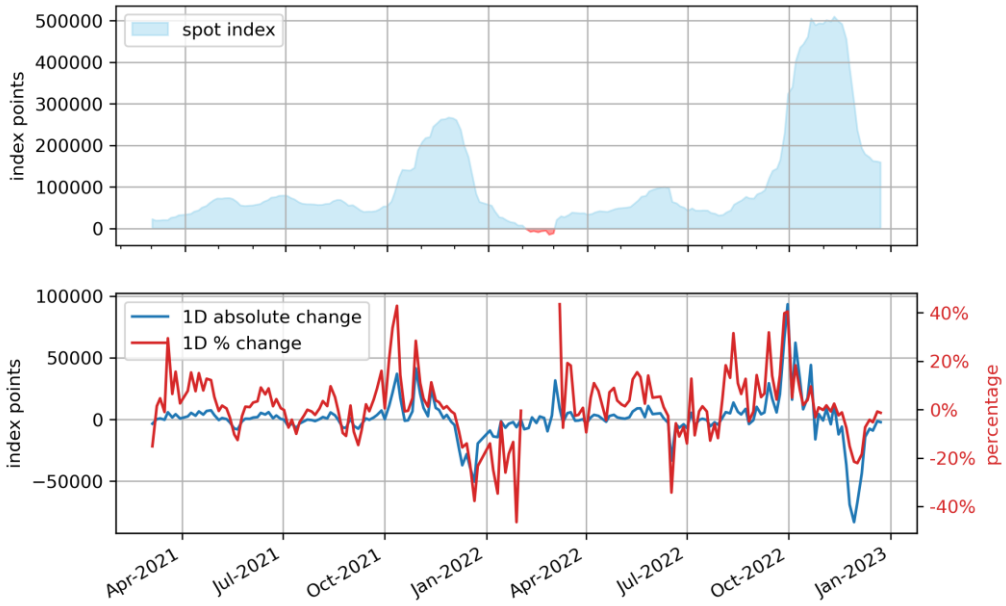


Figure 4: Trans-Atlantic LNG freight rates in 2021 - 2022

Such occurrences of negative prices underscore the importance of robust CCP risk management in both margining and stress testing models. Those models typically adopt relative returns, either percentage or logarithmic returns, to normalize the price data and make them suitable for comparisons across different markets and assets. However, as Figure 5 shows, when an asset price is near zero, relative returns have some limitations for low or negative prices:

i. **Explosive Relative Returns Near Zero Prices:** When an asset's price approaches zero, relative returns can become "explosively" large, leading to significant model errors. Furthermore, in mathematical model, the presence of these "explosively" large returns in historical data can cause the model to over-estimate the market volatility and risk exposure.

ii. **Data Gap at Negative Prices:** This issue is exacerbated if the asset price becomes negative, as shown in Figure 5, where relative returns cannot be calculated, causing a data gap in the modelling. Before the emergence of negative prices, the SGX risk systems would re-calibrate the LNG FFA prices by way of switching to absolute returns. This adjustment ensures that the risk models can continue to operate effectively even with prices in negative territory.

iii. **Lack of Context in Price Levels:** Relative returns do not account for the actual price levels of assets, which can pose an issue for history-based risk metrics like Value-at-Risk ("VaR") or historical stress testing. If these risk metrics are expressed in relative terms, they can potentially become irrelevant and unusable at low or negative prices.

As shown in Figure 5, SGX has put processes in place to monitor products that may be susceptible to significant price fluctuations and risk of negative prices. Unusually low or negative trade prices are verified through intraday monitoring process for potential error trades, to ensure that traded prices represent genuine transactions between buyers and sellers and accurately reflect market conditions.

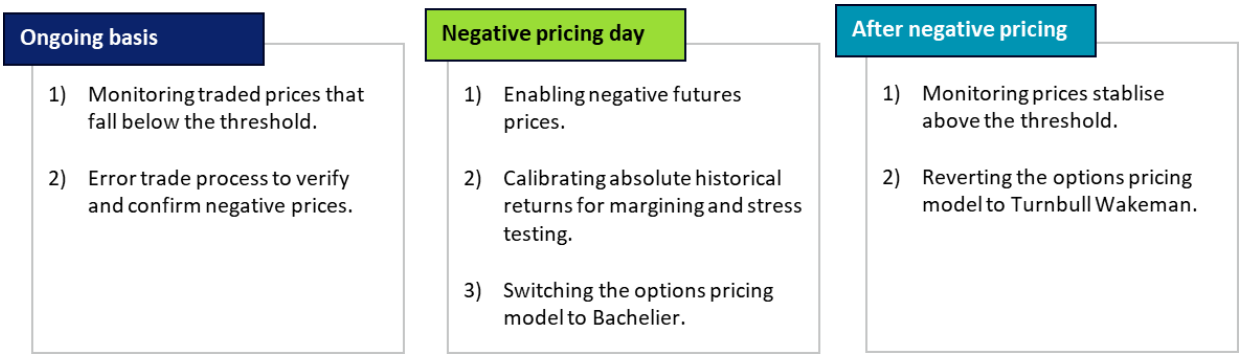


Figure 5: SGX Negative Pricing Process

When negative pricing is triggered for a specific product, SGX risk management systems will re-calibrate its history of absolute returns and incorporate this data into the risk models. If the product contains options, the options pricing model will be switched to handle negative prices.

8.3 MODIFYING THE BACHELIER MODEL TO PRICE ASIAN-STYLE OPTIONS

At normal conditions, SGX utilizes the Black-Scholes or Black 76 models for pricing European-style options, while the TW model is used for Asian-style options. Many FFA options listed on SGX are "Asian-style", i.e. settled based on the arithmetic average of Baltic Exchange's spot assessment prices within the pre-specified period. Asian-style options have become popular in commodity markets due to their reduced sensitivity to price fluctuations when approaching the contract's maturity/expiration date. During the averaging period, typically one calendar month, an increasing portion of the option's settlement price is realized, leading to a gradual decay in implied volatility over time. As a result, Asian-style options are generally less expensive. The TW model is a variant of the Black-Scholes formula that adjusts two model parameters: option strike price and implied volatility.

However, both Black-Scholes and TW models assume that asset prices follow a log-normal distribution, which means asset prices cannot be negative. In comparison, the Bachelier model assumes that asset prices follow a normal distribution, enabling it to price options for both positive and negative asset prices. The Bachelier model substitutes the log-normal volatility σ with the normal volatility $\tilde{\sigma}$.

To handle negative prices for Asian-style options, SGX has developed a new model that modifies the Bachelier model using the Haug approximation[74]. In the modified Bachelier model, option strike K_A is adjusted similar to the TW model. As the Bachelier model assumes the arithmetic average of asset prices follows a normal distribution, a new formula has been derived to adjust the normal implied volatility:

$$\tilde{\sigma}_A = \frac{1}{\sqrt{3}}\tilde{\sigma}$$

The modified Bachelier Asian option price formula can be given by:

[74] *"Asian option pricing under negative asset price in commodity market", International Journal of Financial Markets and Derivatives, 2024, vol. 10(1), pages 21-34.*

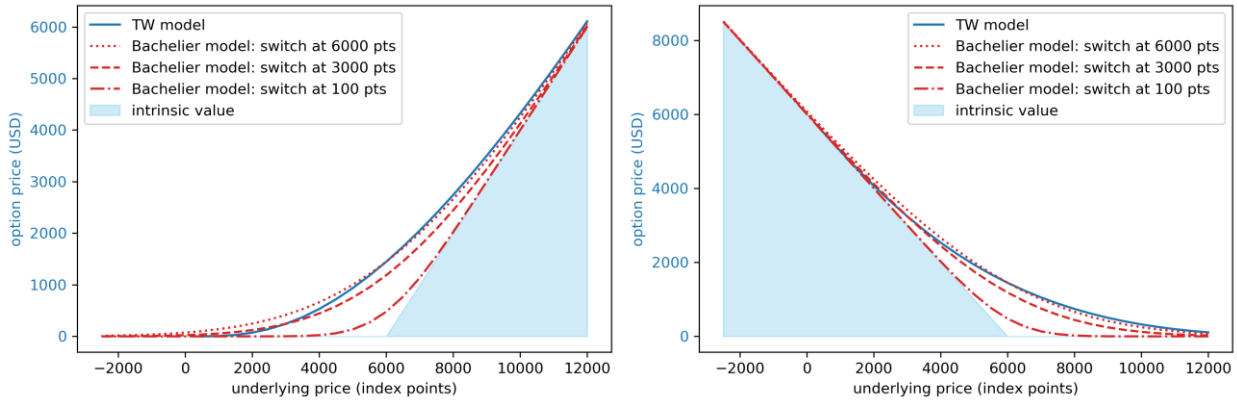
$$V_{Bachelier}(F, K_A, \tilde{\sigma}_A, T) = \frac{T}{T_2}\left[\tilde{\sigma}_A \cdot \sqrt{T} \cdot n(d) + \phi \cdot (F - K_A) \cdot e^{-rT} \cdot N(\phi \cdot d)\right]$$

Where:

$$d = \frac{F - K_A}{\tilde{\sigma}_A \sqrt{T}}$$

$\phi = 1$ for call and -1 for put options; $N(\cdot)$ and $n(\cdot)$ are the cumulative and probability density functions of standard normal distribution respectively; T is the option's time to maturity; T_2 is the averaging period of the Asian-style option; F is the underlying futures price; r is the risk-free rate.

When the asset price approaches zero, it is challenging to determine an appropriate price level at which to switch the pricing model. It is reasonable to expect that, upon switching the models, the option prices by various models should be identical. This is because, assuming all other factors remain constant, the economic value of the option should not be influenced by the choice of model. This concept is demonstrated in Figure 6, where the pricing curves of the TW model and the modified Bachelier model intersect at the model switch point.



(a) Call option (b) Put option

Figure 6: Switching between the Turnbull-Wakeman and the modified Bachelier model

Figure 6 presents three scenarios of switching from the TW model to the modified Bachelier model when the asset price drops to 6000, 3000, and 100, respectively. As the asset price approaches zero, the modified Bachelier model yields higher values for both call and put options compared to the TW model. This is because, at near-zero prices, logarithmic returns become distorted, and even very high volatility does not result in high option values in the TW model. If the model switch occurs only when the asset price is very low, e.g., 100, the TW option price is primarily influenced by its intrinsic value. In contrast, the normal volatility in the modified Bachelier model remains unaffected by low price levels, making it suitable for pricing options at both negative and low asset prices. Conversely, the modified Bachelier model might undervalue options if the asset price rebounds above the switching point. To avoid this, it should be promptly switched back to the TW model.

In practice, market participants in commodity markets either quote the option price or the option implied volatility. Quoting option prices is generally preferred because it is independent of the pricing model and less susceptible to model bias. On the other hand, some participants quote log-normal volatility based on a specific pricing model. These participants may face challenges with negative prices and upgrading their systems to accommodate the modified Bachelier model can be both expensive and time-consuming. Consequently, they might continue quoting log-normal volatility to the exchanges, relying on the exchanges to convert this data and derive equivalent option prices.

8.4 CONCLUSION

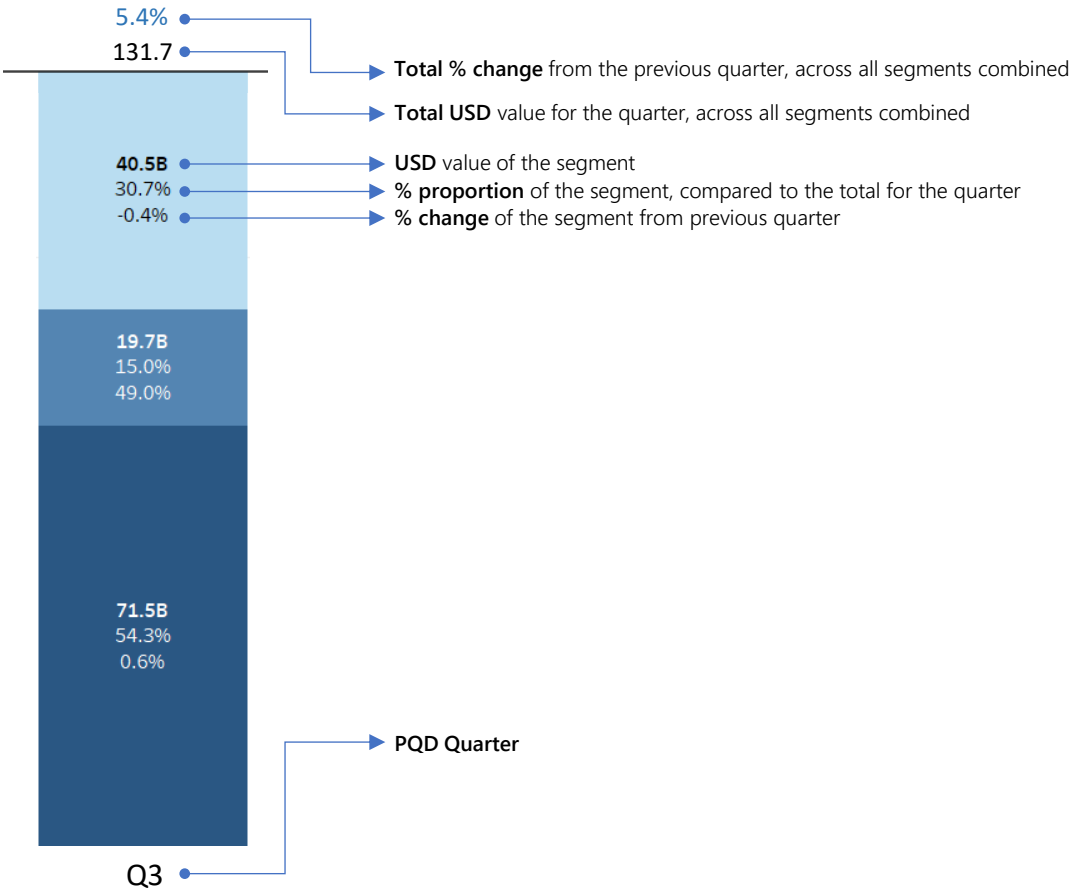
The shipping market and freight derivatives play a crucial role in global trade. The market was traditionally dominated by participants from the physical shipping sector, such as ship owners and charterers, etc. In recent years, there has been a noticeable shift with an increasing number of financial institutions and managed money participants entering the market.

High volatility and negative FFA prices highlight the importance of strong risk management practices. SGX has implemented robust processes to monitor and manage negative prices, recalibrate risk parameters, and switch option pricing models.

The traditional TW option pricing model cannot handle negative asset prices when pricing Asian-style options. To address this, SGX has developed a modified Bachelier model with closed-form formulae. Switching between models, such as from the TW model to the modified Bachelier model, ensures that option pricing remains consistent and reliable, minimizing market impact even during extreme conditions.

9. APPENDIX I: PQD BAR CHART KEY

For certain PQD charts throughout section 2, bar charts may have three values per bar segment and two values per individual column. These can be interpreted as follows:

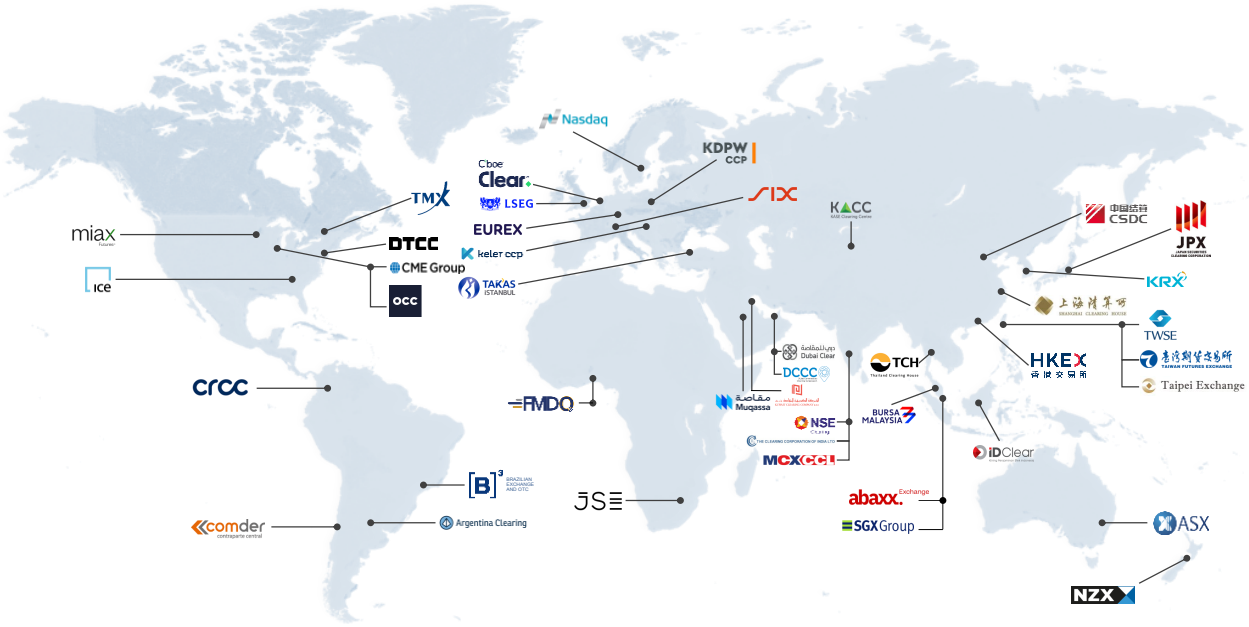


10. ABOUT CCP GLOBAL

CCP Global is the international association for central counterparties ("CCPs"), representing 43 members who operate over 60 individual CCPs across the Americas, EMEA, and the Asia-Pacific region.

CCP Global promotes effective, practical, and appropriate risk management and operational standards for CCPs to ensure the safety and efficiency of the financial markets it represents. CCP Global leads and assesses global regulatory and industry initiatives that concern CCPs to form consensus views, while also actively engaging with regulatory agencies and industry constituents through consultation responses, forum discussions, and position papers.

For more information, please contact the office by e-mail at office@ccp-global.org or through our website by visiting www.ccp-global.org.



11. CCP GLOBAL MEMBERS