Methodologies for determining the parameters used in Margin Calculations for Equities and Equity Derivatives

Manual

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1.0 Executive summary

This document aims at describing the methodologies and related underlying assumptions adopted by CC&G to determine the parameters used for Initial Margin calculation.

2.0 Methodologies for determining Margin Parameters used in Margin Calculations for Equity and Equity Derivatives Section

This section aims at explaining the proposed methodology for calculating Margins parameters for Equities Section.

2.1. Main parameters

As for any other model, the quality of the results generated from the MARS - *Margining System* - methodology depends on the quality of the parameters it is supplied with.

Here below a brief overview of the two main parameters is provided.

A) *The Margin Interval*

The Margin Interval applied to each underlying asset is defined on the basis of statistical analyses. It is normally set equal to such a value that ensures a targeted Coverage Level compared to the price fluctuations actually recorded. Confidence levels are defined by taking into consideration three dimensions: instrument type, the length of time series of prices and the holding period. On the basis of the three variables a confidence interval table is constructed (with confidence level up to 99,8%) and it is characterized by higher confidence levels for more recent observations.

B) The Future Straddle Margin

The aim of Futures Straddle Margins is to guarantee Futures positions having opposite sign on different maturities (Futures Spread position) considering the lower risk level expressed by the interest rate variations (or price correlation calculated on time series of Dividend Futures with different expiry): these margins are applied on Futures Spread

positions of the same Class[1].

C) The Minimum Margin

In order to apply a significant Initial Margin even to those portfolios which ordinary Initial Margin is close to or equivalent to zero, a Minimum Margin is defined as well. Among other things, its purpose is to take into account the bid-offer spread existing on the market in the hypothesis of closure of the positions.

D) The Offset Factor

The degree of the correlation's plausibility is measured for each pair of underlying assets by calculating the Div/Undiv indicator (see paragraph 2.3). In case that a stable correlation above significant values occurs a Product Group is set up. The Offset Factor of each Product Group is determined in a complementary manner with respect to the Div/Undiv value; therefore the higher the correlation is, the lower the abatement applied to the theoretical revenues will be, thus making the cross-margining effect greater.

2.2. Margin Interval calculation

2.2.1. Defining Coverage Level

Different Coverage Levels are applied according three dimensions: types of financial instrument, time series dimension, holding period analyzed. For equity cash, one day and two days holding periods are analyzed; for equity derivatives one day, two days, and three days holding periods are considered.

2.2.2. Determining the Margin Interval for Equity cash

In order to determine the Margin Interval for new instruments for Equity section, CC&G refers to the time series of prices of the *comparables* indicated by the Italian Stock Exchange in the admission form or, for ETF and ETC, to time series of replicated Indices. If comparables or indices are denominated in a currency other than Euro, CC&G also considers time series converted in Euro to take into account the exchange rate risk. In case where a new instrument is admitted to trading as a result of a corporate action (merger, division and reorganization, etc.), CC&G will also take into account the Margin

[1] The *Class* is the set of contracts of the same kind having the same underlying asset (for example Futures on ENI for the Class of Futures or Options on Fiat shares for the class of options).

Interval calculated for the securities related to the company/companies involved in corporate action.

If the new instrument is already traded on other markets and the time series of prices is sufficiently long, Margin Interval calculation will be based on that historical data.

The analysis of time series identified as described above is defined at Step 1 to 4; the Margin interval for the new instrument will be in line with the highest value resulting for comparables / indices, both in Euro and foreign currency.

The following steps describe the calculation procedure of the Proposed Margin Interval:

Step 1. Identification, for each instrument, of the corresponding Margin Interval for each time bracket (separately for each holding period considered in the analysis) by applying confidence intervals - as defined in the previous paragraph - under two different hypothesis:

(1) <u>Normal distribution</u>

a. Calculation of the number of standard deviations corresponding to the Coverage Level (defined in tables above) for each time series under the assumption of standard normal distribution of price variations (e.g. Coverage Level = 99.80% → 2.878 Standard Deviations);

b. definition of the Margin Interval under the hypothesis of Normal Distribution by multiplying the standard deviation of n-days price variation calculated for each time horizon by the number of standard deviations obtained as at point a.

(2) <u>Real distribution</u>

a. Calculation of the number Np_v of price variations to be excluded from the Margin Interval by multiplying 1-α, where α is the Coverage Level, by the number of days comprised in time series analyzed. The result is then rounded to the nearest unit;

b. Determination of the Np_v-th and Np_v-th +1[2] highest (in absolute value) price variations for each time bracket, separately for each holding period

[2] Margin interval at this step is positioned between the first variation to exclude and the first to include, by applying a rounding up of 0.25% to the first price variation to include or a rounding down to 0.25% the first to be excluded.

considered[3].

Step 2. Identification (for each of the time horizons and for each holding period) of the corresponding Margin interval as the greatest between the amount determined in the assumption of normal distribution (as defined at sub-step 1.1.b) and the one determined in actual distribution (as defined at sub-step 1.2.b). The result is then rounded up to 0,25%.

Step 3. Identification of the Mathematical Margin Interval for each instrument, as the greatest among all the Margin Intervals as calculated at Step 2 for each holding period analyzed.

Step 4. The Proposed Margin Interval is the greatest among:

1) Mathematic Margin Interval calculated for 1-day holding period;

2) Mathematic Margin Interval calculated for 2-day holding period;

In order to mitigate procyclicality phenomena, CC&G applies the required buffer of 25% only to those instruments whose time series are shorter than 10 years.

An Internal policy defines a set of warning thresholds for proper market benchmarks that help identifying market stress circumstances under which the buffer could be temporarily exhausted, in part or in full, in order to avoid big-stepped margin changes during periods of high volatility.

	All data	12 y	10 y	9 y	8 y	7 y	6 y	5 y	4 y	3 y	2 y	12 m	6 m	3 m	1 m	1 w
Max 1°	01/04/04 29,716%	01/04/04 29,716%	01/04/04 29,716%	30/06/04 25,336%	22/04/09 24,286%	22/04/09 24,286%	22/04/09 24,286%	22/04/09 24,286%	22/04/09 24,286%	29/05/12 19,203%	29/05/12 19,203%	29/05/12 19,203%	22/02/18 9,729%	22/02/18 9,729%	14/03/18 2,750%	28/03/18 0,409%
Max 2°	30/06/04 25,336%	30/06/04 25,336%	30/06/04 25,336%	22/04/09 24,286%	25/02/08 21,769%	25/02/08 21,769%	25/02/08 21,769%	09/12/08 21,701%	21/04/09 19,454%	20/12/11 15,656%	20/12/11 15,656%	01/05/12 15,139%	02/03/18 3,268%	02/03/18 3,268%	06/03/18 2,519%	
Max 3°	22/04/09 24,286%	22/04/09 24,286%	22/04/09 24,286%	25/02/08 21,769%	09/12/08 21,701%	09/12/08 21,701%	09/12/08 21,701%	23/07/08 20,075%	29/05/12 19,203%	31/05/12 15,139%	31/05/12 15,139%	21/08/12 10,537%	28/11/12 3,049%	14/03/18 2,750%	03/04/18 2,041%	
Max 4°	25/09/03 21,966%	25/09/03 21,966%	25/09/03 21,966%	09/12/08 21,701%	28/06/06 21,053%	28/06/06 21,053%	30/09/07 20,260%	21/04/09 19,454%	04/11/09 16,781%	21/08/12 10,537%	21/08/12 10,537%	22/02/18 9,729%	09/11/12 2,767%	18/03/18 2,684%	22/03/18 1,813%	
Max 5°	25/02/08 21,769%	25/02/08 21,769%	25/02/08 21,769%	28/06/06 21,053%	30/09/07 20,260%	30/09/07 20,260%	23/07/08 20,075%	29/05/12 19,203%	20/12/11 15,656%	22/02/18 9,729%	22/02/18 9,729%	21/05/12 9,144%	14/03/18 2,750%	18/03/18 2,577%	03/04/18 1,222%	
Max 6°	09/12/08 21,701%	09/12/08 21,701%	09/12/08 21,701%	30/09/07 20,260%	23/07/08 20,075%	23/07/08 20,075%	21/04/09 19,454%	18/08/08 18,317%	31/05/12 15,139%	21/05/12 9,144%	21/05/12 9,144%	26/08/12 8,405%	18/03/18 2,684%	06/03/18 2,515%	12/03/18 1,061%	
Max 7°	28/06/06 21,053%	28/06/06 21,053%	28/06/06 21,053%	23/07/08 20,075%	03/07/06 19,954%	03/07/06 19,954%	29/05/12 19,203%	26/05/08 17,110%	19/06/09 14,573%	22/08/12 8,405%	26/08/12 8,405%	24/08/12 7,965%	18/02/18 2,577%	07/02/18 2,220%	14/03/18 0,792%	
Max 8°	30/09/07 20,260%	30/09/07 20,260%	30/09/07 20,260%	03/07/06 19,954%	21/04/09 19,454%	21/04/09 19,454%	18/08/08 18,317%	04/11/09 16,781%	02/06/09 12,922%	22/12/11 8,195%	23/12/11 8,195%	08/05/12 7,345%	06/03/18 2,515%	14/02/18 2,083%	28/03/18 0,409%	
Max 9°	23/07/08 20,075%	23/07/08 20,075%	23/07/08 20,075%	21/04/09 19,454%	29/05/12 19,203%	29/05/12 19,203%	07/06/08 17,559%	14/06/08 16,154%	16/12/09 12,624%	23/08/12 7,965%	24/08/12 7,965%	24/08/12 6,803%	07/02/18 2,220%	01/03/18 2,041%	03/04/18 0,393%	
Max 10°	03/07/06 19,954%	03/07/06 19,954%	03/07/06 19,954%	29/05/12 19,203%	18/08/08 18,317%	18/08/08 18,317%	03/06/08 17,203%	20/12/11 15,656%	29/05/09 11,498%	03/08/11 7,641%	08/05/12 7,345%	28/05/12 6,776%	14/02/18 2,083%	22/03/18 1,813%	21/03/18 0,204%	
Min 1°	18/04/11 -21,098%	18/04/11 -21,098%	18/04/11 -21,098%	18/04/11 -21,098%	18/04/11 -21,098%	18/04/11 -21,098%	18/04/11 -21,098%	18/04/11 -21,098%	18/04/11 -21,098%	18/04/11 -21,098%	18/04/11 -21,098%	13/05/12 -11,857%	25/02/18 -5,204%	25/02/18 -5,204%	15/03/18 -4,398%	02/04/18 -1,935%
Min 2°	26/03/04 -17,763%	26/03/04 -17,763%	26/03/04 -17,763%	23/05/08 -12,922%	23/05/08 -12,922%	23/05/08 -12,922%	23/05/08 -12,922%	23/05/08 -12,922%	13/05/12 -11,857%	13/05/12 -11,857%	13/05/12 -11,857%	23/08/12 -6,677%	15/03/18 -4,398%	15/03/18 -4,398%	04/03/18 -2,772%	25/03/18 -1,660%
Min 3°	26/09/03 -15,306%	26/09/03 -15,306%	26/09/03 -15,306%	08/07/04 -12,436%	10/12/08 -12,345%	10/12/08 -12,345%	10/12/08 -12,345%	10/12/08 -12,345%	24/06/09 -11,368%	19/04/11 -11,250%	19/04/11 -11,250%	13/08/12 -6,290%	11/02/18 -3,663%	11/02/18 -3,663%	20/03/18 -1,980%	26/03/18 -0,325%
Min 4°	12/09/01 -14,774%	12/09/01 -14,774%	21/05/08 -13,220%	10/12/08 -12,345%	19/08/08 -12,343%	19/08/08 -12,343%	19/08/08 -12,343%	19/08/08 -12,343%	19/04/11 -11,250%	20/04/11 -10,288%	20/04/11 -10,288%	15/05/12 -5,385%	29/10/12 -3,273%	26/02/18 -2,980%	02/04/18 -1,935%	27/03/18 -0,204%
Min 5°	12/04/02 -14,004%	12/04/02 -14,004%	27/05/08 -12,922%	19/08/08 -12,343%	13/05/12 -11,857%	13/05/12 -11,857%	13/05/12 -11,857%	13/05/12 -11,857%	01/06/09 -10,521%	16/04/10 -9,175%	09/01/12 -8,724%	10/04/12 -5,380%	12/11/12 -3,269%	04/02/18 -2,963%	25/03/18 -1,660%	
Min 6°	21/05/08 -13,220%	21/05/08 -13,220%	08/07/04 -12,436%	13/05/12 -11,857%	24/09/07 -11,675%	24/09/07 -11,675%	24/09/07 -11,675%	24/06/09 -11,368%	20/04/11 -10,288%	09/01/12 -8,724%	09/11/11 -8,142%	13/08/12 -5,216%	09/10/12 -3,248%	15/02/18 -2,961%	11/03/18 -1,245%	
Min 7°	23/05/08 -12,922%	23/05/08 -12,922%	10/12/08 -12,345%	24/09/07 -11,675%	24/06/09 -11,368%	24/06/09 -11,368%	24/06/09 -11,368%	26/05/08 -11,260%	26/04/10 -9,175%	09/11/11 -8,142%	21/12/11 -7,519%	23/02/18 -5,204%	26/02/18 -2,980%	07/03/18 -2,958%	08/03/18 -1,075%	
Min 8°	08/07/04 -12,436%	08/07/04 -12,436%	19/08/08 -12,343%	24/06/09 -11,368%	28/05/08 -11,260%	28/05/08 -11,260%	28/05/08 -11,260%	19/04/11 -11,250%	06/03/09 -9,174%	21/12/11 -7,519%	23/08/12 -6,677%	26/08/12 -5,172%	04/02/18 -2,963%	04/03/18 -2,772%	26/03/18 -0,325%	
Min 9°	10/12/08 -12,345%	10/12/08 -12,345%	17/05/12 -11,857%	28/05/08 -11,260%	19/04/11 -11,250%	19/04/11 -11,250%	19/04/11 -11,250%	06/10/08 -11,063%	09/01/12 -8,724%	30/09/11 -7,500%	13/09/12 -6,290%	05/06/12 -5,117%	15/02/18 -2,961%	20/03/18 -1,980%	27/03/18 -0,204%	
Min 10°	19/08/08 -12,343%	19/08/08 -12,343%	24/09/07 -11,675%	19/04/11 -11,250%	06/10/08 -11,063%	06/10/08 -11,063%	06/10/08 -11,063%	09/06/08 -10,534%	09/11/11 -8,142%	27/08/12 -6,677%	14/02/13 -5,953%	25/04/12 -4,796%	07/03/18 -2,958%	02/04/18 -1,935%	18/03/18 -0,020%	
Confidence	**99,000%**	**99,500%**	**99,650%**	**99,100%**	**99,150%**	**99,200%**	**99,250%**	**99,300%**	**99,325%**	**99,350%**	**99,375%**	**99,400%**	**99,700%**	**99,700%**	**99,700%**	**99,700%**
Number of Events	3263	3030	2525	2273	2020	1768	1515	1263	1010	758	505	253	127	64	21	5
Events In	3230	3015	2501	2253	2003	1754	1504	1254	1003	753	502	251	127	64	21	5
Events Out	33	15	24	20	17	14	11	9	7	5	3	2	0	0	0	0
Average	-0,012%	-0,019%	0,045%	0,014%	0,054%	0,058%	0,039%	0,014%	0,032%	-0,050%	-0,125%	0,042%	-0,112%	-0,032%	-0,115%	-0,743%
St. Dev.	3,329%	3,431%	3,488%	3,331%	3,382%	3,559%	3,529%	3,489%	3,148%	2,819%	2,971%	3,079%	1,780%	2,158%	1,802%	1,007%
Hist. Volatility	52,889%	54,574%	55,479%	52,987%	53,801%	56,604%	56,136%	55,489%	50,076%	44,841%	47,253%	48,973%	28,319%	34,324%	28,669%	16,013%
Asymmetry	1,686%	1,656%	1,810%	1,786%	1,695%	1,637%	1,512%	1,326%	1,226%	0,361%	0,362%	1,620%	0,986%	1,089%	-0,490%	-0,288%
Kurtosis	12,716%	11,935%	12,505%	12,115%	11,058%	10,026%	10,112%	9,765%	11,347%	10,384%	12,270%	9,137%	6,876%	5,842%	0,166%	-2,400%
Margin Interval (Norm D.)	8,750%	9,750%	9,250%	8,750%	9,000%	9,500%	9,500%	9,500%	8,750%	7,750%	8,250%	8,500%	5,500%	6,500%	5,500%	3,000%
No. Of St. Dev. (Norm D.)	2,576	2,807	2,594	2,612	2,632	2,652	2,674	2,697	2,709	2,721	2,734	2,748	2,968	2,968	2,968	2,968
Confidence Level (Norm D.)	97,027%	97,525%	97,030%	97,096%	97,079%	97,059%	97,090%	97,070%	97,624%	97,889%	97,624%	97,628%	99,213%	98,438%	100,000%	100,000%
Margin Interval (Largest Is)	14,750%	17,750%	15,750%	15,250%	15,750%	17,000%	17,250%	16,250%	14,750%	11,500%	15,250%	12,000%	9,750%	9,750%	4,500%	2,000%
No. Of St. Dev. (Largest Is)	4,436	5,173	4,516	4,578	4,656	4,777	4,888	4,658	4,685	4,079	5,133	3,898	5,476	4,518	2,497	1,987
Confid. Level (Largest Is)	99,019%	99,505%	99,089%	99,120%	99,158%	99,208%	99,274%	99,287%	99,307%	99,340%	99,406%	99,209%	100,000%	100,000%	100,000%	100,000%
Margin Interval (Mid-way)	14,750%	17,750%	15,750%	15,500%	16,000%	17,000%	17,250%	16,500%	15,000%	11,750%	15,500%	13,500%	9,750%	9,750%	4,500%	2,000%
No. Of St. Dev. (Mid-way)	4,436	5,173	4,516	4,653	4,730	4,777	4,888	4,730	4,765	4,168	5,218	4,385	5,476	4,518	2,497	1,987
Confidence Level (Mid-way)	99,019%	99,505%	99,089%	99,120%	99,158%	99,208%	99,274%	99,287%	99,307%	99,340%	99,406%	99,209%	100,000%	100,000%	100,000%	100,000%
Marg. Interv.(Smallest Out)	14,750%	17,750%	15,750%	15,500%	16,000%	17,000%	17,250%	16,750%	15,000%	11,750%	15,500%	15,000%	9,750%	9,750%	4,500%	2,000%
No. Of SD(Smallest Out)	4,436	5,173	4,516	4,653	4,730	4,777	4,888	4,801	4,765	4,168	5,218	4,872	5,476	4,518	2,497	1,987
Confid. Level(Smallest Out)	99,019%	99,505%	99,089%	99,120%	99,158%	99,208%	99,274%	99,287%	99,307%	99,340%	99,406%	99,209%	100,000%	100,000%	100,000%	100,000%
Math. marg.	**14,750%**	**17,750%**	**15,750%**	**15,250%**	**15,750%**	**17,000%**	**17,250%**	**16,250%**	**14,750%**	**11,500%**	**15,250%**	**12,000%**	**9,750%**	**9,750%**	**5,500%**	**3,000%**
Math. st. dev.	4,436	5,173	4,516	4,578	4,656	4,777	4,888	4,658	4,685	4,079	5,133	3,898	5,476	4,518	3,051	2,980
Math. conv.	99,019%	99,505%	99,089%	99,120%	99,158%	99,208%	99,274%	99,287%	99,307%	99,340%	99,406%	99,209%	100,000%	100,000%	100,000%	100,000%
Math. margin (1 days)	17,250%															
Math. margin:	20,25% Holding period: 2 days, Period: 1768 days															
Prop. margin.:																
Custom:																
Math. mar. cov.	100,00%	100,00%	100,00%	100,00%	99,21%	99,41%	99,34%	99,31%	99,29%	99,27%	99,21%	99,16%	99,12%	99,09%	99,59%	99,02%
Prop. mar. cov.	100,0%	100,0%	100,0%	100,0%	100,0%	99,8%	99,9%	99,8%	99,8%	99,7%	99,7%	99,7%	99,7%	99,6%	99,7%	99,7%

2.2.3. Determining the Margin Interval for Equity derivatives

Margin Interval calculation for Equity derivatives follows the same approach illustrated at previous paragraph 2.2.2 for equity cash products. Steps from 1 to 3 remain the same, while step 4 becomes:

Step 4. The Proposed Margin Interval is the greatest among:

1) Mathematic Margin Interval calculated for 1-day holding period;
2) Mathematic Margin Interval calculated for 2-day holding period;
3) Mathematic Margin Interval calculated for 3-day holding period;

2.3. Product Group Offset Factor

For each couple of instruments for which an economic reason for a price relation exists, it is possible to identify for each time horizon/holding period, the following measure:

$$\text{Div/Undiv} = 1 - \frac{\sqrt{\sigma_a^2+\sigma_b^2-2\sigma_a\sigma_b\rho_{ab}}}{|\sigma_a+\sigma_b|}$$

In case of a high and stable correlation more instruments can be comprised in a Product Group.

The Proposed Offset factor (for each time bracket and holding period analyzed) is calculated as a function of minimum correlation calculated by using the Div/Undiv indicator.

2.4. Futures Straddle Margin

Straddle margins are computed for futures positions of opposite sign on different maturities and are equal to the number of Futures Spread positions[4] multiplied by the Future Spread Margin fixed by CC&G.

In order to quantify the risk of a Straddle position it is necessary to determine the greatest daily variation, reasonably possible, between the difference of futures prices F_i and F_j (calendar spread) having different maturities occurred in a day, and the same difference (calendar spread) on the following day.

[4] The number of Futures Spread positions for each Class is equal to *Min (Σ long positions; Σ short positions).*

Depending on instrument type two different methodologies for calculating Straddle Margin have been defined:

1. Straddle interest rate: Methodology applied when the straddle value depends mainly on the interest rate curve. The margin is calculated as a function of the maximum variations in the interest rates used as input in the determination of the theoretical values for the futures contracts of the straddle. This methodology is used for straddle made up of FTSEMIB index futures or single stock futures.
2. Straddle correlations: The margin is calculated as a function of the time series correlations for all the maturity pairs for each single underlying. This methodology is used for straddle position involving dividend futures, which have as underlying the dividend amount paid by the reference entity in a specified year (maturity of the contract)

2.4.1. Straddle Interest Rate Methodology

The Proposed Futures Straddle Margin is calculated as the sum of the absolute values of the Mathematical Futures Straddle Margin as determined in paragraph 2.4.1.1 and the Applicable Bid-Ask Spread determined in paragraph 2.4.1.2.

2.4.1.1. Determining Mathematical Futures Straddle Margin

The value of a calendar spread on a stock that does not pay dividends is: $SPR = F_i - F_j = Se^{\rho_{2t_2}} - Se^{\rho_{1t_1}}$, where S is the price of the underlying, ρ^1 and ρ^2 are the interest rates applied on the first and the second maturity and t_2 and t_1 represent the time to maturity.

To consider explicitly the case of a calendar spread on a stock that pays dividends between the first and the second maturity, the following notation should be used:

$SPR = F_i - F_j = (S - De^{-\rho_{dt_d}})e^{\rho_{2t_2}} - Se^{\rho_{1t_1}}$, where $De^{-\rho_{dt_d}}$ represents the present value of the expected dividend within the two maturities.

Nevertheless this generalization is useless, because the expected dividend affects the level of the calendar spread but it does not have any influence on its variations between two days; so the application of the previous expression can be generalized with a calendar spread without dividends.

If the first day *i* the calendar spread is equal to $SPR_i = Se^{\rho_{2t_2}} - Se^{\rho_{1t_1}}$, it can be assumed that the following day j the spread becomes equal to

$SPR_j = (S + \Delta S)[e^{(\rho_2 \pm \Delta p2)(t_2 - \frac{1}{365})} - e^{(\rho_1 \pm \Delta p1)(t_1 - \frac{1}{365})}]$.

So it has been assumed, during a day, a variation of the underlying of $\pm\Delta S$, a variation of interest rates of $\pm\Delta\rho_1$ and $\pm\Delta\rho_2$; moreover a day from the time to maturity has been subtracted.

Formalizing, the variation of the calendar spread is defined below and indicated as the Mathematical Future Straddle Unit Margin.

The mathematical Future Straddle Unit Margin SPR_{ij} for each pair of maturities i and j is given by the following formula:

$$\Delta SPR_{ij} = SPR_i - SPR_j = (S \pm \Delta S)\left[e^{(\rho_j \pm \Delta\rho_j)\left(t_j - \frac{n}{365}\right)} - e^{(\rho_i \pm \Delta\rho_i)\left(t_i - \frac{n}{365}\right)}\right] - S(e^{\rho_j t_j} - e^{\rho_i t_i})$$

Where S is the last available price in the time series of the underlying prices; ΔS is the current Margin Interval for the underlying instrument; ρ_i e ρ_j are the yield applicable respectively to *i-th* and *j-th* Futures maturity; t_i e t_j are times to maturities; $\Delta\rho_i$e $\Delta\rho_j$ are the n-th maximum variations selected by using system parameters.

The next step consists of determining the greatest Mathematical Future Straddle Unit Margin as the maximum value among those calculated for each couple of maturities.

$$\Delta SPR_{ij} = \{Max(\Delta SPR_{ij}); \forall i, \forall j, i \neq j\}$$

The resulting Future Straddle Unit Margin is then multiplied by the multiplier in order to obtain Future Straddle Margin.

2.4.1.2. Determining Applicable Bid-Ask Spread

The applicable Bid-Ask spread is determined comparing the last available underlying prices with the Market Maker table associated to each underlying.

Table 2.2: Bid-Ask Spread for Market Makers - Example

Bid Ask spread table- n°1		
Price from	to	Spread
0	4	0,02
4,01	10	0,04
10,01	20	0,1
20,01		0,015

The Applicable Bid-Ask Unit Spread must be then multiplied by the multiplier associated with the instrument to get the Applicable Bid-Ask Spread.

2.4.2. Straddle Correlation Methodology

The aim of the Straddle Margin is to determine the greatest daily variation, reasonably possible, between the difference of futures prices F_i and F_j (calendar spread) having different maturities occurred in a day, and the same difference (calendar spread) on the following day.

The calculation methodology used to determine the margin on the basis of time series correlations (measured with the Div/Undiv index) of the maturity pairs for each single underlying is the following:

$$Future\ Straddle\ Margin = (1 - Correlation\ Parameter) \times Initial\ Margin\ Amount$$

where

$$\begin{aligned} &Initial\ Margin\ Amount \\ &\quad = Futures\ Price\ of\ the\ Reference\ Maturity^{5} \\ &\quad \times Margin\ Interval\ of\ the\ Reference\ Maturity\ \times Multiplier \end{aligned}$$

$$Correlation\ Parameter = \min Div/Undiv[Futures\ Maturities]$$

The $Div/Undiv[Futures\ Maturities]$ is the matrix that contains all the values of the Div/Undiv index calculated for each maturity pair of the futures

The Div/Undiv is calculated with the following formula:

$$Div/Undiv = 1 - \frac{\sqrt{\sigma_a^2 + \sigma_b^2 - 2\sigma_a\sigma_b\rho_{ab}}}{|\sigma_a + \sigma_b|}$$

Where $\sigma_a$and σ_b are the standard deviations of the prices of the two futures maturities considered and ρ_{ab} is the correlation coefficient.

The Straddle Margin calculated is used for all the Future Spread positions on the same underlying.

2.5. Minimum Initial Margin

The Minimum Initial Margin is calculated by multiplying these four factors:

- Current Margin Interval

[5] The reference maturity is the first one since it is the most liquid and therefore the one with the most reliable prices

- Multiplier
- Last available price
- 4%

2.6. Margin Intervals and Additional Margin changes

The final set of parameters may differ from mathematical values in case of highly volatile markets, when a smoother recalibration may be deemed more appropriate in order to avoid pro-cyclical effects while keeping target levels of margin coverage.