NOTICE TO MEMBERS

No. 2015 – 152
December 16, 2015

SELF-CERTIFICATION

AMENDMENTS TO THE RISK MANUAL OF THE CANADIAN DERIVATIVES CLEARING CORPORATION TO ADDRESS PROCYCLICALITY OF MARGIN

On July 14, 2014, the Board of Directors of the Canadian Derivatives Clearing Corporation (CDCC) approved amendments to the Risk Manual of CDCC. CDCC wishes to inform the Clearing Members that the amendment has been self-certified pursuant to the self-certification process set forth in the *Derivatives Act* (C.Q.L.R., c I-14.01) and approved by the Ontario Securities Commission in accordance with the "Rule Change Requiring Approval in Ontario" process.

The purpose of the proposed amendments is to implement a new margining framework to ensure compliance with PFMI requirements and limit the procyclicality observed with the current Initial Margin model.

You will find attached hereto the amendments to be incorporated into the version of the Risk Manual of CDCC that will be made available on the CDCC website at www.cdcc.ca as of December 16, 2015 and set to come into force on December 17, 2015.

This new framework will be applied to all products cleared by CDCC with the exception of the Three-Month Canadian Bankers' Acceptance Futures (BAX) Contracts. The postponement of the applicability of the new margin framework to the BAX contract is related to the recent postponement of the modification to the BAX contract margin methodology announced via Notice to Members 2015-139. As a result, the Rules put into effect will reflect the above changes. For greater clarity and until the postponement of the BAX modification Rule is lifted, CDCC will use the current margin methodology for the margining of BAX contracts.

The Margin Interval (MI) will continue to be calculated using the following formula:

$$MI = \alpha \times \sqrt{n} \times Max\left[\sigma_{20\ days}, \sigma_{90\ days}, \sigma_{260\ days}\right]$$

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Where ‘n’ is the number of liquidation days, ‘σ’ is the standard deviation of the daily variation over 20, 90 and 260 days, and α is equal to the critical value equivalent to 99.87% of the cumulative Normal distribution. For BAX contracts, the number of liquidation days is 2.

For intra Intra-Commodity (Inter-Month) Spread Charge, α is equal to the critical value equivalent to 99% of the cumulative Normal distribution.

CDCC currently does not combined the contracts in different groups. As such, one charge is applied for all outright BAX contracts and another single charge per strategies (i.e. one charge for each type of strategy (spreads, consecutives butterflies, non-consecutives butterflies)).

If you have any questions or concerns regarding this notice, please contact CDCC’s Corporate Operations department or direct your e-mail inquiries to cdcc-ops@cdcc.ca.

Glenn Goucher
President and Chief Clearing Officer

TMX | CDCC

Risk Manual

INITIAL MARGIN

As fundamental inputs to calculate the Initial Margin, the Corporation uses the following parameters: 1) confidence level (to reflect normal market conditions), 2) assumed liquidation period and 3) historical volatility over a specific period.

Specifically, the Corporation uses a volatility estimator as described below and ~~three standard deviations to consider~~ a confidence level over 99% under the Nnormal distribution's or the Student's t-distribution assumption. The Corporation also considers a variable number of days as an acceptable liquidation period. The Initial Margin amount is calculated using the historical volatility of the daily price returns of the Underlying Interests for Options contracts, the daily price returns of the Ffutures prices for Futures contracts and the yield-to-maturity (YTM) daily variation of the on-the-run security for Fixed Income Transactions. The historical volatility, combined with the liquidation period and the confidence level gives the Margin Interval (MI) as described below.

MARGIN INTERVAL (MI) CALCULATION

The Margin Interval calculations are re-evaluated regularly. However, the Corporation may use its discretion and update the Margin Intervals more frequently if necessary. The Margin Intervals are used to calculate the Initial Margin for each Derivative Instrument.

The Margin Interval (MI) is calculated using the following formula:

$$MI = \alpha \times \sqrt{n} \times \sigma$$

Where 'n' is the number of liquidation days (see the next section for more details). 'α' is equal to the critical value equivalent to 99.87% of the cumulative Normal distribution (applicable to all products except for the BAX Futures products) or equal to the critical value equivalent to 99% of the cumulative Student's t-distribution with 4 degrees of freedom (applicable to the BAX Futures products). '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 volatility estimator at any time *t* is:

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

Where R is the contract one day price's return, $\overline{R}$ is the mean return over the specified period and λ is the decay factor. CDCC uses λ = 0.99.

In addition, CDCC considers a minimal 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. In other words, the volatility estimator that will be used to calculate the MI can not be lower than the calculated floor.

$$MI = 3 \times \sqrt{n} \times Max\left[\sigma_{20\ days}, \sigma_{90\ days}, \sigma_{260\ days}\right]$$

Where 'n' is the number of liquidation days[1], 'σ' is the standard deviation of the daily variation over 20, 90 and 260 days, and 3 is equivalent to 99.87% for a one-tail confidence interval under the normal distribution's assumption.

Price Scan Range (PSR) Calculation

In order to calculate the most unfavourable projected liquidation value, the Risk Engine uses the MI of the above formula to calculate the Price Scan Range (PSR) and to run several scenarios through its Risk Array calculation (for a detailed description refer to the section on **Erreur ! Source du renvoi introuvable.**Risk Arrays below).

A Risk Array is a set of 16 scenarios defined for a particular contract specifying how a hypothetical single position will lose or gain value if the corresponding risk scenario occurs from the current situation to the near future (usually next day).

PSR is the maximum price movement reasonably likely to occur, for each Derivative Instrument or, for Options contracts, their Underlying Interest. The term PSR is used by the Risk Engine to represent the potential variation of the product value and it is calculated through the following formula:

PSR = Underlying Interest Price x MI x Contract Size.

[1] The Corporation uses the following number of liquidation days 'n' as follows:

- For Futures contracts and Options contracts n = 2 days;
- For OTCI options n = 5 days;
- For Fixed Income Transactions, where the Underlying Interest is issued by the Government of Canada or a federal Crown corporation n = 2 days; and
- For Fixe Income Transactions, where the Underlying Interest is issued by a provincial government or a provincial Crown corporation n = a + 2 days, where a = number of additional days.

'a' is based on a quantitative and qualitative analysis, established according to the degree of liquidity of the Underlying Interest which is derived from parameters such as but not limited to traded volume, Government of Canada/ provincial yield spreads and international guidelines. For a provincial government or provincial Crown corporation issuer 'a' is determined at least once a year and communicated to Clearing Members by written notice.

Furthermore, in anticipation of Remembrance Day (the "Banking Holiday") the Corporation will add one more day to the number of liquidation days 'n'. Hence, for Options and Futures contracts where the Underlying Interest is an Equity (i.e. Stock and ETF) or an Index the liquidation period will increase to three Business Days prior and up to the Banking Holiday, and for OTCI options, the liquidation period will increase to six Business Days prior and up to the Banking Holiday. The additional margin amount for the Banking Holiday will be released on the morning of the following Business Day.

INTRA-COMMODITY (INTER-MONTH) SPREAD CHARGE

The different Futures contracts belonging to the same Combined Commodity have generally positively correlated returns. For example, a portfolio composed of a long position and a short position of two Futures contracts that have the same Underlying Interest but different expiry dates, will be less risky than the sum of the two positions taken individually. Margins on correlated positions address this fact.

The Risk Engine automatically matches the long positions on futures maturing in one month with the short positions on futures maturing in another month. The resulting Margin Requirement on these two Futures contracts belonging to the same Combined Commodity, assumes a perfect correlation between the two Futures contracts. Thus the gain of one position is offsetted by the loss of the other position. However, the Futures contracts prices with different maturity months are not perfectly correlated. Gains on a Futures contracts with a certain expiry month should not totally offset losses on a Futures contracts whose expiry month is different. To fix this issue, the Risk Engine allows the user to calculate and to apply a margin charge relative to the Inter-Month spread risk, in order to cover the risk of these two positions. This margin is called Inter-Month Spread Charge or Intra-Commodity Spread Charge (because it is calculated within the Combined Commodity).

Intra-commodity (Inter-month) Spread Charge on correlated futures positions are calculated by the Corporation's risk department and updated regularly.

For the Futures contracts, the Intra-Commodity Spread Charge (ICSC) which is an additional dollar amount charge applied to each combination of two different Futures contracts, is determined as follows:

$$ICSC = \alpha \times \sqrt{n} \times \sigma$$

Where 'n' is the number of liquidation days (see the Margin Interval (MI) Calculation section for more details). 'α' is equal to the critical value equivalent to 99.87% of the cumulative Normal distribution (applicable to all products except for the BAX Futures products) or equal to the critical value equivalent to 99% of the cumulative Student's t-distribution with 4 degrees of freedom (applicable to the BAX Futures products). 'σ' is the volatility estimator of the Futures combination's daily profiy and loss (P&L) over the reference period and is computed using the EWMA approach. The EWMA formula is described in the Margin Interval (MI) Calculation section.

In addition, CDCC considers a minimal 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. In other words, the volatility estimator that will be used to calculate the ICSC can not be lower than the calculated floor.

$$ICSC = 3 \times \sqrt{n} \times Max\left[\sigma_{20\ days}, \sigma_{90\ days}, \sigma_{260\ days}\right]$$

~~Where 'n' is the number of liquidation days (see footnote 3), 'σ' is the standard deviation of the Futures combination's daily profit and loss (P&L) over 20, 90 and 260 days, and 3 is equivalent to 99.87% under the normal distribution's assumption.~~

INTER-COMMODITY SPREAD CHARGE

Similarly, the Corporation considers the correlation that exists between different classes of Futures contracts when calculating the Initial Margin. For example, different interest rate Futures contracts are likely to react to the same market indicators, but at different degrees. For instance, a portfolio composed of a long position and a short position on two different interest rate Futures contracts will be likely less risky than the sum of the two positions taken individually. The Corporation will grant a margin relief according to the historical correlation of the returns of the two Futures contracts.

When calculating the Initial Margin on a portfolio with several long and short futures positions, the Corporation matches the positions in accordance with predefined steps. For example, if the first matching step consists of matching long or short positions on the front month Futures contracts with long or short positions on the second front month Futures contract, the positions of both Futures contracts might not be equal. In this case, the Corporation determines, using the hedge ratio concept the exact position (number of contracts) of a Future contract that can be offset by a position on the other Future contract. Any position that has not been matched will be available for the second matching step. This is the same spread priority process also defined for Cash Buy or Sell Trades and Repurchase Transactions.

The Corporation regularly performs an analysis to determine the margin reductions that are applied for all Futures contracts combinations.

The Corporation also considers the positive (negative) correlation that exists between the different interest rate Futures contracts and the Fixed Income Transactions, and provides a margin benefit for a combination of any Futures contracts with the opposite (same) Fixed Income Transactions.

SECURITY PRICE RISK

The price of the Purchased Security changes continuously during the life of a Repurchase Transaction. On one hand, if the price decreases and the Repo Party defaults, the Corporation, as a central counterparty, incurs market risk for the price difference. The position may be transferred to any Fixed Income Clearing Member who agrees to buy the security at the expiry date with the new market conditions (new security's market price and interest rate). In this case, the Corporation has to cover the potential decrease in the security's value (negative variation for the seller) that could arise during the next specific period. On the other hand, if the security's price increases and the Reverse Repo Party defaults, the Corporation, as a central counterparty, incurs market risk for the price difference. The position may be transferred to any Fixed Income Clearing Member who agrees to sell the same security at the expiry date with the new market conditions (new security's market price and interest rate). In that case, the Corporation has to cover the potential increase in the security's value (negative variation for the buyer) that could arise during the next specific period.

The methodology to calculate the Initial Margin for Fixed Income Transactions is slightly different from the Options contracts and Futures contracts. Indeed, the different types of securities that are accepted by the Corporation for clearing of a Repurchase Transaction are separated in different Buckets depending on their remaining time to maturities and issuers. In addition, in its risk model, the Corporation assumes that all securities belonging to the same Bucket have the same yield volatility expressed in terms of Margin Interval (same concept of Margin Interval ~~as~~ described before) which is calculated using the Yyield-Tto-Mmaturity (YTM) of the on-the-run security of the Bucket. The Margin Interval is calculated as follows:

$$MI = \alpha \times \sqrt{n} \times \sigma$$

Where 'n' is the number of liquidation days (see the Margin Interval (MI) Calculation section for more details). 'α' is equal to the critical value equivalent to 99.87% of the cumulative Normal distribution. 'σ' is the volatility estimator of the YTM's daily variation of the on-the-run security over the reference period and is computed using the EWMA approach. The EWMA formula is described in the Margin Interval (MI) Calculation section.

In addition, CDCC considers a minimal 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. In other words, the volatility estimator that will be used to calculate the MI can not be lower than the calculated floor.

~~$$MI = 3 \times \sqrt{n} \times Max\left[\sigma_{20\,days}, \sigma_{90\,days}, \sigma_{260\,days}\right]$$~~

~~Where 'n' is the number of liquidation days (see footnote 3), σ is the standard deviation of the YTM's daily variation of the on-the-run security over the reference~~

~~period and 3 is to allow a confidence level over 99% under the normal distribution's assumption.~~

It's important to note that for some particular Buckets, there may not be any on-the-run security. In this particular situation, a linear interpolation between the MIs of the two closest Buckets is performed to determine the MI of the particular bucket.

Each Bucket is considered as a Combined Commodity. Since the bond's convexity effect is very small with respect to its duration, the Initial Margin is calculated for a physical cash trade exactly the same way as for Futures contracts. The first part of the example # 2 of the section on **Erreur ! Source du renvoi introuvable.**~~Risk Arrays~~ shows how the Scanning Risk is calculated for a Futures contract. As for a Futures contract, the Initial Margin for a physical security can also be obtained straightforwardly by calculating its Price Scan Range (PSR).

Therefore, the Initial Margin amount related to the security's price of a Repurchase Transaction on one security belonging to a Bucket is calculated as follows:

$$\textit{Initial Margin 1} = \textit{Security's Price} \times \textit{MI} \times \textit{D} \times \textit{Contract Size}$$

Where D is the duration of the security and the contract size is the transaction's Nominal Value divided by 100. However, for all securities that belong to the 3-month, 6-month and 1-year buckets, CDCC uses a fixed duration which is set at 1.

Thus, all Repo related Fixed Income Securities belonging to the same Bucket have the same Margin Interval but each specific Repo related security of the same Bucket has a different Initial Margin driven by its own price and its own duration.

In the above formula of the Price Scan Range, only the first part of the Initial Margin of a Repurchase Transaction is calculated, namely, the Initial Margin 1. As mentioned above, there are two sources of risk for a Repurchase Transaction. This is the Initial Margin of the first source of risk, the security's price. In the next section, the second part of the Initial Margin of a Repurchase Transaction which covers the second source of risk, the Floating Price Rate, is described. Finally, both Initial Margins are added up to get the total Initial Margin of a Repurchase Transaction. However, the Initial Margin 1 corresponds to the total Initial Margin for a Cash Buy or Sell Trade.

INTEREST RATE RISK (REPURCHASE TRANSACTIONS)

The Floating Price Rate changes continuously during the life of a Repurchase Transaction. On one hand, if the Floating Price Rate decreases and the Repo Party defaults, the Corporation, as a central counterparty, incurs market risk. The position may be transferred to any Fixed Income Clearing Member who agrees to buy the Fixed Income Security at the expiry date with the new market conditions. In this case, the Corporation has to cover the potential decrease in the Floating Price Rate (negative variation for the seller) that could arise during the next specific period. On the other hand, if the Floating Price Rate increases and the Reverse Repo Party defaults, the Corporation, as a central counterparty, incurs market risk. The position may be transferred to any Fixed Income Clearing Member who agrees to sell the same Fixed Income Security at the expiry date with the new market conditions. In

that case, the Corporation has to cover the potential increase in the Floating Price Rate (negative variation for the buyer) that could arise during the next specific period.

In order to properly quantify the risk related to the Floating Price Rate using the Risk Engine, it is necessary to model the Floating Price Rate into a Virtual Futures Contract (VFC) with a price equal to: VFC's price = 100 – Floating Price Rate. For an overnight Repurchase Transaction the Initial Margin is straightforwardly calculated by sending to the Risk Engine the determined VFC. However, in order to calculate the VFC's price for longer term Repurchase Transactions, the Corporation determines the appropriate interest rate using the overnight index swap (OIS) term structure.

The portion of the Initial Margin that covers the Floating Price Rate related risk is then added to the portion of Initial Margin that covers the security price related risk to get the total Initial Margin for a Repurchase Transaction.

It's important to note that the portion of Initial Margin that covers the Floating Price Rate related risk is very small with respect to the portion of Initial Margin that covers the security price related risk.

INTRA-COMMODITY (INTER-MONTH) SPREAD CHARGE

For Fixed Income Transactions, a portfolio composed of a short position and a long position on two different Acceptable Securities belonging to the same Bucket, will generate a lower margin requirement than if they were margined independently without considering their correlation.

The Risk Engine automatically matches the Seller and the Buyer of two different securities belonging to the same Bucket. The resulted Margin requirement on these two Repurchase Transactions assumes a perfect correlation between the two Fixed Income Securities, thus the gain of one Fixed Income Security is offsetted by the loss of the other Fixed Income Security. However, the Acceptable Securities' prices are not perfectly correlated. Gains on one position should not totally offset losses of the other Fixed Income Security. To fix this issue, the Risk Engine allows the user to calculate and to apply a margin charge relative to the Inter-Month spread risk in order to cover the risk of these two Fixed Income Transactions. This margin is called the Inter-Month Spread Charge or Intra-Commodity Spread Charge (because it is calculated within the Combined Commodity).

The Intra-Commodity (Inter-Month) Spread Charge on correlated Acceptable Securities of each Bucket is calculated by the Corporation's risk department and updated regularly.

For Fixed Income Transactions, the Intra-Commodity Spread Charge (ICSC) which is an additional dollar amount charge applied to each combination of two different transactions on two different securities that belong to a same Bucket, is determined as follows:

$$ICSC = \alpha \times \sqrt{n} \times \sigma$$

Where ‘n’ is the number of liquidation days (see the Margin Interval (MI) Calculation section for more details). ’α’ is equal to the critical value equivalent to 99.87% of the cumulative Normal distribution. ‘σ’ is the volatility estimator of the fixed income transaction combination’s daily profit and loss (P&L) over the reference period and is computed using the EWMA approach. The EWMA formula is described in the Margin Interval (MI) Calculation section.

In addition, CDCC considers a minimal 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. In other words, the volatility estimator that will be used to calculate the ICSC can not be lower than the calculated floor.

~~$$ICSC = 3 \times \sqrt{n} \times Max\left[\sigma_{20\ days}, \sigma_{90\ days}, \sigma_{260\ days}\right]$$~~

~~Where ‘n’ is the number of liquidation days (see footnote 3), ‘σ’ is the standard deviation of the securities combination’s daily profit and loss (P&L) over 20, 90 and 260 days, and 3 is equivalent to 99.87% under the normal distribution’s assumption.~~