



Clearing Capital at Risk ("CCaR") Model at NASDAQ OMX

Model Validation 2016



Current Version 4 from 08 February 2017

Executive Summary

Nasdaq Clearing AB provides clearing and Central Counterparty (CCP) services. In order to prudently manage these services Nasdaq Clearing uses a large number of different models. These models used by Nasdaq Clearing shall be validated on a yearly basis by a qualified and independent party to ensure accurate procedures. This report at hand is the annual external validation of the Clearing Capital at Risk (CCaR) model used for establishing a daily proxy for the clearing capital at risk and the levels of default funds grouped into financial markets (FIN), commodities (COM) and seafood (SF).

The calculation of the capital at risk simulates extreme but plausible events for the clearing member's portfolio via hypothetical quantitative scenarios and historical replays. In more detail, the potential loss (capital at risk) for Nasdaq Clearing is calculated as the possible simulated market movement minus the available collateral. Currently the CCaR framework models only market movements for underlying instruments whereas risk of value change in collaterals is handled outside CCaR via haircut calculations. The haircut calculation model is not part of this report.

The 2016 validation of the CCaR method used by Nasdaq Clearing in general underlines that the model used is suitable and appropriate to capture the risk of Nasdaq Clearing's portfolio. Nevertheless we recommend some areas of investigation to further improve the model to serve as a reliable proxy within a dynamic environment. None of the findings have been very severe on a three step scale, only low and medium severity was observed according to pre-defined criteria. The validation findings have been grouped into two main topics, first the statement on the general model framework, and second a statement on a numerical validation of the model. A detailed overview table can be found in Section **Error! Reference source not found.** (

Area	Severity	Finding and Recommendation
Documentation of CCaR model	Low	<p>Policies could be rechecked for redundant information and enhanced for more transparency.</p> <p>Versioning of documents would make follow ups of changes more understandable.</p>
Methodological framework Hypothetical quantitative scenarios	Low	<p>In general, the model set-up (hypothetical scenarios) provides more conservative estimates in a diversified portfolio context and produces higher capital at risk requirements.</p> <p>Compared to qualitative scenarios where a committee would decide on possible future scenarios, quantitative scenarios cover all possible future scenarios by design. Therefore, as long as risk parameters are assumed to be similar, there would be no advantage to change to qualitative scenarios.</p> <p>Nasdaq Clearing quantitative scenarios framework establishes a sound and comprehensive proxy for the estimation of capital at risk.</p>
Methodological	Medium	The methodology is generally sound but could be im-

framework Historical replays		proved by extending the simulation/replay to include some period before and after the event in order to capture the expected high volatility of the period and possible market rebounds.
Regulatory topics	Low	<p>Recently the EMIR regulation was updated and amended by delegated regulation 822/2016, which defines liquidation periods for financial instruments in more details. According to Nasdaq Clearing standards the proposed liquidation periods are already met and accounted for in the system.</p> <p>As requested by regulation 648/2012 Article 49 the CCaR model is publicly disclosed on the webpage. Within the model framework (CCaR model instructions) NASDAQ Clearing defines extreme but plausible events in accordance to the delegated regulation 153/2013 Article 29 by considering extreme volatile, illiquid and sudden sales periods.</p>
Monitoring process	Low	The monitoring process of the CCaR model includes monthly, quarterly and yearly internal validations, stress testing and back testing routines, which are adequate to capture any possible changes and also be able to react to new market circumstances. According to the EMIR framework Nasdaq Clearing has established a sound model.
Adequacy of risk parameters	Medium	<p>An analysis of volatile periods suggest to update the historical event list for the October 1998 for Nordic equities.</p> <p>The risk parameters of the current CCaR framework have been aligned with the risk parameters which have been published by ESMA in the CCP stress test report 2016. Additional regulatory scenarios have been added to fill gaps.</p>
Adequacy of product areas	Low	International equities could possibly (needs further investigation) be merged with Nordic equities since the correlation is quite high between these markets.
Concentration risk Product areas and clearing members	Low	We recommend to continue monitoring the product area international equity. Currently concentration risk is compensated by the separation of Nordic and international equity in two different product areas. When merging both product areas due to high correlation, the member structure should also be considered.
Concentration risk Change in member structure	Low	We recommend to continue monitoring the counterparty structure (accounts) in respect to portability and commingling of collaterals.

Table 1).

Within the first topic area, the model framework, we validate that the documentation at Nasdaq Clearing meets its purpose as it describes the model, different assumptions, limita-

tions and simplifications in a comprehensive way. As described in Nasdaq Clearing policies the estimation process of the capital at risk is in line with EMIR requirements. Nasdaq Clearing has decided to use hypothetical quantitative scenarios with risk factors scaled by extreme value theory as the major source to calculate the proxy for capital at risk. By design, hypothetical quantitative scenarios cover a wide range of possible portfolio constellations. As a further security network, historical replays are also estimated in parallel. These historical replays hardly ever triggering capital requirements as the hypothetical quantitative scenarios are more severe. Regarding historical replays we only would recommend to consider a rolling window estimation instead of a static view as currently different instruments have different margin periods of risks and this causes a mixed view on the daily proxy. Updated regulatory policies have been implemented in the CCaR model framework. In accordance with the delegated regulation 153/2013 Article 29 Nasdaq Clearing considering extreme volatile, illiquid and sudden sales periods in the CCaR calculation. We therefore conclude, that the model framework is sound, well established and fulfils the requirements of the regulation.

Within the second topic area, numerical investigation, we have stressed the CCaR model assuming different portfolio constellations to capture whether the current risk parameters setup in the CCaR calculation are adequate. Looking at each product area in CCaR separately we have identified that Nasdaq Clearing could add the market stress levels from October 1998 to the historical replay list for equities. Additionally we recommend Nasdaq to demonstrate adherence to ESMA minimum levels, or explain any deviations. Since the setup of hypothetical quantitative scenarios includes all extreme, positive and negatively correlated possibility of product area interaction, a parallel increase in risk parameters for each product area will lead to even higher levels of capital at risk proxies. In order to not overestimate these proxies the clustering of product areas should be carefully considered keeping the membership structure and correlation of each market in mind. Note that the decision on product groupings into product areas need to reflect the expected market behaviour under stressed market conditions. The measures of historical price dependence (correlation) should be seen as guidance that needs to be complemented with a discussion on economic/fundamental rationale. The recently introduced product area, international equity, constitutes a higher concentration risk when it comes to the volume residing with single clearing members. Since we saw a change regarding the counterparty structure compared to previous years, we further recommend to continue to monitor the clearing member account structure and the risk in respect to portability and commingling of collaterals.

In summary, we have not identified any highly severe problem areas. The areas with the highest priority are (i) to look into the methodology of historical replays, (ii) add October 1998 to the historical replay list, (iii) align with the ESMA minimum scenario list, and (iv) continue to monitor the concentration risk in the product area international equities.

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Table 1: Overview of findings and recommendations

Severity	Criteria
High	<ul style="list-style-type: none"> - Methodology is judged to be breach the purpose - Serious concern on certain elements of the approach and/or critical remedial actions required - Concerns must be addressed as soon as possible
Medium	<ul style="list-style-type: none"> - Methodology is judged to be generally appropriate and adequate for the intended purpose - However certain limitations which are of immaterial impact to the results are revealed during the model validation process, - Identified issues can easily be rectified within a reasonable period - Future analysis and monitoring need to be conducted during the next model validation projects.
Low	<ul style="list-style-type: none"> - Methodology is judged to be appropriate and adequate for the intended purpose and in line with the relevant regulatory requirements and NASDAQ Clearing's policies

Table 2: Color code in order to read severity of recommendations

Your Contacts

Jonas Schödin

Partner, Head of Risk Services

E-mail Jonas.schodin@zeb.se

Mobile +46.70.2206570



Bengt Jansson

Executive Manager

E-Mail bengt.jansson@zeb.se

Mobile +46.73.845.3394



Alexander Zeitlberger

Consultant

E-Mail alexander.zeitlberger@zeb.se

Mobile +46.70.334.5668



Markus Ahlgren

Senior Consultant

E-Mail markus.ahlgren@zeb.se

Mobile +46.73.767.5041

