Public disclosure of CCP.A's Risk Management Systems, Test Policy and Model Validation

Document Title	EMIR* Article	RTS** Article	Document Class
Disclosure Risk Management Validation	26	10 b(iii), 61	Policy (publicly disclosed)

*EMIR = Regulation (EU) 648/2012, **RTS 153/2013 = Regulation (EU) 153/2013

Document Information

Document Owner	Chief Risk Officer (CRO)
Document Approver	General Management

Document Review Cycle: yearly / on occasion

Change Log[1]

Version	Effective Date	Change Description
V1.0	11.06.2014	Initial Document, Summary of Test Results May 2014
V1.1	01.12.2014	Reduction of holding period from T+4 to T+3 due to introduction of settlement period T+2
V1.2	04.05.2016	Including back test of r Factor for all traded instruments, Update on Summary of results
V1.3	15.11.2016	Clarification on applied procedures to assess tests results and performance of stress tests; Link to CPMI-IOSCO Disclosure Framework added in Chapter 4
V1.4	20.10.2017	Annual review: Minor editorial changes
V1.5	31.1.2019	Annual review Minor editorial changes Table 1: Details on Test Results in 2018 inserted in Chapter 4

[1] The Change log is only used for final versions.

Content

1 Introduction

Art 49 EMIR sets several requirements to ensure that the models used for margin calculation and default procedures are based on solid assumptions and reflect the 'real world' as much as possible. Key points of these requirements are:

- Conduction of tests and analysis of results
- Information to National Competent Authority, Finanzmarktaufsicht (FMA)
- Integration of Clearing Members
- Public disclosure of key aspects

ESMA has detailed these key aspects in the delegated Regulation (EU) No 153/2013, Chapter XII, Art 47-57. CCP.A has implemented a Policy for Tests and Model Validation to comply with Art 49 EMIR and the standards defined by ESMA. This document gives an overview of the applied procedures.

2 Models to be validated and applied methodology

2.1 Margin Calculation

All Clearing Members of CCP.A must deposit collateral with the Collateral Custodians for securing the clearing risk. The margin requirements are calculated at least daily based on the balance of open trades (res. open positions) and risk parameters using Risk Based Margining.

Margins are calculated on instrument level on each Margin account, CCP.A does not consider correlations between different instruments to reduce margin requirement.

Basic steps are:

- Net open positions on margin account
- For each instrument of the position
  - Calculate current value (current close out cost if position will be liquidated immediately) on instrument level
  - Calculate potential additional close out (if position will be liquidating at t+3) under assumption of price changes up to x% (Margin Parameter) in the worst case scenario
- Add the two liquidation values to determine the basic risk per instrument and position
- Add basic Risk Margin Requirement of all instruments
- Multiply result with Member Rating factor and procyclicality buffer to obtain final margin requirement for each margin account

Important parameters are:

- Holding period 3 days (cash market)
- Look back period for margin parameter calculation: 250 Days and 600 days
- Confidence level: 99%

Margin parameters (i.e. “r-factor” on cash market) are published on CCP.A’s website.

For details regarding the calculation see “Margin Calculation Methodology” available on CCP.A’s website.

2.2 Default Fund Calculation

CCP.A’s Default Fund is calculated to cover the simultaneous default of the 3 largest Clearing Members. The methodology how the total size of the Default Fund is determined and the allocation of this amount to the individual member is published on CCP.A’s website (see document “Public Information on Default Fund Calculation”).

To validate its model for computing the default fund contributions, CCP.A uses back testing, stress testing and reverse stress testing. The stress testing process is fully automated and is performed daily. The reverse stress test process is also fully automated and executed on daily basis, the analysis of results takes place quarterly.

2.3 Overall Available Resources

The total available resources to cover defaults consist of margin requirements, Default Fund contribution and CCP.A’s own resources. The order of usage is compliant with the waterfall principle defined in EMIR (see document “Default Waterfall”).

To validate the overall resources of the default waterfall, the results of the stress tests and reverse stress tests are used.

2.4 Collateral

Each member has to fulfil its margin requirements and Default Fund contribution with assets according to CCP.A’s *Collateral Policy*. CCP.A’s *Collateral Policy* defines which collateral assets are eligible and how these assets are valuated.

To validate the Collateral Policy (collateral evaluation), the adequacy of the accepted collateral and the applied haircuts are reviewed regularly. This is done by analysing the price series of the pledged securities. For instruments tradeable at Wiener Börse AG, prices (including PWTs[2] and reference prices) of WBAG are used. For other instruments prices are provided by OeKB AG(i.e. prices from the vendor Telekurs which were concluded at the home market (first priority) or the market Frankfurt (second priority). The parameters used by CCP.A‘s *Collateral Policy* are benchmarked against those parameters published by ECB on their list of eligible collateral. This is done on a monthly basis.

2.5 Default Procedures

The procedures, which CCP.A undertakes in the event of a Clearing Member’s default, are summarized in the document “Procedure in the Event of Member Default”.

CCP.A’s rules stipulate the circumstances under which CCP.A will declare a default and what kind of action will be taken for each kind of default. Basic steps are:

1. CCP.A will declare default of a Clearing Member
2. CCP.A will immediately inform Wiener Börse AG

[2] PWT = Price without Turnover

3. Wiener Börse AG will suspend the member (and allocated Non-Clearing Members and Registered Clients) from trading immediately
4. FMA will be informed
5. Penalty fees have to be paid to the Austrian government according to Exchange Law
6. CCP.A will port the position and assets of segregated accounts as far as possible
7. Remaining positions will be liquidated using resources according to the default waterfall
   a. cash collaterals and all cash balances from defaulting member
   b. securities deposited as collateral and securities from defaulting member
   c. contributions to the clearing fund from defaulting member
   d. own dedicated sources of CCP.A
   e. contributions to the clearing fund from non-defaulting members on pro rata basis

To validate the general default procedures and to ensure that members are familiar with the default procedures, CCP.A will simulate a default of member in its simulation environment using a pre-defined screenplay, including some "what if" scenarios. To the extent possible, members will be integrated in this simulation (e.g. portability of assets and collaterals).

3 Testing Programs

3.1 Back Tests

The purpose of back testing is to check the adequacy of the margin calculation on each margin account. Back testing is performed on 2 functional levels:

- Level 1: Back test of margin requirement
- Level 2: Back test of margin parameters

Level 1: The margin requirements should cover the close out value (net profit and loss) of a portfolio within a confidence level of 99% under all circumstances, i.e. the change of the portfolio value between *t* and *t+n* of the portfolios of the Clearing Members.

In the back testing the margin requirement for a portfolio on a margin account on a given past day *t* is being compared with the close out value of that portfolio on *t+n*, thus measuring whether the initial margin requirement computed at *t* would have been sufficient to cover for losses incurred after *n* days. A net loss exceeding the margin requirement is defined as "uncovered loss". The allowed number of breaches has to be defined by the CRO and should be consistent with the applied confidence level chosen by CCP.A.

The model is said to be adequate, if the observed number of breaches is equal or lower than the expected breaches given for the specified confidence interval. A higher number of breaches gives an indication of an underestimation of the potential close out cost. In this case, the parameters of the margin model shall be adjusted. It may also be necessary to analyse whether the margin algorithm is adequate for a given instrument type.

Level 2: CCP.A conducts regularly tests on the appropriateness of the r-factors.

Therefore the daily price variation (from t to t+2) of all traded instruments is compared to the r-factor applied on t. This is done monthly taken the close prices of these instruments in the past 12 months into account.

If the price variation is higher than the applied r-factor, a breach is counted. The number of observed breaches shall support the null hypothesis “The applied r-factor is sufficient to cover T+2 price variations at a confidence level of 99%” at a significance level of 5%.

3.2 Stress Tests

Art 51 EMIR states that a CCP shall perform stress tests to estimate the exposure of the n largest members in extreme but plausible events. Stress tests provide information on risk exposure under stressed market conditions and give information on financial capacity which will be needed to cover the default of one or more member in stressed market conditions.

The standard stress tests for cash market instruments are based on shocking the variations of the instrument price.

The standard stress factor to stress the prices is determined by

1. Analysis of historic trade prices
2. Analysis of historic fair value prices (like “PWT”, “NAV”) provided by issuers
3. Hypothetic assumptions on potential price variations

Additional specific stress scenarios may be used to determine stressed prices of

- Instruments traded in non EUR currency but settled in EUR (currency rate stress scenarios)
- Bonds (interest rate stress scenarios)
- Instruments issued by a defaulting issuer

Standard stress scenarios are created for an upside price scenarios and a downside price scenario and include observed data (n-th largest shock in a given time frame (historical observation approach) as well as hypothetical scenarios like "*k*" times the size of the r-factor (r-factor approach) or a third approach based on statistics, using "*d*" times the standard deviation (standard deviation approach).

3.3 Reverse Stress Tests

Art 60 EMIR states that a CCP shall conduct reverse stress tests which are designed to identify under which circumstances the combination of margin, Default Fund plus other financial resources may provide insufficient coverage of credit exposure and for which its liquid financial resources may not be sufficient.

The reverse stress test methodology consists in a reprocessing of the stress tests using a "trial and error" approach until the objective is met. The relevant risk factor (which is the price for cash market instruments and the settlement price for derivatives) will be shocked by applying a factor to it (e.g. current price*1.5).

The results of the reverse stress tests enable CCP.A to identify the market conditions, under which a predefined threshold (in EUR) is reached. The threshold gives the breakeven point between available financial resources and necessary resources to cover the simultaneous default of *n* Clearing Members.

3.4 Sensitivity Tests

CCP.A conducts monthly sensitivity tests to assess its margin coverage under various market conditions using historical data from stress tests made.

Such analysis is performed on a number of portfolios and is designed to test key parameters of the initial margin model. The test shall includes the simultaneous default of Clearing Members that issue financial instruments cleared by the CCP. For these test cases, CCP.A evaluates the potential close out values of Clearing Member's positions.

The sensitivity test procedure is based on the execution of several margin computation iterations. The result of the iteration is a new set of r-factors and prices. CCP.A performs its sensitivity tests concerning:

- Changes in confidence interval
- Delta % variation of the price for n securities issued by Clearing Members under the assumption of simultaneously default
- Delta % variation of the price of the remaining securities

The result of a sensitivity test is the margin requirement of a Clearing Member under the different sensitivity-test market conditions, which include irregular price variations of several instruments issued by the defaulting Clearing Member.

This amount is compared with the available financial resources to cover the default of the 3 largest Clearing Members.

3.5 Assessment of Results

CCP.A has established criteria to assess whether its models, methodologies and liquidity risk management framework have been successfully validated. These criteria include the analysis of test results as well as clear statistical tests.

CCP.A has defined the procedures to detail the actions it could take given the results of the tests.

4 Summary of Test Results

During the last 12 months, all tests have been performed and successfully validated according to CCP.A's test schedule. There was no evidence of any inappropriateness of CCP.A's models used for margin calculation, determination of the Default Fund size, liquidity needs and default procedures. No corrective actions have been undertaken.

Quantitative information including basic test results are published following the "CPMI-IOSCO quantitative disclosure framework for CCPs" on CCP.A's website (section "Statistics").[3]

Table 1: Details on Test Results in 2018

Test	Model to be tested	Objective	Frequency	Test Evaluation	Test Result
Back Tests	Margin calculation model	To assess reliability of calculated margin requirements by comparing observed outcomes with expected outcomes.	daily	daily	Disclosed in IOSCO Public Data, Section 6.5.3 and 6.5.4
Back Tests	Risk factor calculation model	To ensure that CCP.A applies sufficient risk factors for margin calculation.	daily	monthly	In 2018 all Back Tests were successfully executed with no irregularities observed
Back Tests	Haircuts applied on collateral assets	To ensure that CCP.A applies sufficient haircuts on collateral assets to cover the fall in value during the assumed holding/liquidation period.	monthly	monthly	Disclosed in IOSCO Public Data, Section 5.3.4
Liquidity Stress Tests	Calculation of CCP.A's Liquidity needs	To ensure that CCP.A has sufficient liquid assets to cover settlement obligations toward CMs in case of default of 2 largest Clearing Members.	daily	daily	Disclosed in IOSCO Public Data, Section 7.3.2, 7.3.3, 7.3.6 and 7.3.7
Stress Tests	Model for computing Default Fund and overall resources	To calculate the minimum size of the Default Fund.	daily	monthly / quarterly	Disclosed in IOSCO Public Data, Section 4.1.4 and 4.1.5
Simulation of Events	Default Procederes	To ensure default procedures are practical and effective.	annually	annually / on clients demand	Last test successfully executed and validated on 31.8.2019

[3] https://www.ccpa.at/en/cpmi-iosco/

Sensitivity Tests	Margin Model	To determine sensitivity of key parameters of margin model taking into consideration the scenario of simultaneous default of Clearing Members, which issue financial instruments cleared by CCP.A.	daily	monthly	Sensitivity tests are performed daily, at the end of each month the test results from the day with highest exposure is evaluated. In 2018, these dates were: 10.01.2018 06.02.2018 19.03.2018 11.04.2018 30.05.2018 15.06.2018 18.07.2018 03.08.2018 24.09.2018 11.10.2018 30.11.2018 03.12.2018 In 2018, all Sensitivity Tests were successfully validated, no corrective measures required.
Reverse Stress Tests	Model for computing Default Fund and overall resources	To ensure that margin, Default Fund and skin-in-the game are sufficient to cover the loss of the 3 largest Clearing Members.	daily	quarterly	Reverse Stress Tests are performed daily, at the end of each quarter the test results from the day with highest exposure is evaluated. In 2018, these dates were: 19.03.2018 15.06.2018 24.09.2018 03.12.2018 In 2018, all Reverse Stress Tests were successfully validated, no corrective measures required.