NOTICE TO MEMBERS

N° 2021 - 020

February 2, 2021

REQUEST FOR COMMENTS

AMENDMENTS TO THE RISK MANUAL OF THE CANADIAN DERIVATIVES CLEARING CORPORATION INITIAL MARGIN MODEL CHANGE FOR EQUITY DERIVATIVES

On January 29, 2021, the Board of Directors of Canadian Derivatives Clearing Corporation ("CDCC") approved certain amendments to the Risk Manual of CDCC in connection with the initial margin model change for equity derivatives.

Please find enclosed an analysis document as well as the proposed amendments.

Process for Changes to the Rules

CDCC is recognized as a clearing house under section 12 of the *Derivatives Act* (Québec) by the Autorité des marchés financiers ("AMF") and as a recognized clearing agency under section 21.2 of the *Securities Act* (Ontario) by the Ontario Securities Commission ("OSC").

The Board of Directors of CDCC has the power to approve the adoption or amendment of the Manuals of CDCC. Amendments are submitted to the AMF in accordance with the self-certification process and to the OSC in accordance with the process provided in the Recognition Order.

Comments on the proposed amendments must be submitted before **MARCH 2, 2021**. Please submit your comments to:

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A copy of these comments shall also be forwarded to the AMF and to the OSC to:

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For any question or clarification, Clearing Members may contact Sophie Brault at 514-787-6565 or at sophie.brault@tmx.com.

Jay Rajarathinam
President

AMENDMENTS TO THE RISK MANUAL OF THE CANADIAN DERIVATIVES CLEARING CORPORATION

INITIAL MARGIN MODEL CHANGE FOR EQUITY DERIVATIVES

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I. DESCRIPTION

During the period beginning March 2020 to July 2020, variations in the securities and derivatives markets primarily caused by the impact of the COVID-19 outbreak on the financial markets have resulted in the Initial Margin (IM) models of the Canadian Clearing Derivatives Corporation ("CDCC" or "the Corporation") to encounter a number of backtesting breaches for equity derivatives. Such breaches were assessed as material on CDCC's impact scale.

Among other steps taken by CDCC during the period mentioned above, CDCC implemented COVID-19 related emergency measures and remediation actions in order to bring back backtesting results under the current models at appropriate levels. These COVID-19 measures, made in compliance with the Rules of CDCC, were nevertheless considered mitigant solutions for the issue at stake before a permanent and general solution gets implemented.

The next step, which is the subject of the proposed changes, is to translate the current remediation action for equity derivatives into a permanent model revision, which will take the form of a model change. Based on the foregoing, CDCC hereby proposes changes to its Risk Manual that will target the asset class that triggered this revision (i.e. equity derivatives). To this end, the remediation action currently in force for equity derivatives will be replaced by the addition of a new margin component to the current methodology for the Margin Interval (MI) as outlined in the CDCC Risk Manual.

The proposed model change will only be applicable to equity derivatives listed at the Bourse de Montreal (MX) and cleared by CDCC. The Corporation considers the following product groups as falling under the equity derivatives product category:

- Index Futures (SXF, SXM, SCF, SMJ, SXA, SXB, SXH, SXK, SXU, SXY)
- Share Futures
- Index, Share and Currency Options

Unless otherwise defined herein, all defined terms used in this analysis will have the meaning described to them in CDCC's Rules.

II. PROPOSED AMENDMENTS

CDCC proposes amending the Risk Manual with regard to the Base Initial Margin ("Base IM") methodology for Options, Futures and Unsettled Items. CDCC first intends to clarify the major components which currently constitute the MI in its calculation: the Historical Risk component and the volatility floor. The Corporation then intends to integrate another measure to mitigate the procyclicality of equity derivatives margins: the Stress Risk component.

Furthermore, the Corporation proposes to modify Section 6.5 of the Risk Manual: "*Margin Interval*" to clearly identify the *Historical Risk* from the anti-procyclicality measures that the Corporation may consider, while adding the *Stress Risk* component to that list. Additionally, CDCC proposes to modify Sections 1.1 and 6.1 of the Risk Manual, respectively *"Initial Margin"* and "*Base Initial Margin Calculation for Options, Futures and Unsettled Items*" to align the manual with the proposed modification.

The proposed amendments are attached hereto.

III. ANALYSIS

a. Background

Variations in the equity derivatives market primarily caused by the impact of the COVID-19 outbreak on the financial markets resulted in CDCC's IM models to experience a certain number of backtesting breaches. These breaches were considered material on CDCC's impact scale. As a result, remediation actions were proposed based on reverse backtesting and/or partial modelization analysis. Although useful, these remediation actions are nevertheless considered mitigant solutions and the Corporation is now disposed to propose a permanent solution for equity derivatives.

Risk Model

Base IM requirements for equity derivatives are derived from the SPAN-based methodology, where every risk group (or "Combined Commodity", level at which the Base IM is calculated) has its own Price Scan Range (PSR). The PSR is the primary driver of the level of Base IM requirements: it is calibrated by the Margin Interval (MI) and scaled by the price of the underlying risk factor.

More specifically, The MI is calculated using a (i) Historical Risk component and (ii) measures to mitigate the procyclicality of margins ("Anti-Procyclicality" or "APC" measures). The Historical Risk component is calculated with a daily volatility estimator using a 260-day EWMA and a parametric distribution assumption. On the other side, the volatility floor serves as an APC measure and takes the form of a 10-year floor of the daily volatility estimator determined under the Historical Risk approach.

At the time of entering the COVID-19 period, the 2008 financial crisis had just exited the 10-year look-back period, leading to a potential underestimation of the floor level. The temporary remediation, as well as the proposed model change, are therefore in line with this finding around the volatility floor and hence, directly addressing APC measures .

Temporary Remediation

Although not addressing the model's procyclicality as a whole, the volatility floor identifies as one of the three APC measures recommended by the ESMA regulatory body[1]. Given the identified weakness of a 10-year floor for equity derivatives, and provided that ESMA's guidelines explicitly do not restrict to the use of a single APC measure, the temporary remediation that is currently in force for equity derivatives takes the form of a 25% buffer on the level of the volatility floor (the "Buffered Floor"), which corresponds to another one of the three APC measures.

[1] "Guidelines on EMIR Anti-Procyclicality Margin Measures for Central Counterparties". ESMA 28 May 2018. ESMA70-151-1293

The reason for this choice is twofold: First, the activation of this additional APC measure was deemed the most appropriate for a rapid and seamless implementation during the crisis, while efficiently bringing back backtesting results at appropriate levels. Second, such a measure was considered appropriate to ensure a soft margin transition during times of high volatility as the Historical Risk component was still driving the calibration of the MI for most products, rather than the volatility floor. By doing so, the Corporation provided a targeted response to address the performance of its model without adversely impacting its Clearing Members in times of stress.

Proposed Model Revision

With the benefit of hindsight and the prevalent stabilization of financial markets, the Corporation is now disposed at proposing a permanent solution for equity derivatives, which one will take the form of a model change. CDCC proposes to replace the temporary remediation by the introduction of a Stress Risk component based on the Stressed Value-at-Risk (SVaR) methodology, which again, corresponds to another one of the three APC measures.

Provided that the COVID-19 crisis will now be included in the 10-year lookback window, one can argue that the additive effect of the Buffered Floor may lead to an overestimation of APC measures combined for equity derivatives when the market volatility will reach regular levels again. In this way, CDCC considers the introduction of the Stress Risk component as a refinement of the generalized Buffered Floor into a more comprehensive approach that allows for a better complementarity with the volatility floor (please refer to the section below for additional details). Consequently, when compared with the Buffered Floor, the proposed model change is improving both the model performance and the cost to Clearing Members.

Additionally, CDCC considers the timing appropriate for a smooth transition toward the permanent solution. Indeed, the calibration of the MI for the SXF Futures contract[2] is still driven by the Historical Risk component. In other words, the Buffered Floor is still considered as fully exhausted (thus ineffective) and for as long as the period of high margin level remains. Based on stable volatility projections, the contract is expected to meet back regular margin levels by the end of Q1 2021, when the volatility floor will be expected to drive the levels of margin again.

<u>Details on the new risk model</u>

The SVaR aims at measuring risk from a fixed period of time where the market volatility is considered extreme ("Stressed period"). At CDCC, the SVaR will be obtained by taking the 99th percentile of the 260-day return distribution of each underlying risk factor (level at which the MI is calculated). Should no market observations be available on the selected Stressed period, CDCC will use prices that have been extrapolated from the relation between the underlying risk factor and its sector proxy[3]. With the addition of the SVaR methodology, not only the Corporation ensures that a Stressed period is always captured, but the Corporation also introduces a

[2] Representative contract of the Canadian equity market while driving approximately 80% of the Base IM for equity derivatives at CDCC

[3] The Buffered Floor will apply as an alternative method in specific cases where a Stress Risk component is not available.

nonparametric component to the calculation of the MI, while not disrupting the existing parametric framework.

More specifically, the SVaR will be integrated alongside the parametric component of the MI (i.e. the Historical Risk component) as a weighted proportion, and the parametric volatility floor will continue to apply as the last step of the calculation. Overall, the independent use of a *fixed* Stressed period in parallel to the *rolling* 10-year lookback window allows for the two APC measures to work in complementarity. This prudent approach ensures that the MI always captures an identified *market-specific* period (under the Stress Risk component), while still capturing *product-specific* dynamics (under the volatility floor). This is all the more justified for products with distinctive or unique characteristics, or products which heavily rely on a sector proxy for the Stressed period.

b. Objectives

The proposed amendments are motivated by CDCC's governance process around the reaction of its IM models to the COVID-19 outbreak on financial markets. The Corporations considers that a targeted model change for equity derivatives is the appropriate response for the permanent solution.

c. Comparative Analysis

A comparative analysis of publicly available information from different clearing houses such as ASX Clear, CME Clearing, Eurex Clearing, ICE Clear US and LCH SA was performed by CDCC on the usage of APC measures in the equity derivatives clearing market.

The three APC measures established by the ESMA's EMIR in 2019 are the closest to being global standards in terms of anti-procyclicality controls. In fact, CDCC managed to rely on each of these measures in the recent history, and to incorporate them within its margin models framework appropriately. Although clearing houses may use other proprietary measures or fall under other jurisdictions, in view of the foregoing, the Corporation focused its comparative analysis to the three measures as described by the regulatory body.

CDCC consulted PFMI Disclosure documents as well as other publicly available documents in which the clearing houses mentioned above only describe their margin process at a very general level. APC measures that were clearly identifiable have been summarized in the table below:

CCP	Margin Model (Equity Derivatives)	Identified APC Measures			
		STRESS	FLOOR	BUFFER	Details
ASX Clear[4]	SPAN methodology	X	X		• Floors are set across a range of risk parameter inputs • Stressed market conditions are incorporated in the sensitivity analysis
CME Clearing[5]	SPAN methodology. Use of the VaR methodology for risk parameters		X	X	Proprietary measures equivalent to: • A 10-year historical floor • A 25% margin buffer temporarily eroded in times of stress
Eurex Clearing[6]	PRISMA methodology (based on a filtered VaR methodology)	X	X		• Using a minimum of 25% of stress scenarios in the VaR sample • Dynamic volatility scalings using volatility floors
ICE Clear US[7]	SPAN based methodology (ICE Risk Model). Use of the VaR and EWMA methodology for risk parameters		X		• Floor established using 10 years of historical observations (using the EWMA methodology)
LCH SA[8]	VaR methodology (using the EWMA methodology)		X	X	• Application of countercyclicality buffers • Use of long term margin floors

Every clearing house mentioned above uses some form of floor level, as it has historically been the case at CDCC. Most clearing houses make use of another APC measure, either by using stress scenarios or buffers of some sorts. These facts lead CDCC to understand that from the sample of major global clearing houses for equity derivatives, the 10-year floor seems to be used as the core APC measure while only one of the other two measures applies in complement to the floor.

[4]https://www.asx.com.au/documents/asx-compliance/pfmi-disclosure-framework.pdf
[5]https://www.cmegroup.com/clearing/risk-management/files/cme-clearing-principles-for-financial-market-infrastructures-disclosure.pdf
[6]https://www.eurex.com/resource/blob/1911986/afa68344defdd2987df43754e3848cb4/data/cpss-iosco-pfmi_assessment_2019_en.pdf
[7]https://www.theice.com/publicdocs/clear_us/ICUS_DisclosureFramework.pdf
[8]https://www.lch.com/system/files/media_root/2019%20PFMI%20Assessment_%20public%20version%20Final.pdf

d. Analysis of Impacts

i. Impacts on Market

The observed limitation in the volatility floor led CDCC to consider other APC measures to mitigate the procyclicality of margins and bring back margin models for equity derivatives at appropriate coverage levels. Given CDCC's proposition to replace the emergency APC measure that was better fit for a rapid remediation (i.e. the Buffered Floor), with another one that is more appropriate for a long term solution (i.e. the Stress Risk component), the risk analysis suggests that no significant impact is expected on the Margin and Clearing Funds requirements.

Moreover, when compared with the additive effect of the Buffered Floor, the Stress Risk component proves to work in better complementarity with the volatility floor. Indeed, in times of low volatility, margin levels would go below the level of margins that would be generated by the Buffered Floor, equivalent but more reactive when market fluctuations rise, and with a greater persistence in times of stress. In other words, major differences between the two measures occur in periods when the Buffered Floor is fully activated, which corresponds to periods with market volatilities at exceptionally low levels.

With the COVID-19 outbreak on financial markets still part of the ongoing year, along with the periods of moderate volatility that followed, margin levels for equity derivatives are expected to continue their slow decrease toward Q2 2021 if current volatility dynamics are maintained. This corresponds to the post-crisis period described above, during which the level of margins is expected to be slightly more persistent under the proposed model change. Consequently, the Corporation has estimated a small increase of the Margin Fund would the Stress Risk component be implemented by the end of 2020, but going toward a break even (no impact) with an implementation expected for Q2 2021.

Given that the proposed model does not affect the methodology of the Clearing Fund and that the impact on the level of the Base IM (which is an input parameter to calibrate the Clearing Fund) is considered low, consequently no significant impact on the level of the Clearing Fund is also expected by the Corporation.

ii. Impacts on Technology

The proposed amendments have no impact on the clearing system (SOLA) or the risk system. Indeed, both the clearing and risk systems make external use of the information to be processed (the calculation of the MI).

Regarding the end-user-computing-system, CDCC expects a medium impact as new developments will be required to integrate the proposed model change to the existing process for the calculation of the MI.

User Acceptance Testing (UAT) is planned prior to implementation to ensure that changes are appropriately handled in all relevant IT systems.

iii. Impacts on trading functions

The proposed amendments will have no impact on MX trading systems or rules.

iv. Public Interest

CDCC is of the view that the proposed amendments are not contrary to the public interest. In fact, the public and Clearing Members are generally requesting clear rules that are consistent with the best practices of other clearinghouses and are PFMI compliant.

Moreover, CDCC considers these amendments to be in the interest of the public as the Corporation is improving the performance of its IM models without adversely impacting its Clearing Members in times of stress, which should benefit and strengthen the entire marketplace.

IV. PROCESS

The proposed amendments, including this analysis, must be approved by CDCC's board of directors and submitted to the Autorité des marchés financiers, in accordance with the regulatory self-certification process, and to the Ontario Securities Commission in accordance with the rules stated in Appendix "A" of Schedule "C" of CDCC Recognition Order dated April 8, 2014 (as amended from time to time). The proposed amendments and analysis will also be submitted to the Bank of Canada in accordance with the Regulatory Oversight Agreement. The proposed amendments are expected to take effect during Q2 2021.

V. ATTACHED DOCUMENTS

- Appendix 1: Amended Risk Manual

APPENDIX 1: AMENDED RISK MANUAL

AMENDED VERSION

RISK MANUAL

~~JUNE 12~~, 202~~0~~

Section 1: Margin Deposits

As set out in the Rules, every Clearing Member shall be obligated to deposit Margin with the Corporation, as determined by the Corporation. Deposits must be made in the form of eligible collateral, as specified in Section 2 of this Risk Manual, in an amount sufficient, taking into account the market value and applicable Haircuts.

The Corporation requires Margin Deposits to cover two types of requirements, namely:

- Margin requirement; and
- Clearing Fund Requirement.

1.1 MARGIN REQUIREMENT

The Margin requirement is composed of the Initial Margin and the Variation Margin.

1.1.1 Initial Margin

The Initial Margin is composed of the Base Initial Margin (or Adjusted Base Initial Margin, as the case may be) and the Additional Margins. In order to cover the Initial Margin described below, Clearing Members shall deliver to CDCC an acceptable form of Deposits in accordance with Section 2 of this Risk Manual.

1.1.1.1 Base Initial Margin

The Base Initial Margin requirement covers the potential losses and market risk that may occur as a result of future adverse price and/or Risk Factors across the portfolio of each Clearing Member under normal market conditions.

The risk methodology for the Options, Futures and Unsettled Items incorporates the historical volatility of the daily price returns of the Underlying Interests for Options, Unsettled Items and Share Futures and the daily price returns of the Futures prices for Futures (excluding Share Futures). In addition, as part of the methodology, the Corporation uses a volatility estimator, a confidence level over 99% under the normal distribution or the student's t-distribution assumption and a variable number of days as the MPOR. The Corporation also considers various measures to mitigate the procyclicality of margins:

- A Stress Risk component, calculated with a Stress Value at Risk (SVaR) and a weighting factor of 25%.
- A volatility floor, calculated as an average of the daily volatility estimator observed over the last 10 years.

The risk methodology for Fixed Income Transactions is the Value at Risk methodology (VaR)[1]. This methodology considers a full revaluation method and it is based on Zero Curves. In addition, as part of the methodology, the Corporation uses a volatility estimator, a Margin Buffer Multiplier to prevent a large decrease in Margin requirements during periods of low volatility, a confidence level over 99% and a variable number of days as the MPOR.

Please refer to Sections 6.1 and 6.2 for additional details on the Base Initial Margin calculation.

With respect to the Limited Clearing Members, the Base Initial Margin is multiplied by the Effective Ratio to calculate the Adjusted Base Initial Margin. Please refer to Section 6.3 for additional details on Effective Ratio Recalibration.

1.1.1.2 Additional Margins

In addition to the Base Initial Margin (or Adjusted Base Initial Margin, as the case may be), the Corporation requires Margin Deposits for the following Additional Margins:

(1) Additional Margin for Market Liquidity Risk

(2) Additional Margin for Specific Wrong-Way Risk

(3) Additional Margin for Mismatched Settlement Risk

(4) Additional Margin for Intra-day Variation Margin Risk

(5) Additional Margin for Unpaid Option Premium Exposure Risk

(6) Additional Margin for Banking Holiday Risk

(7) Additional Margin for Variation Margin Delivery Risk

(8) Additional Capital Margin Risk

(9) Additional Margin for Uncovered Risk of Limited Clearing Members

(10) Any other additional Margins

[1] The same methodology used for Fixed Income Transactions is applied for physical delivery of Government of Canada Bond Futures.

[...]

Section 6: Appendix

6.1 BASE INITIAL MARGIN CALCULATION FOR OPTIONS, FUTURES AND UNSETTLED ITEMS[2]

For greater certainty, this sections only applies to Options, Futures and Unsettled Items.

To calculate the Base Initial Margin the risk methodology is based on the PSR and the VSR which are then converted into the Scanning Risk parameter. The Scanning Risk parameter represents the difference between the most unfavourable projected liquidation value and the initial reference price[3]. The most unfavourable projected liquidation value amongst the Risk Array is obtained by varying the values of the Underlying Interest and implied volatility according to several scenarios representing adverse changes in normal market conditions. The projected liquidation values are obtained using specific valuation models such as Black 76, Black-Scholes, Binomial and others.

The Scanning Risk is calculated at the Combined Commodity level and is denominated in the same currency as the contract. For contracts belonging to the same Combined Commodity, the Risk Array results are added up for all contracts under the same scenario. The highest loss represents the Scanning Risk.

The other variables influencing the value of the Base Initial Margin are the Intra-Commodity, the Inter-Commodity and the Short Option Minimum. The following table summarizes the variables used in the calculation.

Input variables to calculate the Base Initial Margin	Options	Futures	Unsettled Items
Scanning Risk	●	●	●
Intra-Commodity		●	
Inter-Commodity[4]		●	
Short Option Minimum	●		

[2] Unsettled Items resulting of a physical delivery of Government of Canada Bond Futures are margined under the VaR methodology.

[3] The initial reference price is the market price or the theoretical price derived from market observations.

[4] Not applicable for Share Futures.

6.1.1 Scanning Risk

The Scanning Risk parameter represents the difference between the most unfavourable projected liquidation value and the initial reference price. The most unfavourable projected liquidation value amongst the Risk Array is obtained by varying the values of the Underlying Interest and implied volatility according to several scenarios representing adverse changes in normal market conditions. The table at the end of this section shows all the risk scenarios. The projected liquidation values are obtained using specific valuation models such as Black 76, Black-Scholes, Binomial and others. If the largest loss is negative, the Scanning Risk is set to zero. The Scanning Risk is then compared to the Short Option Minimum. This amount is required if the Short Option Minimum is higher than the result of the Risk Arrays.

6.1.1.1 Price Scan Range

The term PSR represents the potential variation of the contract value and it is calculated through the following formula:

$$PSR = \ Price \times MI \times Contract\ Size$$

The methodology for the MI is detailed in Section 6.5.

6.1.1.2 Volatility Scan Range

The term VSR represents the potential variation of the implied volatility and it is calculated through the following formula:

$$VSR = \ Volatility\ Shock \times \sqrt{n}$$

Where 'n' is the MPOR, and 'Volatility Shock' represents the 95% confidence level of the historical daily fluctuations for the series volatility over a one year look-back period. The daily fluctuations are scaled up with the use of MPOR. VSR values are subject to a floor value and a cap value.

Risk Scenarios	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Underlying Price Variation *	0	0	1/3	1/3	-1/3	-1/3	2/3	2/3	-2/3	-2/3	1	1	-1	-1	2	-2
Volatility Variation *	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	0	0
Weight Fraction Considered	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	35%	35%

* Expressed in scan range

The MI, MPOR and Volatility Shocks values are updated by the Corporation from time to time.

6.1.2 Intra-Commodity

Long positions on Futures maturing in one month are automatically matched with short positions on Futures maturing in another month. The resulting Base Initial Margin on these two Futures belonging to the same Combined Commodity, could be lower than the real risk associated with the combination of the two contracts. In order to cover this inter-month spread risk, a charge is included in the Base Initial Margin.

For the Futures, the Intra-Commodity which is an additional dollar amount charge applied to each combination of a minimum of two different Futures, is determined ~~as follows:~~ by applying the MI methodology on the Futures combination's daily profit and loss over the reference period.

The methodology for the MI is detailed in Section 6.5.

~~$$Intra - Commodity = \alpha \times \sqrt{n} \times \sigma$$~~

~~Where 'n' is the number of MPOR, 'α' is equal to the confidence value equivalent to 99.87% (three standard deviations) of the cumulative normal distribution (applicable to all products except for the Three-Month Canadian Bankers' Acceptance Futures (BAX) and CORRA Futures (COA & CRA)) or equal to the confidence value equivalent to 99% of the cumulative student's t-distribution with 4 degrees of freedom (applicable to the BAX and CORRA Futures). 'σ' is the volatility estimator of the Futures combination's daily profit and loss over the~~

~~reference period and is computed using the EWMA approach. Further details on the EWMA are described in Appendix 6.5.~~

~~In addition, CDCC considers a floor for the EWMA volatility estimator. The level of such floor is calculated as an average of daily EWMA volatility estimator observed over the last 10 years. The EWMA volatility estimator that will be used to calculate the Intra-Commodity cannot be lower than the calculated floor.~~

With respect to the BAX and CORRA Futures (COA & CRA), CDCC calculates the Intra-Commodity for all combinations of spreads and butterfly–strategies and applies a same charge for a same group of combinations with close maturities. If multiple Intra-Commodity are defined, the Corporation will prioritize the ones providing the lowest Base Initial Margin.

The combinations and the spread priorities for the Intra-Commodity are updated by CDCC from time to time.

6.1.3 Inter-Commodity

The Corporation may consider the correlation that exists between different Futures when calculating the Base Initial Margin. The Corporation will grant a credit according to the historical correlation of the returns of the two Futures. If multiple Inter-Commodity are defined, the Corporation will prioritize the ones with the highest correlation.

The Inter-Commodity and the spread priorities are updated by CDCC from time to time.

[…]

6.5 MARGIN INTERVAL

The MI is calculated using the following formula for the Historical Risk:

$$Historical\ Risk\sout{MI} = \sigma_t \times \alpha \times \sqrt{n} \sout{\times \sigma}$$

Where 'n' is the MPOR, 'α' is equal to the confidence level equivalent to 99.87% (three standard deviations) of the cumulative normal distribution (applicable to all products except for the BAX, the CORRA Futures and the S&P/MX International Cannabis Index Futures ~~and CORRA Futures~~) or equal to the confidence value equivalent to 99% of the cumulative student's t-distribution with 4 degrees of freedom (applicable to the BAX, the CORRA Futures and the S&P/MX International Cannabis Index Futures ~~and CORRA Futures~~). 'σ_t~~σ~~' is the volatility estimator of the contract's returns and is computed using an exponentially weighted moving average (EWMA) approach.

The implemented formula for the estimator at any time *t* is:

~~$IM = \alpha \times \sqrt{n} \times \sigma$~~

$$\sigma_t = \sqrt{\frac{(1-\lambda)\sum_{i=1}^{260}\lambda^{i-1}(R_{t-i}-\bar{R})^2}{(1-\lambda^{260})}}$$

Where R is the daily price returns of the Underlying Interests for Options and Share Futures and the daily price returns of the Futures prices for Futures (excluding Share Futures), $\overline{R}$ is the mean return over the specified period and λ is the decay factor. CDCC uses λ = 0.99.

In addition, CDCC considers the following measures to mitigate the procyclicality of margins:

- A Stress Risk component, calculated using a Stress Value at Risk (SVaR):

$$MI^* = (1-w) \times Historical\ Risk + w \times Stress\ Risk$$

Where the *Stress Risk* component is equal to a confidence level equivalent to a minimum of 99% of the ranked distribution of the absolute price return of the Underlying Interest or an equivalent Risk Factor over a fixed period of a minimum of 260 days with a high market volatility, a variable number of days as MPOR and a weighting factor of 25% ('w').

The SVaR is applicable to all Index and Share Futures and Options[5]. For all other products (all Interest Rate Futures), the weighting factor is set to zero and only the Historical Risk component is applicable[6].

- A volatility floor, calculated using the EWMA approach:

$$MI^{**} = max\,(MI^{*}, Volatility\ floor)$$

Where the volatility floor is calculated as an average of the daily volatility estimator observed over the last 10 years.

The volatility floor is applicable to all Options, Futures and Unsettled Items.

~~In addition, CDCC considers a floor for the EWMA volatility estimator defined above. The level of such floor is calculated as an average of daily EWMA volatility estimator observed over the last 10 years. The volatility estimator that will be used to calculate the MI cannot be lower than the calculated floor.~~

[5] CDCC sets the weighting factor to zero and uses a 25% buffer on the volatility floor as an alternative method in specific cases where a Stress Risk component is not available.

[6] Also true for the calculation of the Intra-Commodity.

CLEAN VERSION

RISK MANUAL

Section 1: Margin Deposits

As set out in the Rules, every Clearing Member shall be obligated to deposit Margin with the Corporation, as determined by the Corporation. Deposits must be made in the form of eligible collateral, as specified in Section 2 of this Risk Manual, in an amount sufficient, taking into account the market value and applicable Haircuts.

The Corporation requires Margin Deposits to cover two types of requirements, namely:

- Margin requirement; and
- Clearing Fund Requirement.

1.1 MARGIN REQUIREMENT

The Margin requirement is composed of the Initial Margin and the Variation Margin.

1.1.1 Initial Margin

The Initial Margin is composed of the Base Initial Margin (or Adjusted Base Initial Margin, as the case may be) and the Additional Margins. In order to cover the Initial Margin described below, Clearing Members shall deliver to CDCC an acceptable form of Deposits in accordance with Section 2 of this Risk Manual.

1.1.1.1 Base Initial Margin

The Base Initial Margin requirement covers the potential losses and market risk that may occur as a result of future adverse price and/or Risk Factors across the portfolio of each Clearing Member under normal market conditions.

The risk methodology for the Options, Futures and Unsettled Items incorporates the historical volatility of the daily price returns of the Underlying Interests for Options, Unsettled Items and Share Futures and the daily price returns of the Futures prices for Futures (excluding Share Futures). In addition, as part of the methodology, the Corporation uses a volatility estimator, a confidence level over 99% under the normal distribution or the student's t-distribution assumption and a variable number of days as the MPOR. The Corporation also considers various measures to mitigate the procyclicality of margins:

- A Stress Risk component, calculated with a Stress Value at Risk (SVaR) and a weighting factor of 25%.
- A volatility floor, calculated as an average of the daily volatility estimator observed over the last 10 years.

The risk methodology for Fixed Income Transactions is the Value at Risk methodology (VaR)[1]. This methodology considers a full revaluation method and it is based on Zero Curves. In addition, as part of the methodology, the Corporation uses a volatility estimator, a Margin Buffer Multiplier to prevent a large decrease in Margin requirements during periods of low volatility, a confidence level over 99% and a variable number of days as the MPOR.

Please refer to Sections 6.1 and 6.2 for additional details on the Base Initial Margin calculation.

With respect to the Limited Clearing Members, the Base Initial Margin is multiplied by the Effective Ratio to calculate the Adjusted Base Initial Margin. Please refer to Section 6.3 for additional details on Effective Ratio Recalibration.

1.1.1.2 Additional Margins

In addition to the Base Initial Margin (or Adjusted Base Initial Margin, as the case may be), the Corporation requires Margin Deposits for the following Additional Margins:

(1) Additional Margin for Market Liquidity Risk

(2) Additional Margin for Specific Wrong-Way Risk

(3) Additional Margin for Mismatched Settlement Risk

(4) Additional Margin for Intra-day Variation Margin Risk

(5) Additional Margin for Unpaid Option Premium Exposure Risk

(6) Additional Margin for Banking Holiday Risk

(7) Additional Margin for Variation Margin Delivery Risk

(8) Additional Capital Margin Risk

(9) Additional Margin for Uncovered Risk of Limited Clearing Members

(10) Any other additional Margins

[1] The same methodology used for Fixed Income Transactions is applied for physical delivery of Government of Canada Bond Futures.

[…]

Section 6: Appendix

6.1 BASE INITIAL MARGIN CALCULATION FOR OPTIONS, FUTURES AND UNSETTLED ITEMS[2]

For greater certainty, this sections only applies to Options, Futures and Unsettled Items.

To calculate the Base Initial Margin the risk methodology is based on the PSR and the VSR which are then converted into the Scanning Risk parameter. The Scanning Risk parameter represents the difference between the most unfavourable projected liquidation value and the initial reference price[3]. The most unfavourable projected liquidation value amongst the Risk Array is obtained by varying the values of the Underlying Interest and implied volatility according to several scenarios representing adverse changes in normal market conditions. The projected liquidation values are obtained using specific valuation models such as Black 76, Black-Scholes, Binomial and others.

The Scanning Risk is calculated at the Combined Commodity level and is denominated in the same currency as the contract. For contracts belonging to the same Combined Commodity, the Risk Array results are added up for all contracts under the same scenario. The highest loss represents the Scanning Risk.

The other variables influencing the value of the Base Initial Margin are the Intra-Commodity, the Inter-Commodity and the Short Option Minimum. The following table summarizes the variables used in the calculation.

Input variables to calculate the Base Initial Margin	Options	Futures	Unsettled Items
Scanning Risk	●	●	●
Intra-Commodity		●	
Inter-Commodity[4]		●	
Short Option Minimum	●		

[2] Unsettled Items resulting of a physical delivery of Government of Canada Bond Futures are margined under the VaR methodology.

[3] The initial reference price is the market price or the theoretical price derived from market observations.

[4] Not applicable for Share Futures.

6.1.1 Scanning Risk

The Scanning Risk parameter represents the difference between the most unfavourable projected liquidation value and the initial reference price. The most unfavourable projected liquidation value amongst the Risk Array is obtained by varying the values of the Underlying Interest and implied volatility according to several scenarios representing adverse changes in normal market conditions. The table at the end of this section shows all the risk scenarios. The projected liquidation values are obtained using specific valuation models such as Black 76, Black-Scholes, Binomial and others. If the largest loss is negative, the Scanning Risk is set to zero. The Scanning Risk is then compared to the Short Option Minimum. This amount is required if the Short Option Minimum is higher than the result of the Risk Arrays.

6.1.1.1 Price Scan Range

The term PSR represents the potential variation of the contract value and it is calculated through the following formula:

$$PSR = \ Price \times MI \times Contract\ Size$$

The methodology for the MI is detailed in Section 6.5.

6.1.1.2 Volatility Scan Range

The term VSR represents the potential variation of the implied volatility and it is calculated through the following formula:

$$VSR = \ Volatility\ Shock \times \sqrt{n}$$

Where 'n' is the MPOR, and 'Volatility Shock' represents the 95% confidence level of the historical daily fluctuations for the series volatility over a one year look-back period. The daily fluctuations are scaled up with the use of MPOR. VSR values are subject to a floor value and a cap value.

Risk Scenarios	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Underlying Price Variation *	0	0	1/3	1/3	-1/3	-1/3	2/3	2/3	-2/3	-2/3	1	1	-1	-1	2	-2
Volatility Variation *	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	0	0
Weight Fraction Considered	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	35%	35%

* Expressed in scan range

The MI, MPOR and Volatility Shocks values are updated by the Corporation from time to time.

6.1.2 Intra-Commodity

Long positions on Futures maturing in one month are automatically matched with short positions on Futures maturing in another month. The resulting Base Initial Margin on these two Futures belonging to the same Combined Commodity, could be lower than the real risk associated with the combination of the two contracts. In order to cover this inter-month spread risk, a charge is included in the Base Initial Margin.

For the Futures, the Intra-Commodity which is an additional dollar amount charge applied to each combination of a minimum of two different Futures,is determined by applying the MI methodology on the Futures combination's daily profit and loss over the reference period.

The methodology for the MI is detailed in Section 6.5.

With respect to the BAX and CORRA Futures (COA & CRA), CDCC calculates the Intra-Commodity for all combinations of spreads and butterfly–strategies and applies a same charge for a same group of combinations with close maturities. If multiple Intra-Commodity are defined, the Corporation will prioritize the ones providing the lowest Base Initial Margin.

The combinations and the spread priorities for the Intra-Commodity are updated by CDCC from time to time.

6.1.3 Inter-Commodity

The Corporation may consider the correlation that exists between different Futures when calculating the Base Initial Margin. The Corporation will grant a credit according to the historical correlation of the returns of the two Futures. If multiple Inter-Commodity are defined, the Corporation will prioritize the ones with the highest correlation.

The Inter-Commodity and the spread priorities are updated by CDCC from time to time.

[…]

6.5 MARGIN INTERVAL

The MI is calculated using the following formula for the Historical Risk:

$$Historical\ Risk = \ \sigma_t \times \alpha \times \sqrt{n}$$

Where 'n' is the MPOR, 'α' is equal to the confidence level equivalent to 99.87% (three standard deviations) of the cumulative normal distribution (applicable to all products except for the BAX, the CORRA Futures and the S&P/MX International Cannabis Index Futures) or equal to the confidence value equivalent to 99% of the cumulative student's t-distribution with 4 degrees of freedom (applicable to the BAX, the CORRA Futures and the S&P/MX International Cannabis Index Futures). 'σ_t' is the volatility estimator of the contract's returns and is computed using an exponentially weighted moving average (EWMA) approach.

The implemented formula for the estimator at any time t is:

$$\sigma_t = \sqrt{\frac{(1-\lambda)\sum_{i=1}^{260}\lambda^{i-1}(R_{t-i}-\bar{R})^2}{(1-\lambda^{260})}}$$

Where R is the daily price returns of the Underlying Interests for Options and Share Futures and the daily price returns of the Futures prices for Futures (excluding Share Futures), $\overline{R}$ is the mean return over the specified period and λ is the decay factor. CDCC uses λ = 0.99.

In addition, CDCC considers the following measures to mitigate the procyclicality of margins:

- A Stress Risk component, calculated using a Stress Value at Risk (SVaR):

$$MI^{*} = (1-w) \times Historical\ Risk + w \times Stress\ Risk$$

Where the *Stress Risk* component is equal to a confidence level equivalent to a minimum of 99% of the ranked distribution of the absolute price return of the Underlying Interest or an equivalent Risk Factor over a fixed period of a minimum of 260 days with a high market volatility, a variable number of days as MPOR and a weighting factor of 25% ('w').

The SVaR is applicable to all Index and Share Futures and Options[5]. For all other products (all Interest Rate Futures), the weighting factor is set to zero and only the Historical Risk component is applicable[6].

- A volatility floor, calculated using the EWMA approach:

$$MI^{**} = max\ (MI^{*}, Volatility\ floor)$$

[5] CDCC sets the weighting factor to zero and uses a 25% buffer on the volatility floor as an alternative method in specific cases where a Stress Risk component is not available.

[6] Also true for the calculation of the Intra-Commodity.

Where the volatility floor is calculated as an average of the daily volatility estimator observed over the last 10 years.

The volatility floor is applicable to all Options, Futures and Unsettled Items.