Risk Management Overview

Version 9.8 of February 2024

Contents

1. Introduction

Cboe Clear operates a reliable, efficient and low risk clearing system. A robust risk management framework allows Cboe Clear and its clients to deal with various risk scenarios with confidence.

One of the main functions of Cboe Clear as a clearing house is to provide continuity of the marketplaces it serves. As the default of a Clearing Participant (CP) can potentially threaten this continuity, Cboe Clear operates a risk model that mitigates this threat ensuring that robust and effective rules, procedures and adequate financial resources are in place to handle default events.

Cboe Clear is authorised as a Central Counterparty under the European Market Infrastructures Regulation. Cboe Clear is regulated in the Netherlands by De Nederlandsche Bank (DNB, the Dutch Central Bank) and the Autoriteit Financiële Markten (AFM).

2. Membership requirements

One of the mechanisms to guarantee a consistent risk management framework for Participants and the markets is selective membership criteria, therefore Cboe Clear ensures only authorised firms are admitted as Clearing Participants. For this purpose eligibility criteria have been defined. These requirements must be met during admission and are monitored on an ongoing basis.

Financial requirements for Clearing Participation are as follows:

- **Direct Clearing Participant** the higher of
  - Euro 7.5 million; or
  - 20% of the 30-day average Aggregate Margin requirement; or
  - 20% of the 250-day average Aggregate Margin requirement

- **General Clearing Participant** the higher of
  - Euro 25 million; or
  - 20% of the 30-day average Aggregate Margin requirement; or
  - 20% of the 250-day average Aggregate Margin requirement

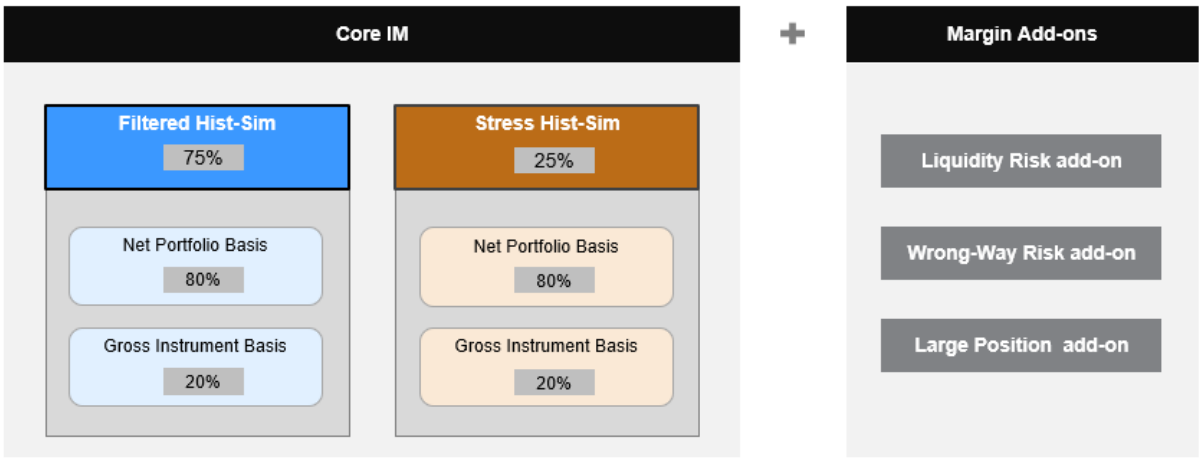
All Clearing Participants that intend to participate in default auctions are required to demonstrate their capacity to fulfil their obligations via a default ‘fire drill’ as a pre-condition of onboarding, and thereafter during the annual default ‘fire drill’.

Full details of membership requirements are set out in the Cboe Clear’ Clearing Rule Book.

3. Margin model overview

For both cash equities and equity derivatives, margin model calculates core initial margin using two components: a Filtered Historical-Simulation (75% weight) and a Stress Hist-Sim (25% weight).

In addition to underlying price volatility risk, Cboe Clear is also exposed to other specific risks which require separate treatment in the form of margin add-ons.



Key features of Initial margin components:

- **Filtered Hist-Sim (FHS)**
  - Lookback Period of 700 days.
  - Returns are scaled by volatility; where volatility is calculated as an Exponentially Weighted Moving Average (EWMA), with lambda of 0.99.

- **Stress His-Sim (StressHS)**
  - Lookback Period of 700 days; consisting of 650 most recent historical observations, and static set of 50 historical scenarios used in the Cboe Clear stress testing suite.
  - No scaling of returns.

- **Margin add-ons**
  - **Liquidity Risk (LR) add-on** – additional margin to cover potential costs of liquidating positions, particularly for concentrated and/or illiquid positions that are large relative to the average daily traded volume.
  - **Wrong-Way Risk (WWR) add-on** – additional margin for direct WWR positions (i.e. where a member and position are part of the same corporate group).
  - **Large Position (LP) add-on** – additional margin for positions that generate large stress losses relative to the size of the Clearing Fund.

Key model assumptions :

- In compliance with EMIR regulation (EU) 152/2013 article 28 requirements relating to anti-procyclicality, each component of initial margin is calculated as the

weighted sum of a portfolio-based Conditional Value-at-Risk (CVaR) (80% weight), and the sum of CVaRs calculated at gross individual product level (20% weight).
- Liquidation Period known also as Margin Period of Risk (MPOR) is 3 days.
- Confidence level is 99% with the lookback period of 700 business days.
- Additional margin add-ons are calculated to cover risks not captured by the core IM model.

The margin model is subject to an annual independent validation.

4. Daily margining

Total margin requirements (for both cash equities and equity derivatives) must be covered by eligible cash or non-cash collateral at all times. If a collateral shortfall arises, Cboe Clear will issue an intra-day margin call, subject to defined margin call thresholds. Cboe Clear reserves the right to issue a higher or supplementary Margin Call to the Clearing Participant at any time where this is required by the respective risk situation.

Margin components include the following:

- Securities Initial Margin (cash equities only)
- Derivatives Initial Margin (derivatives only)
- Securities Variation Margin (cash equities only)
- Futures Variation Margin (derivatives only)
- Options Variation Margin (derivatives only)
- Premium Margin (derivatives only)

The **total margin requirement** is defined as the sum of the following two amounts:

- Securities Initial Margin minus Securities Variation Margin (floored at zero); and
- Derivatives Initial Margin minus the sum of Options Variation Margin, Futures Variation Margin, and Premium Margin (floored at zero).

5. Testing the robustness of the risk management framework

One of Cboe Clear's primary objectives is to ensure continuity of the marketplaces it serves in both normal and extreme market conditions. As such Cboe Clear undertakes regular testing to identify, monitor, and manage risk to ensure its risk model remains robust and effective. These tests consider EMIR requirements and are derived from detailed analysis of historic data, hypothetical scenarios as well as discussions with Cboe Clear's Risk Committee.

5.1. Model assessment trough Backtesting

Backtesting is used to test whether the margin requirement of Cboe Clear covers at the minimum requirement of 99% as per CPMI-IOSCO and EMIR regulation.

When performing the bask test, Cboe Clear compares the margin requirement with the actual result of the CPs' portfolios over the liquidation horizon of 3 days.

The result of the portfolio is calculated by multiplication of the price differences between day 1 and 4 with the actual positions at the close of business day 1 (a so-called clean back test). Cboe Clear uses closing prices provided by vendors – Refinitiv & Bloomberg.

For each house and client account of a Clearing Participant, Cboe Clear defines both observations and violations. An observation is counted when a margin requirement calculated for an account. A violation is counted in case the margin requirement for the account is smaller than the 3-day negative change in value of the portfolio on the account. Hereby the portfolio is kept constant over this 3-day period.

5.2. Credit Stress testing

Stress testing is primarily used for two purposes:

- within the Stress Hist-Sim as component of the initial margin calculation.
- to determine the size of the default fund, and the adequacy of the resources available in a member default.

In each of these cases, stress scenarios are designed to be extreme but plausible, in line with EMIR requirements.

Member portfolios are subject to two forms of stress testing:

- Historical stress testing.
- Hypothetical stress testing.

Historical stress testing

Historical stress testing is used to determine the impact of observed market moves during periods of extreme market volatility over the past 30 years.

The Margin Period of Risk (MPOR) used for defining stress scenarios is 3 business days, and moves are not scaled by volatility.

50 historical stress scenarios are defined for cash equities and an additional 50 historical stress scenarios are defined for derivatives.

Hypothetical stress testing

Hypothetical stress testing is used to determine the impact of market moves that have not been observed, but which are deemed extreme but plausible.

Hypothetical stress testing is expected to consider scenarios in which correlation assumptions partially or fully break down.

6. Liquidity Risk Management

Cboe Clear's liquidity framework ensures with a high degree of confidence to meet its payment obligations resulting from the settlement process.

Liquidity resources include collateral from Clearing Participants, default fund contributions, credit lines, a syndicated loan facility of EUR 1.5 bn, and Cboe Clear's capital.

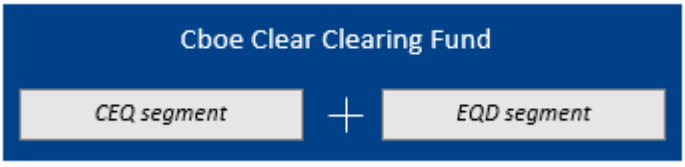
In addition to the above Cboe Clear has liquidity tools at its disposal to call for additional liquidity (when needed) which include the following:

- Settlement Exposure Add-on (**SEA**), and
- Settlement Prefunding Requirement (**SPR**)

7. Clearing Fund

Cboe Clear's Clearing Fund (CLF) is designed to mitigate the risk of all Clearing Participants in the event of a default by one or more Clearing Participants or Co-operating Clearing houses.

The CLF is a single default fund comprising two distinct segments: Cash-Equities (CEQ) and equity derivatives (EQD).



Sizing and determination of member contributions with respect to each CLF segment are performed independently based on the relevant product class exposures.

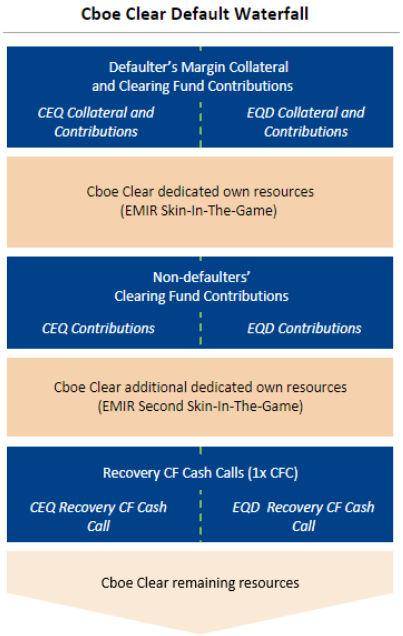
Clearing Participant contributions are based on each Clearing Participant's average margin relative to the average total margin across all Clearing Participants over the last over the last 30 business days, subject to minimum base deposits of €1,000,00 for Direct Clearing Participants and €3,000,000 for General Clearing Participants.

The CLF can be applied against excess default losses, provided that the CLF contributions related to a particular product class segment are first applied to cover all losses related to the given product class until such losses are fully absorbed.

8. Default waterfall

Financial resources in the default waterfall are utilised in the following order in the event of a clearing member default:

- **first**, the defaulter's Collateral and Clearing Fund Contributions;
- **second,** the dedicated own financial resources of Cboe Clear (EMIR skin-in-the-game);
- **third**, the Clearing Fund Contributions made by non-defaulting Clearing Participants
- **fourth,** the additional dedicated own financial resources of Cboe Clear (EMIR second skin-in-the-game);
- **fifth,** the additional Contributions made by non-defaulting Clearing Participants related to Recovery CF Cash Calls; and
- **sixth,** the remaining financial resources of Cboe Clear.



All of a defaulting Clearing Participant's Collateral and Contribution deposited with Cboe Clear shall be applied; provided however that Collateral and Contribution in respect of a particular Product Class is applied first to any loss attributable to that Product Class.

Non-defaulting Clearing Participant's Contributions and Recovery CF Cash Calls deposited with Cboe Clear in respect of a particular Product Class shall be applied first to any loss attributable to that Product Class; any residual Contribution and Recovery CF Cash Call deposited in respect of a Product Class in which the loss does not arise shall be applied on a pro rata basis thereafter.

9. Default handling

The default handling process (DHP) consists of the following phases:

Timeline	DHP Phase	Objective
Prior to default	**Pre-Default**	EuroCCP maintains tools to prevent or mitigate a potential default through a series of monitoring processes as part of its BAU operations.
On default	**Initiation**	On declaration of a default, Breach & Default Management Team (BDMT) determines optimal strategy for managing the default whilst minimising financial loss and disruption to BAU. The BDMT will set out a hedging and disposal strategy that will be dependent on the shape and risk of the defaulting portfolio(s)
Day 1	**Hedging**	If necessary, hedging will be conducted to minimise market risk and maximise the success of an auction. Hedging is expected to be completed within 24 hours of a default being declared.
Day 1-3	**Disposal**	A direct sale or auction will be conducted dependent on optimal disposal strategy. Member participation in auction process incentivised by loss attribution rules.
Post-DHP	**Completions & Loss Attribution**	After successful disposal of the default portfolio(s), the DHP is declared complete*. Auction losses exceeding the defaulter's collateral and EuroCCP skin-in-the-game are attributed against non-defaulters' CLF contributions based on auction bids received.

** In the event of multiple concurrent defaults, the default handling process will be declared complete when all outstanding defaults have been concluded, and all default portfolios have been fully disposed.*

Auction incentives

- Default auctions are a key aspect of the default handling process with respect to equity derivatives.

- Auction participation is incentivised via attribution of excess default losses against non-defaulters' EQD-related CLF contributions based on bidding behaviour.
- The better a bid, the slower the rate at which a clearing member's CLF contributions will be utilised:
    - The winning bid (and bids equal to the winning bid but that did not win the auction) will have their CLF contributions seniorised, i.e. they will rank last in any loss attribution.
    - Other bids will rank proportionally according to their distance from the winning bid, i.e. bids closer to the winning bid will have a proportionally slower rate of utilisation compared to bids that are further away. "No bids" will be treated as equivalent to the lowest bid received.
    - Once a clearing member's CLF contribution is fully consumed, the utilisation ratio will change to reflect the remaining CLF contributions (see worked example on the next slide).

- CLF contributions applicable to another product class can only be used after resources related to the relevant product class have been fully consumed. Where resources from another product class are utilised, loss attribution is on a pro rata basis.

'Fire drills'

- Readiness and preparation is essential in order to ensure a successful default handling process.

- Under EMIR, an annual 'fire drill' must be performed, along with quarterly tests/reviews of the default handling process.
- These 'fire drills' enable both Cboe Clear and clearing members to be fully prepared in the event of an actual default, and allows for continuous refinement and enhancement of the process.

10. Additional Cboe Clear's publicly available resources

For more detailed information about Cboe Clear's admission criteria, eligible collateral and Clearing Fund requirements can be found under the respective link provided below.

- Admission criteria and Rules:
https://cdn.cboe.com/euroccp/resources/Cboe-Clear-Clearing-Rule-Book-effective-6-November-2023.pdf

- Eligible collateral requirements:
https://cdn.cboe.com/euroccp/resources/Regulation-Acceptable-Collateral-effective-6-November-2023.pdf

- Clearing fund requirements:
https://cdn.cboe.com/euroccp/resources/Regulation-Clearing-Fund-effective-24-October-2023.pdf

Appendix

This section provides details of Cboe Clear's systematic risk assessments and test results of the daily back and stress tests which are updated on a monthly basis.

Cash Equities backtesting results

Table 1 shows monthly backtesting results which for publication purposes are limited to the last 12 months. Overall the gross coverage of Cboe Clear's margin model states as limit: 99.98% exceeds Cboe Clear's risk appetite of 99% (set for the previous 24 months).

Table 1 – CEX Backtesting results*

Period	Number of observations	Number of violations	Percentage
Mar 2023	1,335	4	99.70%
Apr 2023	1,023	0	100.00%
May 2023	1,376	0	100.00%
June 2023	1,337	0	100.00%
July 2023	1,267	0	100.00%
Aug 2023	1,375	0	100.00%
Sep 2023	1,277	0	100.00%
Oct 2023	1,331	0	100.00%
Nov 2023	1,288	1	99.92%
Dec 2023	1,055	0	100.00%
Jan 2024	1,220	0	100.00%
Feb 2024	1,169	0	100.00%
Total	**15,053**	5	**99.97%**

Equity Derivatives backtesting results

Cboe Clear's internal confidence for Equity Derivatives is 99% (Margin Period Of Risk of three (3) business days) over the last 24 months.

Table 2 shows monthly backtesting results which for publication purposes are limited to the last 12 months. Overall the gross coverage of Cboe Clear's margin model states as limit: 99.94% exceeds Cboe Clear's risk appetite of 99% (set for the previous 24 months).

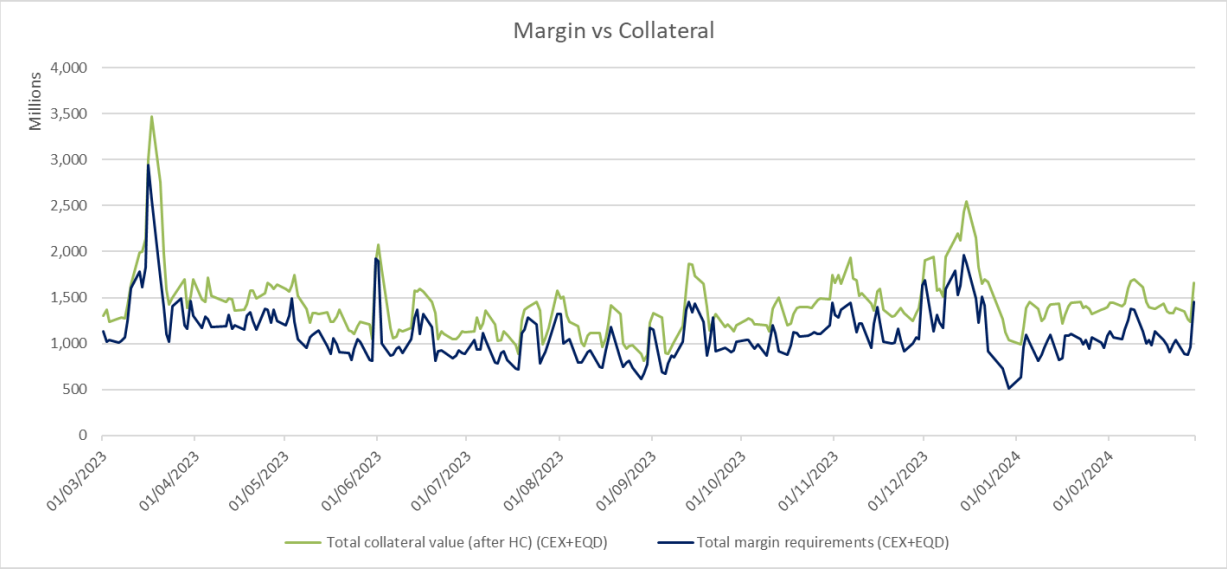
Table 2 – EQD Backtesting results

Period	Number of observations	Number of violations	Percentage
Mar 2023	74	0	100.00%
Apr 2023	54	0	100.00%
May 2023	60	0	100.00%
June 2023	50	0	100.00%
July 2023	63	0	100.00%
Aug 2023	69	0	100.00%
Sep 2023	63	0	100.00%
Oct 2023	66	0	100.00%
Nov 2023	56	0	100.00%
Dec 2023	45	0	100.00%
Jan 2024	66	0	100.00%
Feb 2024	48	0	100.00%
Total	**714**	**0**	**100.00%**

Margin requirements vs Collateral value

The below figures show on a daily basis the comparison of collateral value vs the margin requirements. The value comprises of both CEX and EQD. The data period is from the 1st March 2023 until 29th Feb 2024.

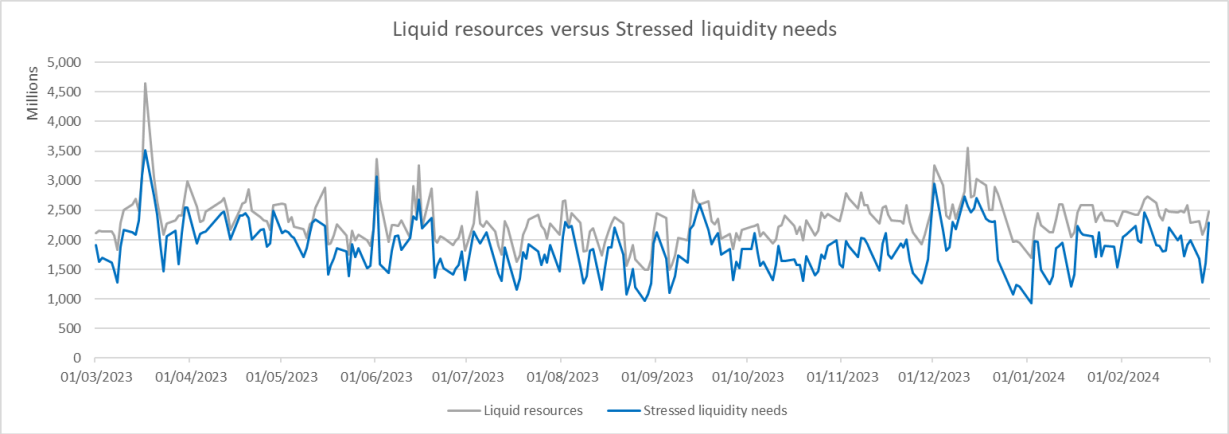
Chart 1 – Margin requirements vs Collateral value



Clearing Fund vs Stress Cover – 2 results

The below figures show on a daily basis the largest stress value (Largest P&L) and the second largest stress values (Total P&L) compared to Cboe Clear's Clearing Fund Size. Stress values are defined as the stress outcome after deduction of the collateral value of the Clearing Participants. The data period is from the 1st of March 2023 until 29th Feb 2024.

Chart 2 - Clearing Fund vs Stress Cover - 2 requirements



Stressed liquidity results

Cboe Clear performs stress tests on the liquidity position by assuming the default of the two Clearing Participants, or the default of a co-CCP, to which Cboe Clear has the largest exposures. The available liquidity resources are expected to cover at least the stressed liquidity need. The data period is from the 1st of March 2023 until 29th Feb 2024.

Chart 3 – Stressed liquidity result