NOTICE TO MEMBERS
No. 2014 -032
February 11, 2014

REQUEST FOR COMMENTS

AMENDMENT TO THE RISK MANUAL
MODIFICATION TO THE THREE-MONTH CANADIAN BANKERS' ACCEPTANCE FUTURES (BAX) CONTRACT MARGIN METHODOLOGY

Summary

On January 31, 2014, the Board of Directors of Canadian Derivatives Clearing Corporation (CDCC) approved amendments to the Risk Manual. The purpose of the proposed amendment consist of using a more appropriate parametric model which fits better the empirical observations of the contract while keeping in place a robust risk management framework.

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).

The Board of Directors of CDCC has the power to approve the adoption or amendment of Rules and Operations Manual of CDCC. Amendments are submitted to the AMF in accordance with the self-certification process.

Comments on the proposed amendments must be submitted within 30 days following the date of publication of the present notice. Please submit your comments to:

Pauline Ascoli
Assistant Secretary
Canadian Derivatives Clearing Corporation
Tour de la Bourse
P.O. Box 61, 800 Victoria Square
Montréal, Québec H4Z 1A9
E-mail: legal@m-x.ca

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

Anne-Marie Beaudoin
Corporate Secretary
Autorité des marchés financiers
Tour de la Bourse, P.O. Box 246
800 Victoria Square, 22nd Floor
Montréal, Québec H4Z 1G3
E-mail: consultation-en-cours@lautorite.qc.ca

For any question or clarification, Clearing Members may contact the CDCC Member Services.

Glenn Goucher
President and Chief Clearing Officer

MODIFICATION TO THE THREE-MONTH CANADIAN BANKERS' ACCEPTANCE FUTURES (BAX) CONTRACT MARGIN METHODOLOGY

AMENDMENTS TO THE OPERATIONS MANUAL OF CDCC

A. Overview

CDCC proposes an amendment to its Risk Manual. The changes are related to a new margin methodology for the Three-Month Canadian Bankers' Acceptance Futures (BAX) contract. The proposed changes consist of using a more appropriate parametric model which fits better the empirical observations of the contract while keeping in place a robust risk management framework.

CDCC hereby proposes to amend its Risk Manual to accommodate the change to the methodology used to calculate the new margin rates for the outright positions and the spreads strategies of this contract.

B. Analysis

Nature and Purpose of Proposed Changes:

This proposed change is an update of the Risk Manual sections related to the Margin Interval (MI) Calculation and the Initial Margin for Futures Contracts. The Initial Margin covers the potential losses that may occur as a result of future adverse price movements across the portfolio of each Clearing Member under normal market conditions.

CDCC's current methodology consist in applying the same charge for all BAX contracts which is calculated using the most volatile contract, likewise for spreads and butterflies strategies. In addition, CDCC's current model is based on a Normal distribution's assumption for the BAX Futures prices' returns. The purpose of this work is to specifically give a distinctive outright margin charge for each BAX contract while guaranteeing robust coverage for all the contracts. However, the analysis of the current model, which is based on the Normal distribution, demonstrates that this goal can not be achieved without a reassessment of the current model. Therefore, a detailed risk analysis was done and the result was to change the parametric model for this product from Normal distribution to Student t-distribution.

Description and Analysis of Impacts:

The Proposed Amendments will have no operational impacts on CDCC and on the Clearing Members.

In fact, the Proposed Amendments will benefit to Clearing Members, market participants and derivatives and financial markets since the outright margin charges for each contract and the spread charges for the combination of contracts represent the appropriate volatility of the contracts and not the worst volatility amongst all listed contracts.

The scope of the analysis is the revision of the current parametric model to ensure that the outright margin charges and strategies charges are sufficiently robust at a granular level (i.e. the level of individual contracts and strategies).

More specifically, to calculate the outright margin charge, we currently use a parametric methodology based on a Normal distribution assumption for the daily price returns with a confidence level of 99.87%. Furthermore, given the current technology limitation, a single value is estimated for all the BAX contracts by taking the maximum outright margin charge value among all the twelve quarterly contracts. However, this approach is economically unfavourable to the Clearing Members because the margin calculated for each BAX contract is estimated from the most volatile contract (usually the contract with the furthest expiration date). Hence, we propose to modify the current parametric methodology using a Normal distribution with a confidence level of 99.87% to a Student's t-distribution with a confidence level of 99%.

In a similar way, the margin charges on spread strategies, consecutive butterfly strategies and non-consecutive butterfly strategies are currently calculated using a Normal distribution for the daily price variation with a confidence level of 99%. The greatest spread, consecutive butterfly and non-consecutive butterfly strategy charge is then applied across all similar strategies, resulting in only three (3) possible margin charges on BAX strategies. We propose to change the spread strategy charge and the butterfly strategy charge by applying a Student's t-distribution on the daily price changes with a confidence level of 99% and provide a greater degree of granularity in the strategy charges. Finally, a cap on the correlation between individual contracts is introduced to limit the margin reduction that is caused by a very high level of correlation.

Drafting Process:

The Proposed Amendments were elaborated by the Risk Management department with no market consultation.

Impacts on Technological Systems:

Because the change is limited to the methodology used to calculate the outright and the spread strategies charges for the BAX contracts by the Risk team of CDCC, the Proposed Amendments will have no impact on the technological systems of CDCC and of the Clearing Members.

Benchmarking:

The Proposed Amendments are aligned with the operations of other global central counterparties which are active in the futures markets. For example:

Outright

- LCH Clearnet, ICE Clear Europe and CME Clearing use a month tier structure in their respective methodologies to calculate the total margin requirements for positions on EURIBOR Futures, whereas Eurex Clearing's margin methodology – which is comparable to CDCC's current one for BAX Futures – does not bundle the different delivery months in tier groups. Note that LCH Clearnet however, applies the same outright margin value to every tier. A tier grouping methodology is also used by the two clearers of the EURODOLLAR Futures, CME Clearing and NYPC. As opposed to CDCC, LCH Clearnet or Eurex Clearing, a majority of Central Clearing Counterparties (CCPs) apply different levels of margin depending on the maturities of the short term rate contracts. Individual contract month outright margins increase the accuracy of the different levels of risk to be covered and benefit to the nearest contract months which are often over margined when a unique charge is required.

- It can also be noticed that all CCPs that clear a substantial number of delivery-month contracts (over 20), have adopted a tier grouping methodology. It often consists of grouping four quarterly month contracts together but the tiering of the first contracts, including serials, is often done in a more granular way in order to make a distinction of the different levels of risk embedded in the nearest months period. On the other hand, the need to be more precise can be a burden if

48 different delivery months are offered. Tier grouping also makes the reading of the outright margins easier for the members.

Spread Charges

- The majority of the CCPs use a tier structure to present their inter-month spread charges.
- The spreads are calculated with more precision depending on the combinations.
- The tier grouping bundles together the numerous possible combinations with comparable spread widths.

Butterfly Strategies Charges

- The majority of the CCPs charge individual butterfly strategy margins; each type of butterfly strategy – quarterly, six-monthly, nine-monthly, and yearly – has different margins.
- Within a type of butterfly strategy, different charges are also calculated depending on the strategies' front months.

Public Interest:

The Proposed Amendments are not contrary to the public interest.

C. Process

The Proposed Amendments are submitted for approval by the CDCC Board. Once the approval has been obtained, the Proposed Amendments, including the analysis, will be transmitted to the *Autorité des marchés financiers* in accordance with the self-certification process and to the Ontario Securities Commission for information. The proposed amendment and analysis will also be submitted for approval to the Bank of Canada in accordance with the Oversight Regulatory Agreement.

D. Attached Documents

Risk Manual of CDCC with the Proposed Amendments.

TMX | CDCC

Risk Manual

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Glossary

Margin Interval: Parameter established by the Corporation which reflects the maximum price fluctuation that the Underlying Interest could be expected to have during the liquidation period. The Margin Interval (MI) calculations are based on the historical volatility of the Underlying Interest and these calculations are re-evaluated on a regular~~weekly~~ basis. If necessary, the Corporation may update the Margin Intervals more frequently. The Margin Interval is used to calculate the Initial Margin of every Derivative Instrument.

Haircut: Percentage discounted from the market value of Securities pledged as collateral for Margin Deposit. The discount reflects the price movement volatility of the collateral pledged. Thus, this reduction assures that even if the collateral's market value declines, there is time to call for additional collateral to adjust its value to the required level.

Initial Margin: The Initial Margin covers the potential losses that may occur over the next liquidation period as a result of market fluctuations. The Initial Margin amount is calculated using the historical volatility of the Underlying Interest return for Options contracts, futures prices for Futures contracts and yield-to-maturity (YTM) of the on-the-run security for Fixed Income Transactions.

Variation Margin: The Variation Margin takes into account the portfolio's liquidating value (this is also known as the Replacement Cost or RC) which is managed through the Mark-to-Market daily process.

Price Scan Range: The maximum price movement reasonably likely to occur, for each Derivative Instrument or, for Options, 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

Volatility Scan Range: The maximum change reasonably likely to occur for the volatility of each Option's Underlying Interest price.

Risk Array: A Risk Array (RA) 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).

Combined Commodity: The Risk Engine divides the positions in each portfolio into groupings called Combined Commodities. Each Combined Commodity represents all positions on the same ultimate Underlying Interest – for example, all Futures contracts and all Options contracts ultimately related to the S&P/TSX 60 Index.

Scanning Risk: The Risk Engine chooses the difference between the current market value of an Underlying Interest and its most unfavourable projected liquidation value obtained by varying the values of the Underlying Interest according to several scenarios representing adverse changes in normal market conditions.

Active Scenario: The number of the Risk Arrays scenario that gives the largest amount (worst case scenario).

Short Option Minimum: Rates and rules to provide coverage for the special situations associated with portfolios of deep out-of-the-money short option positions. This amount will be called if it is higher than the result of the Risk Arrays.

Liquidity Interval: The Liquidity Interval is calculated based on the historical bid-ask price spread of the Underlying Interest according to the same formula for Margin Interval.

Buckets: All Acceptable Securities of Fixed Income Transactions that behave in a similar manner are grouped together into "Buckets" and each Bucket behaves as a Combined Commodity. Acceptable Securities are bucketed according to their remaining time to maturity and issuer. Due to the nature of the bucketing process, the Acceptable Securities' assignation will be dynamic in that they will change from one Bucket to the other as the Acceptable Security nears maturity.

MTM Price Valuation: The MTM Price Valuation is the difference between the market value of the Security and the funds borrowed. This amount is collateralized and should be credited (or debited) to the Repo Party's Margin Fund and debited (or credited) to the Reverse Repo Party's Margin Fund.

Intra-Commodity (Inter-Month) Spread Charge: Underlying Interests' prices, from a maturity month to another are not perfectly correlated. Gains on a maturity month should not totally offset losses on another. 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.

Inter-Commodity Spread Charge: 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.

Clearing Engine: The Corporation uses SOLA® Clearing as its Clearing Engine.

Risk Engine: The Corporation uses the Standard Portfolio Analysis system (SPAN®) as its Risk Engine.

The terms and concepts herein defined, as used in this Risk Manual, are derived from the CME Group proprietary SPAN® margin system, adapted for CDCC's licensed use thereof.

Summary

The Corporation applies rigorous risk management methods to protect their Clearing Members.

The main aspects of risk management that are specifically addressed in this manual are as follows:

- The acceptability of Underlying Interests;
- The Margin calls that occur when a member's potential loss exceeds its Margin Deposit;
- The monitoring of each Clearing Member's credit risk by regular tracking of Margin Deposit and Capital;
- The Clearing Member's contribution to the Clearing Fund;
- The management of the forms of collateral accepted for Margin Deposit and the calculation of the Haircuts that apply to these assets;
- The monitoring program;
- The adjustments in contract terms; and
- The default management process.

ACCEPTABILITY OF UNDERLYING INTERESTS

ACCEPTABLE UNDERLYING INTERESTS OF EQUITY OPTIONS

- *Section B-603* of the Rules sets out the eligibility criteria for Equity Options.
- *Section B-604* of the Rules sets out the ineligibility criteria for Equity Options.

CDCC reviews and publishes quarterly the eligibility threshold and deficiency threshold in terms of market capitalization and volume (expressed as an average daily volume of the last 20 business days) for clearing Equity Options.

ACCEPTABLE UNDERLYING INTERESTS OF SHARE FUTURES

- *Section C-1503* of the Rules sets out the eligibility criteria for Share Futures.
- *Section C-1504* of the Rules sets out the ineligibility criteria for Share Futures.

CDCC reviews and publishes quarterly the eligibility threshold and deficiency threshold in terms of market capitalization and volume (expressed as an average daily volume of the last 20 business days) for clearing Share Futures.

ACCEPTABLE UNDERLYING INTERESTS OF OTCI

- *Section D-104* of the Rules sets out the acceptance criteria for OTCI.

CDCC reviews and publishes quarterly on its website a list of the single name equities and ETFs that are Acceptable Underlying Interests for clearing OTCI.

Between two quarterly publications of the list of Acceptable Underlying Interests, a Clearing Member who wishes to clear OTCI for which an Underlying Interest is not included on the list must obtain the Corporation's prior approval. The Underlying Interest must at least meet the acceptance criteria prescribed in *Section D-104* of the Rules.

ACCEPTABLE UNDERLYING INTERESTS OF CASH BUY OR SELL TRADES

For the application of *Sections D-104* and *D-603* of the Rules, Securities are acceptable for Cash Buy or Sell Trades clearing if they meet the following criteria:

- The issuer must be eligible, which includes the following issues:
    - Bonds and Treasury bills issued by the Government of Canada, including real return issues;
    - Canada Mortgage and Housing Corporation debt securities;
    - Bonds issued by Business Development Bank of Canada;

- Bonds issued by Export Development Canada;
- Bonds issued by Farm Credit Canada; and
- Bonds issued by Canada Post;
- Bonds issued by certain provincial governments and provincial Crown corporations determined as acceptable by CDCC[1], excluding real return issues, zero coupon bonds, and bonds with a maturity of less than one year.

- The bonds must be repayable at maturity;
- The bonds must be denominated in Canadian dollars;
- The coupon type must be fixed, real return, step-up or zero (Treasury bills are eligible);
- The net amount outstanding[2] must be greater than or equal to $250 million;
- The bonds' prices must be issued by a source that is acceptable to the Corporation.

ACCEPTABLE UNDERLYING INTERESTS OF REPURCHASE TRANSACTIONS

For the application of the provisions of *Sections D-104* and *D-603* of the Rules, Securities are eligible for clearing of Repurchase Transaction if they meet the following criteria:

- The Underlying Interest must be an Acceptable Underlying Interests of Cash Buy or Sell Trades;
- The Purchase Date of the Repurchase Transaction must be no earlier than the Novation Date;
- The Repurchase Date of the Repurchase Transaction must not be more than 365 days later than the Purchase Date of the Repurchase Transaction and must be no later than the maturity date of the Acceptable Security.

[1] To be acceptable by CDCC, the credit rating of the issuer must be investment grade and not lower than 6 notches below the credit rating of the Government of Canada, as stated by Standard & Poor's (or another recognized rating agency). For example, if the Government of Canada has an AAA rating, the lowest rating eligible would be A-.

[2] The net amount outstanding is defined as the outstanding amount issued on the market minus the stripped coupon bonds and issuer repurchases.

MARGIN DEPOSIT

The Corporation has three different funds for margining purposes and each serves a specific purpose:

- Margin Fund
- Difference Fund
- Clearing Fund

MARGIN FUND

The Margin Fund is composed of the Initial Margin and the Variation Margin. The Initial Margin covers the potential losses and market risk that may occur as a result of future adverse price movements across the portfolio of each Clearing Member under normal market conditions. Furthermore, in the event of a default, the Corporation is faced with closing out the defaulters' portfolio within a short period (the liquidation period). In a complementary manner, Variation Margin is a daily payment process that covers the market risk due to the change in price since the previous day, ahead of the default of one of its Clearing Members. Variation Margin is settled in cash for Futures contracts and collateralized for Options contracts, OTCI and Fixed Income Transactions.

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 three standard deviations to consider a confidence level over 99% under the normal distribution's 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 futures 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 on a regular~~ly~~ basis. 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:

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

Where 'n' is the number of liquidation days[3], 'σ' is the standard deviation of the daily variation over 20, 90 and 260 days, and α ~~3~~ is equal to the critical value equivalent to 99.87% of the cumulative Normal distribution~~for a one-tail confidence interval under the normal distribution's assumption~~ or equal to the critical value equivalent to 99% of the cumulative Student's t-distribution with 4 degrees of freedom.

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 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.

[3] 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.

INITIAL MARGIN CALCULATION

To calculate the Initial Margin, the Risk Engine uses the MI which is converted to the Scanning Risk parameter. The Scanning Risk parameter represents the difference between the current market value of a Derivative Instrument (for Exchange Transactions) or of an Acceptable Security (for Fixed Income Transactions) and its most unfavourable projected liquidation value obtained by varying the values of the Underlying Interest according to several scenarios representing adverse changes in normal market conditions. The Scanning Risk is always calculated at the Combined Commodity level.

For contracts belonging to the same Combined Commodity, the Risk Engine adds up the Risk Arrays results of all contracts under the same risk scenario. It should be noted that in the situation where the Risk Engine does not consider other variables, the Scanning Risk is the Initial Margin for the Combined Commodity.

However, in some cases other variables can increase or decrease the Scanning Risk. For example, variables such as the Intra-Commodity (Inter-Month) Spread Charge which tends to increase the Initial Margin and the Inter-Commodity Spread Charge which tends to decrease the Scanning Risk to take advantage of the correlations between the different constituents of the Combined Commodity. Another example is the specific case of short deeply out-of-the-money options wherein the Risk Engine calculates a minimum amount called Short Option Minimum (SOM) which otherwise attracts little or no Initial Margin. Finally, in the case of OTCI with Physical Settlement/Delivery, the Corporation calculates an additional Liquidity Interval and adds it to the Margin Interval.

It should also be noted that, as described in the following sections, the determination of the Initial Margin is slightly different for Options contracts, Futures contracts and Fixed Income Transactions. The following table summarizes the list of variables used to calculate the Initial Margin by cleared product category:

Input variables to calculate the Initial Margin	Options contracts (including OTCI options)	Futures contracts and Share Futures	Fixed Income Transactions
Scanning Risk	•	•	•
Intra-Commodity (Inter-Month) Spread Charge[4]		•	•
Inter-Commodity Spread Charge[5]		•	•
Short Option Minimum (SOM) amount	•		
Liquidity Interval[6]	•		

INITIAL MARGIN FOR OPTIONS CONTRACTS

This section describes how the Initial Margin is calculated for the Options contracts, which include the equity options, index options, currency options, exchange-traded-fund options and options on futures.

The Risk Arrays are obtained by varying the Underlying Interest (eight scenarios) and the option's implied volatility (eight scenarios). The term PSR for Options contracts is calculated through the following formula:

PSR = Underlying Interest Price x MI x Contract Size

For equity options contracts, the contract size is usually equal to 100.

RISK ARRAYS

Each Risk Array scenario represents losses or gains due to hypothetical market conditions:

- The (underlying) price movement: upward (+) and downward (-) with corresponding scan range fraction (0, 1/3, 2/3, 3/3 or 2)
- The (underlying) volatility movement: upward (+) and downward (-) with corresponding scan range fraction (0 or 1).

[4] Not applicable to Share Futures Contracts.
[5] Idem 4
[6] Applicable for OTCI options **with Physical Settlement/Delivery only**

Since some scenarios consider large movements on the Underlying Interest price, the whole difference (gain and loss) between the new (simulated) theoretical option price and the actual option price will not be considered. For scenarios 15 and 16, since their probability of occurrence is low, only a fraction of 35% of the difference is considered. The purpose of these two additional extreme scenarios is to reduce the problem of short option positions that are highly out of the money near expiration. If the Underlying Interest price varies sharply, these positions could then be in the money.

A scan range is a fluctuation range of the Underlying Interest price and volatility defined for each Combined Commodity.

The Risk Engine calculates 16 Risk Array scenarios as follows:

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

Each Risk Array value is calculated as the current contract price less the theoretical (simulated) contract price obtained for the corresponding scenario by using the valuation model. (The Risk Engine uses different valuation models including Black 76, Black-Scholes, Generic Merton, Barone-Adesi-Whaley (BAW) and others).

However, it should be noted that for the intra-day margin processes, CDCC relies on the previous day's closing prices for those Option contracts for which it has open interest.

However, since the Initial Margin driven by Option contracts is relatively small with respect to the total Initial Margin that includes all cleared products, the Corporation does not consider the Volatility Scan Range (VSR) in its risk model. This means that the Corporation does not vary the option implied volatility up and down (+1 and -1) eight times, but varies only the Underlying Interest price in order to simulate the potential losses for each position. Therefore, the Risk Engine produces eight different scenarios as shown in the table below.

Risk Scenarios	1	2	3	4	5	6	7	8
Underlying Price Variation*	1/3	-1/3	2/3	-2/3	1	-1	2	-2
Weight Fraction Considered	100%	100%	100%	100%	100%	100%	35%	35%

* Expressed in scan range

For Options contracts belonging to the same Combined Commodity, the Risk Engine first calculates the Risk Arrays for each Option contract and for each one of the eight

risk scenarios. The Risk Engine then adds up the Risk Arrays results of all Options contracts under the same risk scenario. For example, for two Options contracts O1 and O2 on the Underlying Interest XX, the same scenarios are performed for each Option contract, and then, they are added up. Therefore, the Risk Array value for O1 under the risk scenario 1 is added up to the Risk Array value for O2 under the risk scenario 1, likewise the Risk Array value for O1 under the risk scenario 2 is added up to the Risk Array value for O2 under the risk scenario 2, and so on. The largest total Risk Array value amongst the eight values is the Scanning Risk of this Combined Commodity. The details of this method are described in the section on Risk Arrays.

For a better explanation of the Risk Engine methodology used by the Corporation, here are the steps to calculate the Initial Margin for an Option contract using the Risk Array:

Example 1:

Let's assume that the price of an Option contract is X_0, its Underlying Interest price is P_0 and its Margin Interval is MI. Using the formula described above, we can calculate the Price Scan Range (PSR) of the option which represents the fluctuation range of the Underlying Interest as follows:

$$PSR = MI \times P_0 \times Contract\ Size.$$

Since the contract size of an Option contract is generally 100, the formula becomes:

$$PSR = MI \times P_0 \times 100$$

For the clarity of the table below, please note that the PSR used in the following steps does not include the contract size, i.e. PSR = MI x P_0.

Scenario 1:

Step 1: calculate the Underlying Interest price variation. To accomplish this, the Risk Engine varies the Underlying Interest price by 33% (or 1/3) to the upper range of its MI. If for example the MI is 30%, the Underlying Interest price moves to the upper range by 33% of the 30% which leads to a 10% increase. Therefore, the Underlying Interest price variation is +33% of the PSR.

Step 2: calculate the new (simulated) Underlying Interest price by adding the Underlying Interest price variation calculated in the last step to the original Underlying Interest price.

Step 3: calculate the new (simulated) theoretical option price with Barone-Adesi & Whaley (1987) model[7] using the new (simulated) Underlying Interest price.

Step 4: calculate the option's gain or loss by subtracting the new (simulated) theoretical option price from the original option price.

[7] The Corporation uses BAW (1987) model since most of the listed equity options that are cleared are American style.

Step 5: multiply the gain or loss by the considered weight fraction (the last row of the above table) to get the Risk Array amount associated to the scenario 1.

After repeating the above steps for the remaining seven scenarios, the Risk Engine chooses the largest amount of (the weighted) gain or loss as the most unfavourable projected liquidation value (worst case) of the option. This amount is called the Scanning Risk.

Here is the same table as before but with the formulas of each step:

Risk Scenarios	1	2	3	4	5	6	7	8
Underlying Price Variation	1/3 * PSR	-1/3 * PSR	2/3 * PSR	-2/3 * PSR	PSR	-1 * PSR	2 * PSR	-2 * PSR
New Underlying Price	$P_1 = P_0 + 1/3 * PSR$	$P_2 = P_0 - 1/3 * PSR$	$P_3 = P_0 + 2/3 * PSR$	$P_4 = P_0 - 2/3 * PSR$	$P_5 = P_0 + PSR$	$P_6 = P_0 - PSR$	$P_7 = P_0 + 2 * PSR$	$P_8 = P_0 - 2 * PSR$
New Option Price (BAW)	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8
Gain / Loss	$P\&L_1 = X_0 - X_1$	$P\&L_2 = X_0 - X_2$	$P\&L_3 = X_0 - X_3$	$P\&L_4 = X_0 - X_4$	$P\&L_5 = X_0 - X_5$	$P\&L_6 = X_0 - X_6$	$P\&L_7 = X_0 - X_7$	$P\&L_8 = X_0 - X_8$
Weight Fraction Considered	100%	100%	100%	100%	100%	100%	35%	35%
Risk Arrays Results	$RA_1 = 100\%*P\&L_1$	$RA_2 = 100\%*P\&L_2$	$RA_3 = 100\%*P\&L_3$	$RA_4 = 100\%*P\&L_4$	$RA_5 = 100\%*P\&L_5$	$RA_6 = 100\%*P\&L_6$	$RA_7 = 35\%*P\&L_7$	$RA_8 = 35\%*P\&L_8$

The table above shows all details about the Risk Engine method used by the Corporation to calculate the worst potential loss of an Option contract. The last row has the eight Risk Arrays outcomes. The largest amount (positive amount) amongst the eight amounts is the Scanning Risk which will be, in most cases, the Initial Margin of this position.

It is important to note that the above calculations are performed at the Combined Commodity level, implying that when there is more than a single contract with the same Underlying Interest, the Risk Engine method calculates the Risk Arrays for all contracts belonging to the same Combined Commodity and then sums up the Risk Arrays results thus calculated for all contracts for the same scenario. In other words, the RA_1 of the first contract is added up to the RA_1 of the second contract and to the RA_1 of the n^{th} contract that belong to the same Combined Commodity in order to get the Total RA_1 for the same Combined Commodity. Then, the RA_2 of the first contract is added up to the RA_2 of the second contract and to the RA_2 of the n^{th} contract that belong to the same Combined Commodity in order to get the total RA_2 for the Combined Commodity. And so forth for obtaining the total RA_3, RA_4, RA_5, RA_6, RA_7 and RA_8. Finally, the Risk Engine considers the largest amount of the eight total Risk Arrays as the Scanning Risk.

Example 2:

Let's assume a portfolio with three different positions: a short position in ten (10) Futures contracts on the S&P/TSX 60 Index, a long position in six (6) call Options contracts on the same index and a short position in three (3) put Options contracts on the same Underlying Interest (the expiry date for these three Options contracts might be the same or different).

In addition, the contract size and the price of the Futures contract are respectively 200 and F_0 and its Margin Interval is MI_F. The price of the call option is X_0, the price of the put option is Y_0 and the contract size of these two Option contracts is 100, whereas the price of the Underlying Interest S&P/TSX 60 Index is P_0 and its Margin Interval is MI_I. The MI_F and the MI_I values are almost the same but not exactly equal since the first is calculated using the historical volatility of the Ff~~f~~utures' returns, whereas the second is calculated using the historical volatility of the index's returns. However, since the index and the Futures contracts are strongly correlated, both Margin Interval values must be almost similar. Using the calculated Margin Intervals, we can calculate the Price Scan Range (PSR_F) of the Future contract, which represents the fluctuation range of the Futures contract and the index Price Scan Range (PSR_I) which represents the fluctuation range of the underlying index as follows:

$$PSR_F = MI_F \times F_0 \times Contract\ Size$$

and,

$$PSR_I = MI_I \times P_0 \times Contract\ Size$$

Thus, since this Futures contract size is 200 and the contract size of the index option is 100, the previous formulas become:

$$PSR_F = MI_F \times F_0 \times 200$$

and,

$$PSR_I = MI_I \times P_0 \times 100$$

For the clarity of the table below, please note that the PSR_F and the PSR_I do not include the contract size, i.e. $PSR_F = MI_F \times F_0$ and $PSR_I = MI_I \times P_0$.

This is the Risk Arrays table of this example:

Risk Scenario	1	2	3	4	5	6	7	8
10 Index Futures Contracts								
Futures Price Variation	10 x 200 x 1/3 x PSR_F	-10 x 200 x 1/3 x PSR_F	10 x 200 x 2/3 x PSR_F	-10 x 200 x 2/3 x PSR_F	10 x 200 x PSR_F	-10 x 200 x PSR_F	10 x 200 x 2 x PSR_F	-10 x 200 x 2 x PSR_F
Weight Fraction Considered	100%	100%	100%	100%	100%	100%	35%	35%
Total Weighted Profit and Loss	$P\&L_{F1}$ = 2000 / 3 x PSR_F	$P\&L_{F2}$ = -2000 / 3 x PSR_F	$P\&L_{F3}$ = 4000 / 3 x PSR_F	$P\&L_{F4}$ = -4000 / 3 x PSR_F	$P\&L_{F5}$ = 2000 x PSR_F	$P\&L_{F6}$ = -2000 x PSR_F	$P\&L_{F7}$ = 1400 x PSR_F	$P\&L_{F8}$ = -1400 x PSR_F
6 Index Call Option Contracts								
Index Price Variation	1/3 x PSR_I	-1/3 x PSR_I	2/3 x PSR_I	-2/3 x PSR_I	PSR_I	-PSR_I	2 x PSR_I	-2 x PSR_I
New Index Price	P_1 = P_0 + 1/3 * PSR_I	P_2 = P_0 - 1/3 * PSR_I	P_3 = P_0 + 2/3 * PSR_I	P_4 = P_0 - 2/3 * PSR_I	P_5 = P_0 + PSR_I	P_6 = P_0 - PSR_I	P_7 = P_0 + 2 * PSR_I	P_8 = P_0 - 2 * PSR_I
New Call Option Price (BAW)	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8
Weight Fraction Considered	100%	100%	100%	100%	100%	100%	35%	35%
Total (6 x 100) Weighted Profit and Loss	$P\&L_{X1}$ = 600 x (X_0 - X_1)	$P\&L_{X2}$ = 600 x (X_0 - X_2)	$P\&L_{X3}$ = 600 x (X_0 - X_3)	$P\&L_{X4}$ = 600 x (X_0 - X_4)	$P\&L_{X5}$ = 600 x (X_0 - X_5)	$P\&L_{X6}$ = 600 x (X_0 - X_6)	$P\&L_{X7}$ = 210 x (X_0 - X_7)	$P\&L_{X8}$ = 210 x (X_0 - X_8)
3 Index Put Option Contracts								
New put Option Price (BAW)	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7	Y_8
Weight Fraction Considered	100%	100%	100%	100%	100%	100%	35%	35%
Total (-3 x 100) Weighted Profit and Loss	$P\&L_{Y1}$= -300 x (Y_0 - Y_1)	$P\&L_{Y2}$= -300 x (Y_0 - Y_2)	$P\&L_{Y3}$= -300 x (Y_0 - Y_3)	$P\&L_{Y4}$= -300 x (Y_0 - Y_4)	$P\&L_{Y5}$ = -300 x (Y_0 - Y_5)	$P\&L_{Y6}$= -300 x (Y_0 - Y_6)	$P\&L_{Y7}$ = -105 x (Y_0 - Y_7)	$P\&L_{Y8}$= -105 x (Y_0 - Y_8)
Combined Commodity Risk Arrays Results	RA_1 = $P\&L_{F1}$ + $P\&L_{X1}$ + $P\&L_{Y1}$	RA_2 = $P\&L_{F2}$ + $P\&L_{X2}$ + $P\&L_{Y2}$	RA_3 = $P\&L_{F3}$ + $P\&L_{X3}$ + $P\&L_{Y3}$	RA_4 = $P\&L_{F4}$ + $P\&L_{X4}$ + $P\&L_{Y4}$	RA_5 = $P\&L_{F5}$ + $P\&L_{X5}$ + $P\&L_{Y5}$	RA_6 = $P\&L_{F6}$ + $P\&L_{X6}$ + $P\&L_{Y6}$	RA_7 = $P\&L_{F7}$ + $P\&L_{X7}$ + $P\&L_{Y7}$	RA_8 = $P\&L_{F8}$ + $P\&L_{X8}$ + $P\&L_{Y8}$

The largest amount (positive number) of the eight Risk Arrays results is the Scanning Risk which will be the Initial Margin of a portfolio with these three positions.

By convention, Risk Array values are given for a single long position. For a short position (as for the short Put option of the previous example), the calculated profit and loss is multiplied by the negative sign (-1). Losses for long positions are expressed as positive numbers and gains as negative numbers.

In the case of all the eight Risk Arrays values being negative (i.e. all corresponding

to a gain) or zero (no risk), the Scanning Risk amount is set to zero.

The number of the Risk Arrays scenario that gives the largest amount (worst case scenario) for the option is called the Active Scenario. If two scenarios have the same figure, the one with the lowest scenario number is the Active Scenario. For example, if scenarios 5 and 7 give the largest and similar results, scenario 5 will be defined as the Active Scenario.

The Risk Engine calculates the Initial Margin for each Combined Commodity, for each member's account and sub-account. Thus, the Initial Margins calculated for each Combined Commodity account and sub-account are then sent to CDCS in order to be aggregated at the Clearing Member level.

Risk Arrays values are denominated in the same currency as the specific contract.

The Corporation's Risk Arrays file is published every day on the Chicago Mercantile Exchange (CME) website.

Short Option Minimum

In the event of a sharp variation of the Underlying Interest price, short option positions can lead to significant losses. Therefore, the Risk Engine calculates a minimum amount called Short Option Minimum (SOM) for short positions in each Combined Commodity. This amount will be called if it is higher than the result of the Risk Arrays.

In order to determine the appropriate SOM for every group of products, CDCC considers Out of The Money (OTM) call and put Options for every Underlying Interest.

After shocking the Underlying Interest price by its appropriate stress scenario, as set forth in the relevant notice to members, CDCC re-calculates the price of all OTM call and put Options using the new Underlying Interest price and the same other parameters of the Options. The difference between the actual Option price and the new Option price represents the potential loss of the Option. Then, the average of all Options' losses is calculated to determine the potential loss for every Underlying Interest. Finally, the average of the potential losses for all Underlying Interests of the same group of products is calculated to determine the potential loss of the Combined Commodity, which represents its SOM. The latter is then translated in a percentage of the Price Scan Range (PSR).

This SOM calculation is reviewed on a regular basis, at least annually, and communicated to Clearing Members by written notice.

OTCI Transactions for which the Underlying Interest is a Security

The Initial Margin calculation process for OTCI Transactions for which the Underlying Interest is a Security is the same as for listed options, except that the Corporation uses a theoretical price calculated using an in-house program, instead of the contractual option price.

Theoretical Price Calculation

The Corporation uses the Barone-Adesi and Whaley (BAW) model to evaluate the

Options that have an American style and the Black and Scholes (BS) model to evaluate the Options that have a European style. In order to evaluate the Option price, we need to determine the implied volatility to be used. For this, two different methodologies are used depending whether the Option is an Exchange traded Option.

If the Option contract is an Exchange traded Option, the Corporation uses the Option's data (the entire Option series for one expiry month) available at the Exchange and builds a Smile Volatility Curve using a Cubic Spline function. After building the Smile Curve, the Corporation determines the implied volatility that corresponds exactly to the strike price of the Option to be assessed. If the expiry date of the Option does not correspond to the ones of the listed series, the Corporation builds two Smile Volatility Curves, one using the Option series with an expiry date that is right after the one of the assessed Option and one using the series of Options with an expiry date that is right before the one of the assessed Option to be evaluated.

Then, the volatility that corresponds to the strike price of the Option to be evaluated is determined on each curve. Finally, a linear interpolation is done to determine the volatility that corresponds to the strike and to the expiry date of the Option to be evaluated. However, if the expiry date of the Option to be evaluated is before (after) the first (last) expiry date of the listed Options series, the Corporation uses the volatilities of the Smile Volatility Curve of the first (last) expiry date of the listed Option series.

If the Option is not listed and no data is available for it, the Corporation uses the yearly historical volatility of the Option's Underlying Interest price as a proxy for the implied volatility.

Liquidity Interval

To calculate the Margin Interval for OTCI transactions for which the Underlying Interest is a Security, the Corporation may apply a different number of liquidation days. In addition, for OTCI with Physical Settlement/Delivery, the Corporation calculates an additional Liquidity Interval and adds it to the Margin Interval.

The assumptions under which the Liquidity Interval is calculated are similar to the assumptions the Corporation uses to calculate the Margin Interval, i.e., the confidence interval over 99% is obtained by using 3 standard deviations (based on the normal distribution's assumptions). The Liquidity Interval is calculated based on the historical bid-ask price spread of the Underlying Interest according to the same formula for Margin Interval.

UNSETTLED ITEMS

Options contracts with physical delivery that have been exercised or expired in the money without being settled (i.e. the Underlying Interest is not delivered yet) are considered as Unsettled Items and the Corporation has to manage the settlement risk associated with these products until the whole quantity of the Underlying Interest is completely delivered/settled. For instance, when such Option contract expires in the money, the Underlying Interest is delivered three days after the expiry date consistent with current market settlement conventions. The Corporation has to

charge a Margin requirement to cover the Replacement Cost (RC) of the Option contract and its Potential Future Exposure (PFE) as well. The procedure is as follows:

To cover the Replacement Cost of the Option contract, the Corporation requests a Margin requirement equal to the intrinsic value of the Option times the position (quantity of Options). However, when the writer of a put Option has deposited a Put Escrow Receipt to cover the total amount of the strike price in accordance with Section A-708 of the Rules, the Corporation will not require Margin on the relevant put Option. In the same manner, when the writer of a call Option has deposited a Call Underlying Interest Deposit to cover the total quantity of the Underlying Interest deliverable thereunder in accordance with Section A-708 of the Rules, the Corporation will not require Margin on the relevant call Option.

To cover the Potential Future Exposure of the Option contract, the Corporation requests a margin requirement amount to cover any potential Underlying Interest price movement over two days and within three standard deviations (under the normal distribution's assumption).

INITIAL MARGIN FOR FUTURES CONTRACTS

This section describes how the Ii~~i~~nitial Mm~~m~~argin is calculated for the Futures contracts, which includes the Index Futures, Interest Rate Futures, Government of Canada Bonds Futures and Shares Futures.

The first part of the example # 2 of the previous section on Risk Arrays shows how the Scanning Risk is calculated. The Scanning Risk represents the most unfavourable projected liquidation value of the Ff~~f~~utures position. The calculated Scanning Risk is the Initial Margin for a Futures contract. However, since the Futures contract prices are linear with respect to their Underlying Interest prices, the Active Scenario for a Futures contract is always the one with the positive amount between scenario 5 and scenario 6. In other words, the Initial Margin for a Futures contract is always equal to its Price Scan Range (PSR).

With respect to the Three-Month Canadian Bankers' Acceptance Futures (BAX) contract, CDCC combines the contracts in different groups and applies the same charge to the contracts of a same group.

CDCC updates the Margin Intervals (MI) on a regular basis and publish them on its website.

W~~However, w~~hen the holder of a short position on a Futures contract has deposited a Futures Underlying Interest Deposit to cover the total quantity of the Underlying Interest deliverable thereunder in accordance with Section A-708 of the Rules, the Corporation will not require Margin on the relevant Futures contract.

INTRA-COMMODITY (INTER-MONTH) SPREAD CHARGE

The different Futures contracts belonging to the same Combined Commodity have in general~~ly~~ positive~~ly~~ 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 Ff~~f~~utures maturing in one month with the short positions on Ff~~f~~utures maturing in another month. The resulting Margin Requirement on these two Futures contracts belonging to the same Combined Commodity, could be lower than the real risk associated with the combination of the two contracts~~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 address~~fix~~ this issue, the Risk Engine allows the user to calculate and ~~to~~ apply an additional margin charge relative to the Inter-Month spread risk, in order to cover the risk associated with ~~of~~ these two positions. This margin is called Inter-Month Spread Charge or Intra-Commodity Spread Charge (because it is calculated within the same Combined Commodity).

Intra-C~~c~~ommodity (Inter-M~~m~~onth) Spread Charge on correlated Ff~~f~~utures positions ~~are~~is calculated by the Corporation's risk department and updated on a regular~~ly~~ basis.

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:

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

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 α [8]~~3~~ is equal to the critical value equivalent to 99.~~87~~% of the cumulative Student's t-distribution with 4 degrees of freedom with regards to the BAX contract or equal to the critical value equivalent to 99% of the cumulative Normal distribution ~~under the normal distribution's assumption~~with regards to all other Futures products.

With respect to the Three-Month Canadian Bankers' Acceptance Futures (BAX) contract, CDCC calculates the Intra-Commodity (Inter-Month) Spread Charge for all combinations of spreads and butterfly's strategies and applies a same charge for a same group of combinations with close maturities.

For all Futures contracts, in order to consider the highest economical correlation between the different Futures contracts and to offer the highest benefit to the clearing members, CDCC applies the different Intra-Commodity (Inter-Month) Spread Charges by considering the combinations with the lowest charges first and the ones with the highest charges will be considered at the end. If two different combinations

[8] α is equal to 3.75 for the BAX's ICSC and 2.33 for all other Futures's ICSC.

or groups of combinations will have the same charge, the one with the lowest maturity will be considered first. This is the same spread priority concept that is applied for Fixed-Income.

The Intra-Commodity (Inter-month) Spread Charges and the spread priorities are updated and published on the CDCC website on a regular basis.

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 Ff~~f~~utures 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 Futures contract that can be offset by a position on the other Futures 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.

Spread Priority

To determine the appropriate margin reduction for each combination of two Futures contracts, the Corporation performs the following steps:

1) Use the yearly historical data of the different Futures contracts and calculate the correlation matrix.
2) For the priority allowance, start by considering the closest diagonal to the leading one (the diagonal with the 100% correlations that represent the Futures contracts correlations with themselves). This closest diagonal usually contains the highest correlations because of the proximity of the maturities. Then, consider the second closest diagonal, then the third and so on until the last diagonal that has one correlation number.

3) Amongst the numbers of each diagonal, consider the highest number first, then the second highest number, then the third and so on until the last number. This methodology's goal is to maximise the margin reduction applied to the Clearing Members. Discounts are applied to all the matrix correlation numbers before the priority process. The discounts are meant to cover the potential daily variation of the correlations.
4) If there is one or some ties between the discounted numbers within the same diagonal, consider the one with the lowest maturity first, then the second, then the third and so on until the last one.

Different Futures contracts that do not have the same contract size nor the same volatility yield would not have a margin reduction applied to their respective entire positions. By consequent, a hedge ratio is used to determine how much position of one contract in any combination can be matched with the other Futures contract of the same combination. The remaining position (or quantity of Futures contracts) of any contract of this first combination will be matched with another position to form another combination according to the above priority process. At the end of this process, there might be a single outright position that is left to be margined individually.

The Corporation allows a margin reduction for two positively correlated Futures contracts with different directions and for two negatively correlated Futures contracts with same directions.

When the spread priority process is performed, the Corporation considers the combinations between interest rate Futures contracts first (Intra-Commodity Spread Charge). Any remaining (outright) positions in these Futures contracts positions will be considered for Inter-Commodity Spread Charge with Fixed Income Transactions.

INITIAL MARGIN FOR FIXED INCOME TRANSACTIONS

At the Corporation, a Fixed Income Transaction can be either a Repurchase Transaction or a Cash Buy or Sell Trade. A Cash Buy or Sell Trade is the sale of a security from one party to another. Depending on its maturity, the Fixed Income Security can be delivered one, two or three days after the Fixed Income Transaction is completed. Between the Fixed Income Transaction novation date and the delivery date, the Corporation has to cover the counterparty risk.

A Repurchase Transaction is a transaction whereby the seller (the Repo Party) agrees to sell a security to a buyer (the Reverse Repo Party) on a given date (the purchase date) and simultaneously agrees to buy the same security back from the Reverse Repo Party at a later date (the repurchase date) at a fixed price (the repurchase price). Thus, a Repo is equivalent to a cash transaction combined with a forward contract. The cash transaction results in a transfer of money from the buyer to the seller in exchange for a legal transfer of the security from the seller to the buyer, while the forward contract ensures repayment by the seller to the buyer and return of the securities from the buyer to the seller. The difference between the repurchase price and the purchase price is the Price Differential calculated with the agreed Repo Rate, while the settlement date of the forward contract (i.e. the repurchase date) is the maturity date of the transaction.

In such Repurchase Transaction, there are two sources of risk that the Corporation needs to consider and cover. The potential Purchased Security's price fluctuation and the Floating Price Rate fluctuation over the life of the Repurchase Transaction. However, in a Cash Buy or Sell Trade, there is only one source of risk that the Corporation needs to consider and cover, namely, the Purchased Security's price fluctuation.

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 yield-to-maturity (YTM) of the on-the-run security of the Bucket. The Margin Interval is calculated as follows:

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

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 α ~~3~~ is equal to the critical value equivalent to 99.87% of the cumulative Normal distribution ~~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 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:

Initial Margin 1 = *Security's Price* x *MI* x *D* x *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 set to 0.25, 0.5 and 1 respectively.

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 ~~i~~Inter-m~~M~~onth spread risk in order to cover the risk of these two Fixed Income Transactions. This margin is called the Intra-Commodity (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:

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

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 α ~~3~~ is equal to the critical value equivalent to 99.87% of the Normal distribution~~under the normal distribution's assumption~~.

INTER-COMMODITY SPREAD CHARGE

The Fixed Income Securities belonging to two different Buckets generally have a significant correlation. Inter-Commodity spread charge is a margin amount generated for opposite or similar Fixed Income Transactions in two different Acceptable Securities belonging to two different Buckets.

Without any margin relief, the Initial Margin for opposite or similar positions on two different Acceptable Securities belonging to different Buckets would be the sum of both Initial Margins. However, two different Fixed Income Transactions in different Acceptable Securities belonging to two different Buckets can benefit from a reduction in their Initial Margins because of the consideration given to their correlation. The formula to get the portfolio's Initial Margin is:

$$\text{Total Initial Margin} = (\text{Initial Margin}_{\text{Position 1}} \times \text{Hedge Ratio}_{\text{Position 1}} + \text{Initial Margin}_{\text{Position 2}} \times \text{Hedge Ratio}_{\text{Position 2}}) \times (1 - \text{Margin Relief})$$

The margin relief is a percentage determined using the correlation matrix between the different on-the-run Fixed Income Securities of each Bucket.

The Inter-Commodity margin relief percentages between the different Buckets are calculated by the Corporation's risk department and updated on a regular~~ly~~ basis.

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

Spread Priority

To determine the appropriate margin reduction for each combination of two Fixed Income Securities, the Corporation performs the following steps:

1) Use the yearly historical data of the different Fixed Income Securities and calculate the correlation matrix.
2) For the priority allowance, start by considering the closest diagonal to the leading one (the diagonal with the 100% correlations that represents the Fixed Income Securities correlations with themselves). The first diagonal usually contains the highest correlations because of the nearness of the maturities. Then, consider the second closest diagonal, then the third, and so on, until the last diagonal that has only one correlation number.
3) Amongst the numbers of each diagonal, consider the highest number first, then the second highest number, then the third and so on until the last number. This methodology's goal is to maximise the margin reduction applied to the Clearing Members. Discounts are applied to all the matrix correlation numbers before the priority process. The discounts are meant to cover the potential daily variation of the correlations.
4) If there is one or some ties between the discounted numbers within the same diagonal, consider the one with the lowest maturity first, then the second, then the third and so on until the last one.

Different Fixed Income Securities that do not have the same price nor the same

duration would not have a margin reduction applied to their respective entire positions. By consequent, a hedge ratio is used to determine how much position of one contract in any combination can be matched with the other Fixed Income Transaction of the same combination. The remaining position (or quantity of Fixed Income Transaction) of any contract of this first combination will be matched with another position to form another combination, according to the above priority process. At the end of this process, there might be a single outright position that is left to be margined individually.

The Corporation allows a margin reduction for two positively correlated Fixed Income Transactions with different directions and for two negatively correlated Fixed Income Transactions with same directions.

When the spread priority process is performed, the Corporation considers the combinations between Fixed Income Transactions first. Any remaining (outright) positions in these Fixed Income Transactions positions will be considered for Inter-Commodity spread charge with the Futures contracts.

For a better understanding of this process, please refer to the spread priority example of the section Fixed Income Transactions, and to the third scenario of the *IM_repo_3_scenarios.xls* file available at the Corporation website.

Spread Priority Example

Here is an example of the matrix correlation demonstrating the application of the spread priority process:

Correlation	3 months	6 months	1 year	2 year	3 year	5 year	7 year	10 year	15 year	20 year	30 year
3 months	100%	92%	88%	68%	11%	-1%	2%	4%	24%	24%	14%
6 months		100%	94%	81%	54%	42%	5%	7%	26%	26%	17%
1 year			100%	82%	68%	46%	20%	22%	39%	39%	29%
2 year				100%	76%	59%	68%	69%	78%	75%	69%
3 year					100%	82%	87%	86%	93%	90%	89%
5 year						100%	91%	55%	57%	89%	88%
7 year							100%	80%	91%	70%	94%
10 year								100%	82%	95%	43%
15 year									100%	69%	97%
20 year										100%	67%
30 year											100%

The numbers in the first diagonal (blue) on the right of the 100% diagonal should be considered first, then the numbers in the second diagonal (green), then the numbers in the third diagonal (yellow), and so on, until the last white diagonal which contains one single number (the number of this cell is 14%).

Amongst the numbers in the first diagonal in blue, the combination with the highest number is treated first. In this case, it is a combination of 1-year Fixed Income Security with 6-month Fixed Income Security which has the highest number (94%). The combination with a 92% correlation is considered, followed by the combination

with a 91% correlation, and so on.

Out of the 10 numbers of this diagonal, there are three correlations with the same percentage of 82%. By subsequent, the correlation with a 1-year Fixed Income Security and a 2-year Fixed Income Security has to be considered first, then the correlation with a 3-year Fixed Income Security and a 5-year Fixed Income Security has to be considered thereafter and finally the correlation with a 10-year Fixed Income Security and a 15-year Fixed Income Security has to be considered.

VARIATION MARGIN

OPTIONS CONTRACTS

For Options contracts, the Variation Margin is collateralized daily.

FUTURES CONTRACTS

For Futures contracts, the Variation Margin is financially settled every day based on the settlement price as determined by the relevant marketplace.

FIXED INCOME TRANSACTIONS

MTM REPO RATE VALUATION

The Mark-To-Market (MTM) process essentially transfers any losses due to market fluctuations in the Floating Price Rate which is determined from the overnight index swap curve from one party to the Repurchase Transaction to the other. Each open position will be Marked-to-Market on a daily basis with the resulting cash movements settling during the morning settlement cycle. This amount is called the MTM Repo Rate Payment.

The MTM process works as follows. On one hand, if the Floating Price Rate decreases during the life of the Repurchase Transaction, the Repo Party must pay the difference between the original Repo Rate and the new Floating Price Rate. On the other hand, if the Floating Price Rate increases, the Reverse Repo Party must pay the difference between the new Floating Price Rate and the original Repo Rate.

In addition, when one party to the Repurchase Transaction pays the MTM, it is necessary to compensate that Clearing Member for the opportunity cost of funds (OCF) which was forfeited.

The MTM process is important since it ensures that, in the event of default, the Corporation will be able to replace the defaulting Clearing Member's Repurchase Transaction without incurring any additional losses beyond the current valuation.

Since the MTM and OCF are related to the Repo Rate and the Floating Price Rate, these two components are applied only to Repurchase Transactions and not to Cash Buy or Sell Trades.

Here is an example of the MTM and the OCF calculations:

$$MtM_t = A \times (OIS\ rate_t - original\ Repo\ Rate) \times t/365 - MtM_{t-n}$$

and

$$OCF_t = MtM_{t-n} \times Corra_{t-n} \times n/365$$

where

A = Purchase Price

t = Remaining term (in days)

OIS $rate_t$ = Interest rate derived from the OIS curve with a remaining term of t days

Original Repo Rate = the contractual Repo Rate

n = Number of days between t and the last business day. It's usually equal to 1 except when there is a week-end or a Holiday.

MTM PRICE VALUATION

At each margin run process (two intra-days and one end of day process), the Clearing Engine compares the Market Value of the Purchased Security to the Repurchase Price. The Corporation is exposed to the Reverse Repo Party when the Market Value of the Purchased Security exceeds the Repurchase Price, and inversely, the Corporation is exposed to the Repo Party when the Repurchase Price exceeds the Market Value of the Purchased Security; therefore, this difference needs to be considered in the event of a Clearing Member default.

The MTM price valuation amount is the difference between the Market Value of the Purchased Security and the Repurchase Price. This amount is collateralized and should be credited to the Repo Party's Margin Fund and debited to the Reverse Repo Party's Margin Fund when the Market Value of the Purchased Security exceeds the Repurchase Price, and the other way around when the Repurchase Price exceeds the Market Value of the Purchased Security. It should be noted that MTM price valuation is also applicable for Cash Buy or Sales Trades. In this situation, the MTM price valuation amount is the difference between the Market Value of the Purchased Security and the Purchase Price.

ACCOUNT STRUCTURE

The Corporation uses three types of accounts for Margin calculation purposes and positions management: Firm Account, Multi-Purpose Account and Client Account. All the account types are treated on a net account basis for Futures contracts, OTCI and Fixed Income Transactions. However, Options contracts are treated differently depending on the account type they are held in. If they are held in a Firm Account or a Multi-Purpose Account, they are treated on a net account basis, whereas if they are held in a Client Account, they are treated on a gross account basis, which means that only short Options contracts are considered when computing the Initial Margin.

Gross accounts allow calculation of Initial Margin for different clients that clear through one Clearing Member. Since each client has its own risk profile, the Initial Margin must be computed separately for each client and must not allow offsets

between positions that belong to different clients. Subsequently, only Short Positions in Options contracts are considered when calculating the Initial Margins for the Client Account.

Net accounts allow calculation of Initial Margin for the Clearing Member's own positions (Firm Account), for a Market Maker positions (Market Maker Account) or for the positions of a particular single Client (Netted Client Account). In this case, the Initial Margin must consider the possible offsets between all positions. Therefore, all positions held in one Firm Account or one Multi-Purpose Account are used to calculate the Initial Margin for this account.

The Initial Margins calculated for each account are then aggregated at the Clearing Member level to get the Initial Margin by Clearing Member.

In order to cover the Initial Margin described above, Clearing Members shall deposit an acceptable form of Deposits in accordance with Section A-709 of the Rules.

DIFFERENCE FUND

As defined in Section 8.2 of the Operations Manual, the Difference Fund is Margin Deposits held by the Corporation as discretionary margin, such as: (1) Unsettled Items Margin, (2) Daily Capital Margin Monitoring, (3) Advance calls for settlement of losses, (4) OTCI Additional Margin, and (5) Intra-Day Margin. The Corporation accepts Deposits to the Difference Fund in the same form and proportion as for the Margin Fund, as set forth in Section A-709 of the Rules.

Despite the fact that the Difference Fund is used to cover all the above elements, the sub-section regarding the Daily Capital Margin Monitoring intends to capture the credit risk. Consequently, this sub-section is described in details thereunder.

Daily Capital Margin Monitoring:

The Corporation measures the credit exposure to its Clearing Members on a daily basis through the Daily Capital Margin Monitoring Calls (the Difference Fund). The capital level is derived from regulatory reports received on a monthly basis in a timely manner (and on a quarterly basis if it is a Bank Clearing Member).

As prescribed in Section A-710 of the Rules, the Corporation may call for a contribution in the Difference Fund from Members that are undercapitalized in relation to their respective Initial Margin. The Corporation compares the Clearing Member's capital amount to the Initial Margin on a daily basis and requires, if applicable, that the Clearing Member makes up any difference in the form of acceptable Deposits. Each Clearing Member's capital is analyzed and updated on a monthly basis.

In order to determine the contribution to the Difference Fund of Clearing Members, the Corporation uses the Net Allowable Assets (NAA). The Net Allowable Asset is a more restrictive type of capital, since it is the net result of the financial statement capital less the non allowable assets. Non allowable assets are composed of less liquid assets like capitalized leases, Investments in and Advances to Subsidiaries, etc. For Bank Clearing Members, the Corporation uses the Net Tier 1 capital.

The Corporation has access to the Clearing Member's financial statements from the CIPF (Canadian Investor Protection Fund), and the OSFI (Office of the Superintendent of Financial Institutions Canada) for Bank Clearing Members.

In addition to the monthly update of capital numbers, the Corporation performs a qualitative analysis of the financial statements of each member. The Corporation has defined specific thresholds to analyze the profitability, the margin required, the liquidity and the capital level. The Corporation could ask Clearing Members for more clarifications, if necessary.

Indeed, Investment Industry Regulatory Organization of Canada (IIROC) evaluates the financial condition of its Members. If an IIROC Member, who is also a Clearing Member, fails the tests designed to detect the risk of insolvency, the Corporation will be notified by IIROC. The Clearing Member itself shall also advise the Corporation immediately if it enters in an early warning level situation. IIROC may issue two types of warning, early warning level 1 or 2. This is function of the severity of the financial deficiency. The Corporation will be informed by IIROC and will closely monitor the situation. IIROC may impose sanctions or restrictions against the Member. The Corporation will judge if it necessary to take any additional actions and will report the situation to the Risk Management and Advisory Committee (RMAC).

CLEARING FUND

The Clearing Fund deposits are set out in Rule A-6.

These provisions aim to cover extreme but plausible market events. The Clearing Fund is a reserve fund put in place to respond to the deficit that may occur when the Margin Fund and the Difference Fund of a defaulting Clearing Member no longer cover his market exposure. The Clearing Fund is an obligation shared by all the Clearing Members and this Fund is structured to mitigate the Uncovered Residual Risk ("URR"). The URR accounts for the fact that extreme market conditions could generate a major loss for certain Clearing Members, causing the potential default of a Clearing Member.

As it is indicated in Section A-603 of the Rules, the required Clearing Fund contribution of each Clearing Member is composed of Base Deposits plus a Variable Deposit specific to each Clearing Member. Clearing Fund Base Deposits and Variable Deposit could be modified by the Corporation. Clearing Members will be notified of any change pursuant to Section A-604 of the Rules. In accordance with Section A-611 of the Rules, whenever a Clearing Member ceases to be a Clearing Member of the Corporation, the balance of the Clearing Fund owed to the former Clearing Member will be paid to that former Clearing Member, thirty days after all outstanding items have been fulfilled from the Clearing Member's accounts, with the Corporation.

MEMBER CONTRIBUTION

For the purposes of application of Rule A-6, the Corporation issues an amount of Deposit to each Clearing Member on a monthly re-evaluation basis of the following

elements:

- Each Clearing Member's contribution is based on his Uncovered Residual Risk (URR), which represents the difference between his stress margin and base margin, as shown in the below formula. The stress margin is calculated using a stressed Margin Interval which is equal to the Margin Interval times a stress factor. The two calculations are based on open positions on the preceding day of the calculations.

  URR = Stress Margin – Base Margin

- The last sixty business days are used to determine the average URR of each Clearing Member.

$$\mu_{URR^i}^{60} = \frac{\sum_{t=1}^{60} URR_t^i}{60}$$

- The Corporation determines the size of the Clearing Fund (Ω) based on the maximum average URR amongst all Clearing Members.

$$\Omega = \underset{i=1}{\overset{n}{Max}}\left(\mu_{URR^i}^{60}\right)$$

- Each Clearing Member's contribution (C) to the Clearing Fund is determined according to the weight of his respective average URR, with respect to the sum of all the average URRs of all Clearing Members.

$$C^i = \Omega \cdot \frac{\mu_{URR^i}^{60}}{\sum_{i=1}^{n} \mu_{URR^i}^{60}}$$

STRESS SCENARIOS

The Corporation uses four stress scenarios to evaluate the biggest loss amongst all Clearing Members. This loss is utilized to determine the size of the Clearing Fund. A shortfall is equal to the difference between the loss incurred under a stress scenario, reduced of the Margin Fund and the Difference Fund, both belonging to the Clearing Member. By consequence, the size of the Clearing Fund should be at least equal to the greatest shortfall. The stress scenarios use end-of-month positions.

The four stress scenarios currently used by the Corporation are:

- Black Monday (1987)
- Financial Crisis (2008)
- Russian Default (1998)
- Bond Market Crash (1994)

The Corporation regularly assesses whether it is appropriate to add other stress scenarios to the existing scenarios.

The Corporation mostly stresses Futures contracts and Fixed Income Transactions that are considered to be the highest Initial Margin drivers, by historical stressful events. Note that for Fixed Income Transactions, the variations are based on the most representative Fixed Income Securities of each Bucket[9]. Here are the historical percentage variations applied:

Scenario 1 (Black Monday)			
	1987-10-16	1987-10-19	Variation
SXF™ – S&P/TSX 60 Index Standard Futures [10]	174.75	154.63	-11.51%
BAX™ – Three-Month Canadian Bankers' Acceptance Futures [11]	90.81	90.69	-0.14%
CGB™ – Ten-Year Government of Canada Bond Futures [12]	74.40	76.93	3.40%
Fixed Income Security Buckets			
0-3 months GoC yields			0.1857%
3-6 months GoC yields			0.4864%
6-12 months GoC yields			1.0164%
1-2 years GoC yields			1.1663%
2-3 years GoC yields			1.4660%
3-5 years GoC yields			1.7657%
5-7 years GoC yields			2.0654%
7-10 years GoC yields			2.3651%
10-15 years GoC yields			2.1761%
15-20 years GoC yields			2.1760%
20-30 years GoC yields			2.4687%
0-5 years Provincial yields			1.7657%
5-10 years Provincial yields			2.3651%
10-20 years Provincial yields			2.1760%

[9] Selected Government of Canada (GoC) Benchmark Bond yields

[10] The SXF contract has started trading in 1999. Thus, these prices represent the Futures Contract and not the S&P/TSX 60 Index, which is the Underlying Interest of the contract.

[11] The BAX contract was introduced in April 1988. Consequently, the historical price is obtained by using the 3 month US LIBOR interest rates.

[12] The CGB contract was introduced in September 1989. Consequently, the theoretical price is obtained by calculating a 10-year bond, 6% coupon rate actualized with a 10-year Canadian Government rate extracted from an on-the-run Canadian Government Bond.

20-30 years Provincial yields			2.4687%
Scenario 2 (Financial Crisis 2008)			
	2008-10-17	2008-10-20	Variation
SXF™ – S&P/TSX 60 Index Standard Futures	568.5	622.7	9.53%
BAX™ – Three-Month Canadian Bankers' Acceptance Futures	97.63	97.75	0.12%
CGB™ – Ten-Year Government of Canada Bond Futures	117.16	117.14	-0.02%
Fixed Income Security Buckets			
0-3 months GoC yields			-0.0056%
3-6 months GoC yields			0.0354%
6-12 months GoC yields			0.0719%
1-2 years GoC yields			0.1318%
2-3 years GoC yields			0.1635%
3-5 years GoC yields			0.1883%
5-7 years GoC yields			0.1247%
7-10 years GoC yields			0.0528%
10-15 years GoC yields			0.1163%
15-20 years GoC yields			0.1718%
20-30 years GoC yields			0.1491%
0-5 years Provincial yields			-0.0475%
5-10 years Provincial yields			-0.1232%
10-20 years Provincial yields			-0.3703%
20-30 years Provincial yields			-0.2787%
Scenario 3 (Russian Default)			
	1998-08-26	1998-08-27	Variation
SXF™ – S&P/TSX 60 Index Standard Futures	356.54	333.25	-6.53%
BAX™ – Three-Month Canadian Bankers' Acceptance Futures	94.56	93.77	-0.84%
CGB™ – Ten-Year Government of Canada Bond Futures	122.15	121.3	-0.70%
Fixed Income Security Buckets			
0-3 months GoC yields			-0.2069%

3-6 months GoC yields			-0.3263%
6-12 months GoC yields			-0.5015%
1-2 years GoC yields			-1.0739%
2-3 years GoC yields			-1.0429%
3-5 years GoC yields			-1.3803%
5-7 years GoC yields			-0.8457%
7-10 years GoC yields			-1.4312%
10-15 years GoC yields			-1.5248%
15-20 years GoC yields			-1.2586%
20-30 years GoC yields			-1.3089%
0-5 years Provincial yields			-1.2163%
5-10 years Provincial yields			-1.7576%
10-20 years Provincial yields			-1.8987%
20-30 years Provincial yields			-1.4248%
Scenario 4 (Bond Market Crash)			
	1994-04-01	1994-04-04	Variation
SXF™ – S&P/TSX 60 Index Standard Futures	221.09	215.97	-2.32%
BAX™ – Three-Month Canadian Bankers' Acceptance Futures	93.53	92.92	-0.65%
CGB™ – Ten-Year Government of Canada Bond Futures	105.17	102.38	-2.65%
Fixed Income Security Buckets			
0-3 months GoC yields			0.0268%
3-6 months GoC yields			0.1060%
6-12 months GoC yields			0.1814%
1-2 years GoC yields			0.3710%
2-3 years GoC yields			0.4517%
3-5 years GoC yields			0.7702%
5-7 years GoC yields			0.6207%
7-10 years GoC yields			0.8582%
10-15 years GoC yields			1.0067%
15-20 years GoC yields			0.7665%
20-30 years GoC yields			0.5196%

0-5 years Provincial yields			-0.5813%
5-10 years Provincial yields			-2.6390%
10-20 years Provincial yields			-3.0077%
20-30 years Provincial yields			-3.4743%

The procedure to value the size of the Clearing Fund and the contributions of each Clearing Member is performed every month. As previously mentioned, the consideration of the results of the different stress scenarios leads the Corporation to select a stress factor[13]. Therefore, the stress factor depends on Clearing Members' positions (risk profile of each Clearing Member) that vary every day, and the Margin Intervals. After selecting the stress factor, the Corporation monitors and controls the level of the Clearing Fund throughout the month.

[13] The stress factor generally has a value of 1.5, 2, 2.5 or 3. It is generally adjusted by 50% intervals.

FORMS OF COLLATERAL

The forms of collateral that may be deposited with CDCC are prescribed in Section A-608 and Section A-709 of the Rules.

The different forms of collateral are valued by accounting for their potential loss in the event that liquidation is required. Accordingly, the value of the Margin Deposits is discounted in relation to their market value. This discount, commonly called the Haircut, applies to Valued Securities, Canada Mortgage Bonds and Government Securities, as prescribed in Section A-709 of the Rules.

For the purposes of application of the provisions of Section A-608 and Section A-709 of the Rules, CDCC proceeds as follows:

CASH

Cash amounts are accepted only in Canadian dollars.

GOVERNMENT SECURITIES AND CANADA MORTGAGE BONDS

CDCC accepts Acceptable Treasury Bills and other Government of Canada and United States Government bonds, in addition to the bonds of certain Canadian provinces, as Margin Deposits. For each issue accepted in advance, a concentration limit equal to $250 million or 10% of the total issue outstanding, whichever is less, is applied. The concentration limit is in effect for all Government Securities and Canada Mortgage Bonds at the Corporation level. Acceptance of the issues is conditional on the availability of a price from a source that CDCC determines to be acceptable and reliable. The Government Securities and Canada Mortgage Bonds accepted as Margin are reviewed by CDCC on a regular basis.

VALUED SECURITIES

CDCC accepts Valued Securities listed on any duly recognized Canadian Exchange against their total Margin requirements These Securities should respect the criteria set forth in Section A-709 of CDCC's Rules.

CALCULATING THE HAIRCUTS FOR GOVERNMENT SECURITIES AND CANADA MORTGAGE BONDS

The Haircuts are calculated based on the following methodology and assumptions:

- Valuation of the market, credit, liquidity and foreign exchange risks based on historical daily returns;

- Confidence interval over 99% obtained by using 3 standard deviations, and the assumption that the bond can be liquidated at a reasonable price in N days. (N will be determined according to the type of products and prevailing market conditions);
- Liquidity risk valued according to the bid-ask spread of the issues (if this spread is unavailable, the liquidation window will be expanded and will depend on market conditions); and
- Bonds of the same issuer and comparable maturities.

Once the quantitative analysis is performed, CDCC reserves the right to increase the Haircuts based on qualitative criteria, such as:

- Comparative analysis of CDCC's Haircuts in relation to the Haircuts of the Bank of Canada;
- Comparative analysis of CDCC's Haircuts in relation to the Haircuts of other clearing houses;
- The congruence of the different Haircuts to the credit rating spreads of the different issuers;
- Any other factor considered relevant.

THE HAIRCUTS FOR VALUED SECURITIES

A Haircut of 50% is applied to all Valued Securities pledged against the total Margin required against all accounts combined.

HAIRCUT POLICY

The Haircuts are reviewed at least semi-annually and may be reviewed on an ad hoc basis if any event occurs. The Clearing Members are informed of these reviews by written notice and the Haircuts related to Governement Securities and Canada Mortgage Bonds are also published on CDCC's website with their effective dates.

MONITORING PROGRAM

The Corporation conducts daily backtesting and stress testing.

BACKTESTING

Backtesting is performed on a daily basis. Backtesting helps the Corporation to assess the robustness of the existing models and measures the actual credit exposures. In order to have an efficient coverage, even at the introduction of new products, the Corporation performs a complete theoretical backtesting to calibrate the liquidation period and the volatility assumption.

The Corporation has put in place appropriate internal procedures if the backtesting results are not sufficient to cover minimum coverage at the product level and at the portfolio level.

If the results of the backtesting fail to reach the desired minimum coverage, the situation is investigated. If necessary, the results are escalated to upper management. At this level, a decision is made to adjust the current risk parameters and/or ultimately to change the risk methodology. As set in Section A-702 of the Rules, the Corporation has the discretion to adjust the Initial Margin. This can be done at the product level by increasing the Margin Interval, or by asking a Clearing Member for additional Initial Margin.

The results are communicated to the Risk Management and Advisory Committee (RMAC) on a regular basis.

STRESS TESTING

The stress testing is also conducted on a daily basis. The Corporation uses different stress scenarios, each of them designed to test different keys parameters. The results of the stress tests help the Corporation to size the Clearing Fund. The Clearing Fund measures the capacity of the Corporation to address extreme, but plausible market conditions. Another goal of the stress test is to better understand the different relationships among the different positions of the Clearing Members. The various results may contribute to enhance the risk methodology of the Corporation. If it is concluded that these changes in the market are permanent, the Corporation may integrate the new dynamics in the Initial Margin.

The scenarios are historical and theoretical. The historical stress scenarios aim to simulate the biggest historical events that would affect Clearing Members. The historical stress scenarios are used to determine the size of the Clearing Fund. Moreover, in the case of the stress testing monitoring program, the stress scenarios help the Corporation to have a complete view of the risk profile of the current positions undertaken by each Clearing Member, and by all of them simultaneously (the portfolio-level coverage assessment).

In addition, the Corporation performs theoretical stress testing. For example, the

Corporation simulates the impact of a parallel and twist shifts in the interest rate curve; large moves (up or down) in specific contracts and/or Underlying Interests; and the impact of multiple Clearing Members defaults.

Also the results of the scenarios are designed to ensure that the Corporation captures any corporate relationships between different affiliated Clearing Members.

The results are communicated to the Risk Management and Advisory Committee (RMAC) on a regular basis.

CONTRACT ADJUSTMENT

- Section *A-902* of the Rules prescribes the cases in which an adjustment may be made.

The Corporation is responsible for monitoring and identifying the corporate events that may result in an adjustment. It interprets the information and communicates it to the Clearing Members of the Adjustments Committee as soon as possible. The Adjustments Committee acts in accordance with the provisions of Rule *A-9*.

A meeting of the Adjustments Committee is called by the Corporation, whenever circumstances require. The Committee is responsible for preparing the draft notices to the Clearing Members which, once approved by the Committee members, are published to the attention of the Clearing Members and the market participants.

Canadian Derivatives Clearing Corporation
The Exchange Tower
130 King Street West
5th Floor
Toronto, Ontario
M5X 1J2
Tel. : 416-367-2463
Fax : 416-367-2473
e-mail: risk@cdcc.ca

Corporation canadienne de compensation de produits dérivés
Tour de la Bourse
800 Victoria Square
3rd Floor
Montréal, Québec
H4Z 1A9
Tel. : 514-871-3545
Fax : 514-871-3530
e-mail: risk@cdcc.ca