EuroCCP

Risk Management Overview

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1 Introduction

European Central Counterparty N.V.(hereafter “EuroCCP”) operates a reliable, efficient and low risk clearing system. A robust risk management framework allows EuroCCP and its clients to deal with various risk scenarios with confidence.

Clearing Houses are a core component supporting financial markets. One of the main functions of EuroCCP is to provide continuity of the market places it serves. As the default of a Clearing Participant (CP) can potentially threaten this continuity, EuroCCP operates a risk model that mitigates this threat ensuring that adequate protection is available to mitigate systemic risk. Robust and effective rules, procedures and adequate financial resources are in place to handle default events. In section 1.2 we describe this model briefly, followed by a more detailed description of the parts in sections 1.3 through 1.5.

EuroCCPs risk model is designed to mitigate the various repercussions of a default scenario as a CP may als default for reasons beyond the CPs business at EuroCCP (e.g. Lehman Brothers International). The order of liability in the case of a CP default is described in section 1.5.

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

2 Risk Model / Default waterfall

EuroCCP has reviewed the plausible sources of risk, both internal and external, and mitigates their impact through its Risk Model which uses appropriate systems, policies, procedures, and controls. EuroCCPs Risk Model consists of five layers:

1) Participation requirements; only authorised firms can join EuroCCP as a Clearing Participant (hereafter “CP”).
2) Collateral (including interoperability fund deposit and clearing fund contribution of the CP); EuroCCP requires CPs to meet margin requirements on the portfolio by depositing collateral at EuroCCP.
3) Skin in the game; EuroCCP will use its dedicated own resources before using the Clearing fund contributions of non-defaulting CPs.
4) Clearing fund; in the unlikely event that a CP is declared to be in default and layers 2 and 3 are not sufficient to cover the liquidation of the portfolio of the CP, the clearing fund provides an additional buffer.
5) If the losses caused cannot be covered by the collateral provided by the defaulting participant, the skin in the game and the aggregate amount of the Contributions to the Clearing Fund of all Clearing Participants (layers 2, 3 and 4) the non-defaulting Clearing Participants shall on demand make an additional payment to EuroCCP on a pro rate basis in proportion to the amount of their Contributions to cover any such remaining losses (limited to an amount equal to the amount of their Contribution).

Layer 1 provides assurance that all Clearing Participants are reputable and authorised to operate as a CP.
Layer 2 provides assurance that the portfolio of the CP can be liquidated in case of a default under normal or mildly extreme circumstances without additional costs to the non-defaulting CPs.
Layer 3 ensures that the CCP is incentivised to have conservative participation requirements and ensures a robust risk management framework.
Layer 4 provides assurance that in case the circumstances turn extreme, there will still be enough funds to cover a potential default.
Layer 5 provides additional assurance in addition to the financial resources. The financial resources (layers 2, 3 and 4) should together suffice to withstand the stress tests. Layer 5 is therefore more a recovery tool and not part of the financial resources.

3 Admission requirements

The first level of protection for EuroCCP is to ensure only authorised firms are admitted as clearing participants. For this purpose eligibility criteria have been defined which includes, in addition to regulatory authorization a number of financial resource requirements. These requirements must be met during admission and observed on an ongoing basis.

The financial requirements concerning the capital of the (applicant)-CP are:

- at least Euro 7.5 Million (Direct CP) or Euro 25 Million (General CP)
- at least 10% of the 30-day average Margin requirement
- at least 10% of the 250-day average Margin requirement

In addition there are other requirements to be met to ensure that the CP is capable of fulfilling its role. Please refer to the EuroCCP Clearing Rulebook sections 4 and 5 for more detailed information.

4 Margin Criteria

As set out in the European Market Infrastructure Regulation (EMIR) margin requirements should cover the losses in a portfolio in at least 99% of all cases. Furthermore EMIR requires that CCPs take a number of factors into consideration when determining whether a percentage of 99% is sufficient or should be increased. In appendix A, we provide details of EuroCCPs analysis and considerations in determining its confidence interval. The conclusion is that 99% is sufficient for a cash equity CCP like EuroCCP but also that the current shareholders have a risk tolerance corresponding to a confidence level of 99.7% and thus EuroCCP will use a confidence interval of 99.7%.

The liquidation period that EuroCCP uses for the margin calculations is set to three days.

Further information about the margin model of EuroCCP can be found at:
https://euroccp.com/document/euroccp-coh-user-manual/

5 Clearing fund deposit criteria

The Clearing Fund is an important line of defence which can be used to protect CPs and CCPs in extreme stress scenarios such as a CP default. The Clearing Fund is a pool of funds made up of Clearing Participants contributions. All CPs are required to contribute to the Clearing Fund. The deposit of a clearing participant to the clearing fund is determined as follows.

5.1 Base Deposits

Pursuant to paragraph 8.2.2. (a) of the Clearing Rule Book, the applicable base deposits are as follows:

- for a Direct Clearing Participant : € 1.000.000,00
- for a General Clearing Participant : € 3.000.000,00

5.2 Required Clearing Fund Size

The Required Clearing Fund Size is defined as 105% of the two largest uncovered potential losses over the last 12 months.

The uncovered potential loss is the sum of the two largest assumed liquidation losses remaining after the deduction of the financial resources listed in the Clearing Rule Book under paragraph 8.4.2 (a), (b) and (d) under extreme but plausible scenarios. The two largest assumed liquidation losses are determined by calculating and ranking all assumed liquidation losses of all Open Positions per Clearing Participant.

5.3 Determination of the Contribution per Clearing Participant

Each Clearing Participants is required to deposit the base amount as stated in section 5.1

To determine the variable component of the Contribution for each Clearing Participant the average margin percentage is calculated as the average Margin based on the previous thirty (30) Clearing Days of the Clearing Participant's Open Positions in Securities divided by the average Margin based on the previous thirty (30) Clearing Days of all Open Positions in Securities of all Clearing Participants.

If the Required Clearing Fund Size is greater than the sum of the base amounts of all Clearing Participants, the remainder is allocated to each Clearing Participant pro rata to the difference between the average margin percentage of the Clearing Participant and the base amount of the Clearing Participant divided by the Required Clearing Fund Size, provided the difference is greater than zero.

The calculation of the average margin percentage is performed on a monthly basis by EuroCCP at the beginning of each calendar month taking the last Clearing Day of the previous calendar month as reference.

All CP Contributions to the Clearing Fund are rounded up to the next € 50,000.

EuroCCP performs regular stress tests to validate the adequacy of the financial resources including the Clearing Fund on a daily basis.

6 Interoperability fund

Within the interoperability risk framework of the three CCPs each CCP runs the risk that a CCP with which it interoperates goes into default or fails otherwise on its obligations. This would leave the non-failing CCP exposed to the (net) position of the failing CCP in its books. To mitigate this risk, each CCP assesses the exposures that arise from its co-CCPs, in accordance with ESMA Guidelines, applying the same risk management methodology used for its clearing members.

EuroCCP has established the Interoperability Fund to cover for margin obligations coming from the co-CCPs assessments. The Interoperability Fund is a pool of funds made up of Clearing Participants contributions. All CPs with transactions that can be settled through the Co-Operating Clearing Houses are required to contribute to the Interoperability Fund.

6.1 Base Amounts

Pursuant to paragraph 7.2.3 (a) of the Clearing Rule Book, the applicable base amounts are as follows:

- for a Direct Clearing Participant which enters into Trade(s) which can be settled through a Co-operating Clearing House: € 0
- for a General Clearing Participant which enters into Trade(s) which can be settled through a Co-operating Clearing House: € 0

6.2 Determination of the allocation percentage per Clearing Participant

The percentage which will be allocated to each Clearing Participant as referred to in paragraph 7.2.3 (b) of the Clearing Rule Book will be determined as follows:
The average Margin based on the previous thirty (30) Clearing Days of the Clearing Participant's Open Positions in Securities which can be settled through the Co-operating Clearing Houses divided by the average Margin based on the previous thirty (30) Clearing Days of all Open Positions in Securities which can be settled through the Co-operating Clearing Houses.

This calculation is performed on a monthly basis by EuroCCP at the beginning of each month. Reporting of the percentage will be done within two (2) Clearing Days after the calculation, but always within the first five (5) Clearing Days of each month. The percentages will apply as from the first Monday following reporting.
EuroCCP may change the percentages at any time during the month in special circumstances, for instance upon the entry of a new Clearing Participant or the departure of a Clearing Participant.

7 Testing the robustness of the risk management framework

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

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

7.1 Back testing

Back testing is used to test whether the margin requirement of EuroCCP covers at least the minimum requirement of CPMI-IOSCO and EMIR that the margin requirement is at least sufficient in 99% of all cases. We use the same back test results to assess whether we meet EuroCCPs internal requirement of 99.7%.

In our back tests we compare the margin requirement with the actual result of the portfolio of the CPs over the liquidation horizon. As the liquidation horizon is 3 days at EuroCCP we compare the prices of the positions as held at the close of business day 1 with the prices of the same positions at the close of business day 4. 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).

For each house and client account of a Clearing Participant, we define 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.

Overall the number of violations is less than the risk tolerance of EuroCCP states as limit: 99.92% is well above the 99.7% mark and also well above the regulatory required minimum of 99.0%.

On a month to month basis the results were as follows for the last 12 months:

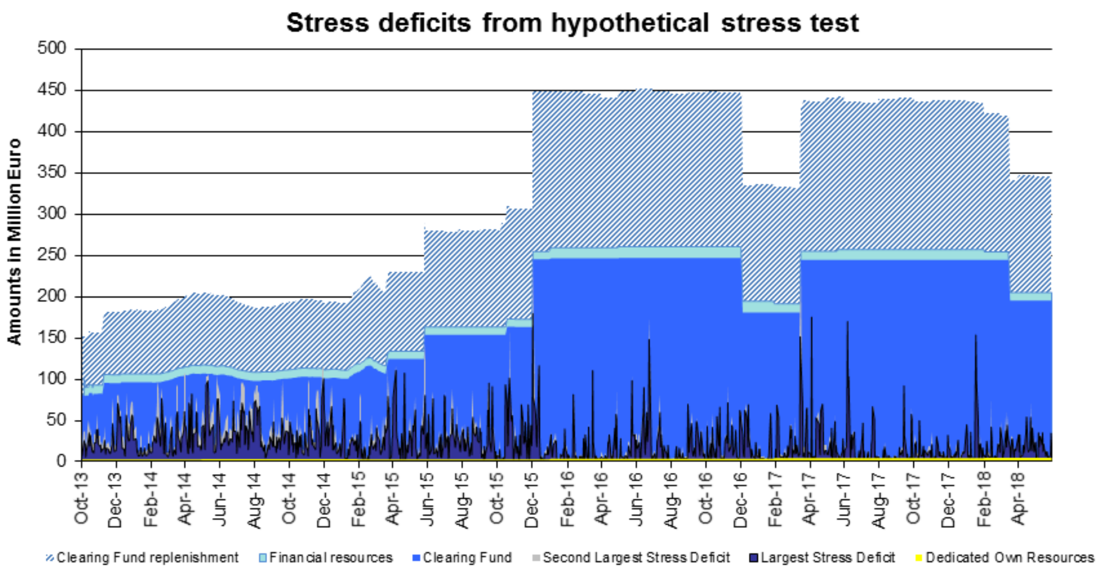
Period	Number of observations	Number of violations	Percentage
Jun-17	1.138	0	100,00%
Jul-17	1.074	0	100,00%
Aug-17	1.177	0	100,00%
Sep-17	1.129	0	100,00%
Oct-17	1.202	0	100,00%
Nov-17	1.204	0	100,00%
Dec-17	964	0	100,00%
Jan-18	1.035	0	100,00%
Feb-18	949	1	99,89%
Mar-18	1.004	0	100,00%
Apr-18	952	1	99,89%
May-18	1.103	0	100,00%
Total	12.931	2	99,98%

7.2 Stress testing

Stress testing is an important tool for EuroCCP to assess the potential losses from the default of Clearing Participants (CPs) beyond their margin requirements. In our stress testing we apply both historical and potential future stress scenarios.
For both the historical and the potential future scenarios the two clearing participants to which EuroCCP has the greatest exposure is identified. The stress levels for these portfolios will be added to identify a total exposure amount. The adequacy of the financial resources is assessed by checking if the available resources as set out in EuroCCPs risk Model are larger than the calculated total exposure amount.

EuroCCPs financial resources consist of EuroCCPs skin in the game and the Clearing Fund contributions of the CPs (incl. the defaulting CP). As stipulated in the Clearing Rule Book, the Clearing Fund may be called upon in the event that a default occurs and that losses exceed the amount of (1) collateral, (2) skin in the game and (3) Interoperability Fund deposit and clearing fund contribution posted by the defaulting participant(s).

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 EuroCCPs Financial Resources. Stress values are defined as the stress outcome after deduction of the collateral value of the CP. The Financial Resources consist of the dedicated own resources and Clearing Fund. The data period is from 1 October 2013 until the 30th of April 2018.



8 Additional EuroCCPs publicly available resources

Further information about EuroCCPs Admission criterial and Rules can be found at:
https://euroccp.com/document/euroccp-clearing-rule-book/

Further information about EuroCCPs eligible collateral requirements can be found at:
https://euroccp.com/document/euroccp-acceptable-collateral/

Further information about EuroCCPs dedicated own resources can be found at:
https://euroccp.com/document/regulation-dedicated-own-resources/

Further information about EuroCCPs clearing fund requirements can be found at:
https://euroccp.com/document/regulation-clearing-fund/

Appendix A: Considerations on the determination of the confidence interval

Under EMIR, EuroCCP adheres to the minimum confidence interval as specified in Regulation (EU) No 153/2013 article 24. The article specifies that margin requirements should cover potential losses in a portfolio with a minimum confidence interval of 99%.
The same article also requires a CCP to consider a number of factors to determine whether it should raise the percentage above the minimum and to inform its regulator and clearing members of the results. EuroCCP undertakes regular testing to ensure its procedures are robust and effective and publishes details of its confidence interval determination on a quarterly basis. The confidence interval is primarily set to regulate the frequency with which margin shortfalls are expected to occur. However EuroCCP thinks that it is even more important to (attempt to) set the margin in such a way that any margin shortfall is within the risk tolerance of the CCP. EuroCCP recognizes that the margin shortfall may be difficult to predict in advance and that the frequency of margin shortfalls can be seen as a crude indicator of the size of the shortfall. A more refined indicator might be something to strive for as a focus on the level of the confidence interval might create a false sense of security if the frequency of margin shortfalls is not correlated in a linear way with the size of the shortfalls of the margin.

Below we have examined the factors specifically listed in the regulation and also included details of factors which EuroCCP deems to be important to the considerations.

Factors to consider as specified in the regulation:
(a) the complexities and level of pricing uncertainties of the class of financial instruments which may limit the validation of the calculation of initial and variation margin;
The cash equity products cleared by EuroCCP are all listed on trading platforms. These platforms issue closing prices each day and during the day real-time information on bid/ask transaction prices are available. As such no complexities or significant pricing uncertainty will limit the validation of the calculation of the margin amounts.

(b) the risk characteristics of the class of financial instruments, which can include, but are not limited to, volatility, duration, liquidity, non-linear price characteristics, jump to default risk and wrong way risk;
The cash equity products cleared by EuroCCP are not considered complex products. More specifically the cash equity class of financial instruments is not particularly volatile and it is quite liquid. Wrong way risk is not relevant as the collateral that EuroCCP accepts is not exposed to the same risk factors as equities, while the other characteristics listed above are not applicable to cash equities.

(c) the degree to which other risk controls do not adequately limit credit exposures;
EuroCCP has installed participation requirements designed to give reasonable assurance that clearing members are reputable and fully authorized as fit to participate in a clearing system. However participation requirements by themselves do not prevent defaults of clearing members. In itself the participation requirements therefore do not impact the required confidence interval. The other financial resources together with the margin requirement ensure that the credit exposures are adequately limited; this process is however independent of the chosen percentage for the confidence interval and only sets the balance between the two types of resources.

(d) the inherent leverage of the class of financial instruments, including whether the class of financial instrument is significantly volatile, is highly concentrated among a few market players or may be difficult to close out.
EuroCCP only clears cash-equities and remain only in the books of EuroCCP until settlement at T+2 (and in some markets T+3). Cash equities do not have inherent leverage, cash equities are not particularly volatile nor is the trading of cash equities concentrated among just a few players. Given the number of venues on which cash-equities are traded and as we only have unsettled positions to guarantee, closing out positions is not perceived as an issue. Note further that additional margin is required in case positions in an ISIN are large in comparison to the overall trading volume in that ISIN.

Additional factor(s) to consider:
(e) Balance between margin requirement and other financial resources.
The margin requirement together with the other financial resources should cover the potential losses in case of a defaulting clearing member. This means that a relatively low margin requirement would need to be offset by a relatively high amount of other financial resources for a given potential loss. The reverse also holds: relatively high margin requirements can be offset by relatively low amount of other financial resources. Although the balance between margin requirement and other financial resources was not

specifically taken into account when the confidence level was set, it must be taken into account when a change to the confidence level is considered.

(f) Expected size of the margin shortfall.

As a CCP we monitor the frequency of margin shortfalls but we are also concerned about the size of a margin shortfall. We would rather observe 10 shortfalls of €1 than have to record 1 shortfall of €1 million. To this end we have performed tests on the shortfalls we would have experienced in our margin back tests if we were to have margined those positions at a confidence interval of 99%. And additionally assuming we margin them (as we currently do) to achieve 99.7%.

At 99% the largest shortfall would have been €2.9 Million while the average shortfall is €308,168 and; at 99.7% the largest shortfall would have been €1.5 Million while the average shortfall is €162,924. Neither approach would have led to insurmountable losses to EuroCCP or its default fund.

(g) Risk tolerance of the CCP and its shareholders.

The current shareholders have not considered changes to the policy in place at one of the predecessors of EuroCCP NV to set the confidence level at 99.7%. If the shareholders would consider reviewing their risk tolerance in this respect, it may lead (up) to a change.

Conclusion:

Based on the factors listed in article 24 of the Regulation (EU) No 153/2013 and EuroCCPs risk management framework in its entirety, there is no need for a confidence interval above 99%.

At the moment there is no compelling reason for EuroCCP to revise the current percentage it has set for the confidence interval.