

Fixed income - Margins Manual (MVP)

Manual

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EURONEXT CLEARING

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Foreword

This document describes the MVP methodology to calculation of Initial Margins on cash and repo (both «Classic», and «Sell-BuyBack»¹) bond transactions executed on Bonds Markets, for which Euronext Clearing acts as Central Counterparty.

In particular, MVP is a SPAN-like methodology applicable to Fixed Income Section bond instruments not represented by government bonds issued by Italy, Spain, Ireland and Portugal.

To government bonds issued by Italy, Spain, Ireland and Portugal the VaR-based margin methodology FIRE² (Fixed Income Risk Engine) applies.

The following types of Initial Margins are foreseen:

1. **Mark-To-Market Margins**, which re-evaluate daily the portfolio to the market;
2. **Additional Margins**, which evaluate the largest possible loss under the hypothesis of portfolio liquidation in the most unfavourable price/yield scenario reasonably possible.

The Margin calculation is separated for each settlement currency of the cleared instruments. Mark-To-Market Margins, Additional Margins and Initial Margins have to be separately calculated for each settlement currency. Initial Margins separately calculated must be then converted in Euro at the related exchange rate; the haircut applied to convert in Euro will depend on the specific currency. Total Initial Margins are the sum of all the converted Initial Margins.

¹ between «Classic» and «Sell-BuyBack» Repos is in the management of coupons paid during the transaction. In «Classics», coupons paid on the bond during the term of the transaction are required to be paid on to the original seller upon receipt. Whereas in «Sell-BuyBacks» coupons are deemed to be paid to the buyer and reinvested at the repo rate until the termination of the transaction. The coupon amount plus the interest accrued from coupon payment date to transaction settlement date is then deducted from the cash to be received at the termination date.

² For further details ref to the following documents available into website: module A1 - mark-to-market margins; module A2 - initial margins; module A3 - decorrelation risk add-on; module A4 - idiosyncratic-concentration risk add-on; module A5 - repo-concentration risk add-on; module A6 - settlement risk add-on; module A7 - final margins.

a) Calculation of Mark-To-Market Margins

Here below is detailed the methodology for computing the *Mark-to-market Margin* for the Clearing Members with outstanding positions at the evaluation date on the *Fixed Income* Section.

In particular, all positions are assigned to the *cash*, *repo* and *forward starting repo* categories according to their particular contractual features. Each of the aforementioned categories implies the adoption of a different calculation methodology of the *Mark-to-market Margin*.

In order to allocate the contracts in the *cash*, *repo* and *forward starting repo* categories, the following should be observed:

1. *cash* positions consist of all *spot* bond purchase contracts whose settlement has still to take place (usually these positions settle in *two* business days after the *trade date*);
2. *repo* positions consist of all *spot vs term* trades (*repurchase agreements*) whose *spot leg* has already settled and *term leg* has yet to settle;
3. *forward starting repo* positions consist of all *repos* whose *spot leg* and *term leg* have both yet to settle.

The calculation methodology of the *Mark-to-market Margin* applies to all types of securities subject to margining.

Mark-to-market Margin of a cash position

The *Mark-to-market Margin* of a **cash position** is a function of the following components:

- 1) market price of the traded bond at evaluation date;
- 2) original settlement price of the bond;
- 3) accrued interest of the bond at original settlement date;
- 4) principal of the position in bond;
- 5) position sign (+ : *long* / - : *short*).

The *Mark-to-market Margin* calculation formula is:

$$(1) \text{MtM}_{\text{margin}} = N * \left(\frac{P_{\text{market}} + \text{AI}_{\text{SD}}}{100} - \frac{P_{\text{trade}} + \text{AI}_{\text{SD}}}{100} \right) * \text{ps},$$

with N: principal; P_{market} : market price at evaluation date (i.e. p_2); P_{trade} : original settlement price (i.e. p); AI_{SD} : contractual accrued interest;³ ps: position sign (+ : *long* / - : *short*).

³ The accrued interest is computed for *cash* positions at *settlement date* and not at evaluation date since the difference between the two is considered negligible (*cash* positions usually settle 2 days after the trade date).

In particular, $\frac{P_{\text{trade}} + AI_{SD}}{100} * N$ is the contractual traded amount; in the original contract it is also available the principal of the position N . P_{market} is directly available from the market, while AI_{SD} is computed by employing the last coupon date, the *settlement date* and the next coupon date.

Mark-to-market Margin of a repo position

In order to compute the *Mark-to-market Margin* for *repo* positions, besides the difference in bond prices p (*trade date*) and p_2 (*evaluation date*), it is thus necessary to estimate the *repo rate* of the *closing repo trade* in t (*evaluation date*). After having estimated this quantity, one can compute the corresponding *repo interest R2* and finally the *Mark-to-market Margin*.

The steps in the estimation of the *repo rate* of the *closing repo trade* carried out by the CCP in t are the following:

- a) retrieve the *OIS/EONIA spot curve*⁴ at *trade date*;
- b) compute the duration of the *original repo trade*;
- c) find on the *OIS/EONIA spot curve* the *tenor* corresponding to the duration of the *original repo trade*;
- d) find the *rate* corresponding to the *tenor* on the *OIS/EONIA spot curve* corresponding to the duration of the *original repo trade*;
- e) compute the *original OIS spread* as the difference between the *original repo rate* (hereinafter also *repo rate 1*) and the *OIS rate* corresponding to the *tenor* on the *OIS/EONIA spot curve* corresponding to the duration of the *original repo trade*;
- f) retrieve the *OIS/EONIA spot curve* at *evaluation date t*;
- g) compute the duration of the *closing repo trade*;
- h) find on the *OIS/EONIA spot curve* the *tenor* corresponding to the duration of the *closing repo trade*;
- i) find the *rate* corresponding to the *tenor* on the *OIS/EONIA spot curve* corresponding to the duration of the *closing repo trade*;
- j) compute the *closing repo rate* (hereinafter also *repo rate 2*) as sum of the *OIS rate* corresponding to the *tenor* on the *OIS/EONIA spot curve* corresponding to the duration of the *closing repo trade* and the *original OIS spread*.

The *repo rate* of the post-default *closing repo trade* is thus calculated by adding the *spread* of the *original repo rate* with respect to the *trade date* risk-free *OIS/EONIA spot curve* on top of the *evaluation date t OIS/EONIA spot curve*, taking into account the different duration of the *closing repo trade* with respect to that of the *original* one (i.e. the reference *tenor* will be different as $t > \text{trade date}$)⁵.

Once *repo rate 2* has been computed, it is possible to compute *R1* and *R2* as follows:

⁴ Bootstrapped from *EONIA par swap rates*.

⁵ In case the (*original/closing*) *repo trade* maturity doesn't match any particular *tenor* of the *OIS/EONIA spot curve*, it is necessary to linearly interpolate rates in order to obtain the proper *OIS rate*.

$$(2) R1 = \frac{(\text{term_date} - \text{spot_date})_{\text{days}} * \frac{P_{\text{trade}} + AI_{\text{SSD}}}{100} * N * \text{repo_rate_1}}{36000};$$

$$(3) R2 = \frac{(\text{term_date} - t)_{\text{days}} * \frac{P_{\text{market}} + AI_{E1D}^6}{100} * N * \text{repo_rate_2}}{36000};$$

with *repo rate 1* and *repo rate 2*: *original* and *closing repo rates* computed following above steps a)-j).

Once *R1* e *R2* have been computed, it is possible to compute the *Mark-to-market Margin*. However, one has to bear in mind that both the differences in prices and repo rates are effective at *settlement date* of the *original repo trade term leg*: discounting (as $t \leq \text{term date}$) the respective amounts is therefore necessary.⁷

$$(4) \text{MtM}_{\text{margin}} = (N * \left(\frac{P_{\text{market}} + AI_{E1D}}{100} - \frac{P_{\text{trade}} + AI_{\text{SSD}}}{100} \right) - (R1 - R2)) * \text{OIS}_{\text{discount_factor}} * ps,$$

with $\text{OIS}_{\text{discount_factor}}$: *OIS/EONIA discount factor* from *term date* to evaluation date *t*, computed according to the following steps:

- compute *term date* – *t* in year fractions;
- linearly interpolate from *OIS rates* at evaluation date *t* to obtain the *OIS rate* corresponding to *tenor term date - t*;
- turn the obtained *OIS rate* into the *OIS discount factor* by employing the following

$$\text{formula: } \text{OIS}_{\text{discount_factor}} = \frac{1}{(1 + \text{OIS_rate}/100)^{\frac{(\text{term_date}-t)}{365}}}$$

Mark-to-market Margin of a forward-starting repo position

In light of what outlined in the previous sections, the *Mark-to-market Margin* for *forward starting repo* positions is computed as follows⁸:

$$(5) \text{MtM}_{\text{margin}} = ((N * \left(\frac{P_{\text{market}} + AI_{\text{SSD}}}{100} - \frac{P_{\text{trade}} + AI_{\text{SSD}}}{100} \right)) * (\text{OIS}_{\text{df2}} - \text{OIS}_{\text{df1}}) - (R1 - R2) * \text{OIS}_{\text{df2}}) * ps ,$$

with OIS_{df1} and OIS_{df2} computed according to the following steps:

⁶ AI_{SSD} represents the accrued interest at *spot leg settlement date* while AI_{E1D} represents the accrued interest at evaluation date + 1 business day.

⁷ The same should apply to *cash* positions, however in that case the time lag between evaluation date and *settlement date* is always negligible.

⁸ In this case accrual interests are computed at SSD (*spot settlement date*) also for both the market price component and the *R2* component. This is due to the fact that, unlike *repos*, the *spot leg* has yet to settle and a hypothetical close out *repo* would settle with accruals defined at *spot settlement date*. For the same reason, *R2* component for *forward starting repos* accrues for the entire trade duration (*term – spot*)days.

- a) compute *term date* - *t* in year fractions;
- b) linearly interpolate from *OIS rates* at evaluation date *t* to obtain the *OIS rate 2* corresponding to *tenor term date - t*;
- c) turn the obtained *OIS rate 2* into the *OIS discount factor 2* by employing the following formula:
$$\text{OIS}_{df2} = \frac{1}{(1+\text{OIS_rate_2})^{\frac{(\text{term_date}-t)}{365}}};$$
- d) compute *spot date* - *t* in year fractions;
- e) linearly interpolate from *OIS rates* at evaluation date *t* to obtain the *OIS rate 1* corresponding to *tenor spot date - t*;
- f) turn the obtained *OIS rate 1* into the *OIS discount factor 1* by employing the following formula:
$$\text{OIS}_{df1} = \frac{1}{(1+\text{OIS_rate_1})^{\frac{(\text{spot_date}-t)}{365}}}.$$

Treatment of Inflation-linked bonds (Linkers)

Inflation-linked bonds (linkers) are bonds whose coupons and nominal amount are re-evaluated based on the trend of a specific inflation index⁹. In particular

The same logic outlined in the previous paragraphs for the calculation of the *Mark-to-Market Margins* still applies. However, formulas must be amended as follows:

Cash positions – Mark-to-Market Margins:

$$(6) \text{MtM}_{\text{margin}} = N * \left(\frac{P_{\text{market}} + \text{AI}_{\text{ED}}}{100} * \text{CI}_{\text{ED}} - \frac{P_{\text{trade}} + \text{AI}_{\text{TD}}}{100} * \text{CI}_{\text{TD}} \right) * \text{ps};$$

Repo positions – Mark-to-Market Margins:

$$(7) \text{MtM}_{\text{margin}} = (N * \left(\frac{P_{\text{market}} + \text{AI}_{\text{ED}}}{100} * \text{CI}_{\text{ED}} - \frac{P_{\text{trade}} + \text{AI}_{\text{TD}}}{100} * \text{CI}_{\text{TD}} \right) - (R1-R2)) * \text{OIS}_{\text{discount_factor}} * \text{ps};$$

Forward starting repo positions – Mark-to-Market Margins:

$$(8) \text{MtM}_{\text{margin}} = ((N * \left(\frac{P_{\text{market}} + \text{AI}_{\text{ED}}}{100} * \text{CI}_{\text{ED}} - \frac{P_{\text{trade}} + \text{AI}_{\text{TD}}}{100} * \text{CI}_{\text{TD}} \right)) * (\text{OIS}_{df2} - \text{OIS}_{df1}) - (R1-R2) * \text{OIS}_{df2}) * \text{ps},$$

where $\frac{P_{\text{trade}} + \text{AI}_{\text{TD}}}{100} * \text{CI}_{\text{TD}}$ is directly retrievable from the contract, while CI_{ED} must be computed following the steps below:

⁹ Currently, only the following *linkers* are subject to margining according to the methodology: *BTP Italia*: Italian treasuries indexed to Italian ex-tobacco inflation (FOI); *BTP€i*: Italian treasuries indexed to European ex-tobacco inflation (CPTFEMU).

Base index definition:

Inflation-linked bonds (CPTFEMU):

Assuming the *issue date* of the *linker* is the 4th of May 2017, the two relevant dates for computing the *base index* are March 2017 (2 months earlier than the *issue date*) and February 2017 (3 months earlier than the *issue date*).

Consider the following CPI (FOI or CPTFEMU depending on the *linker*) time series:

| Date | CPI |
|-----------|--------|
| 02 - 2017 | 100,77 |
| 03 - 2017 | 101,59 |

The *base index* at *issue date* (4th of May 2017) is computed according to the following formula:

$$(9) \text{base}_{\text{index}} = \text{index}_{m-3} + \frac{(d-1)}{\text{days_month}} * (\text{index}_{m-2} - \text{index}_{m-3}),$$

with index_{m-2} : 101,59; index_{m-3} : 100,77; $d-1$: *issue date*-1 day (in this case equal to 3) and days_month : number of days in the *issue month* (in this case equal to 31).

Inflation-linked bonds (FOI):

For Italian linkers the same as described above is applied, with the exception that instead of the issuance date of the bond the last coupon date previous to the evaluation date is considered.

Current index definition:

In order to compute the *current index* it is necessary to employ formula (9) with d : *settlement* / evaluation date + 1 business day (settlement date for *cash* trades and evaluation date + 1 business day for *repo* trades). The reference data for index_{m-2} and index_{m-3} is in this case the date which is 2 months / 3 months respectively prior to evaluation date + 1 business day.

Inflation coefficient CI_{E1D} definition:

$$CI_{E1D} = \frac{\text{current}_{\text{index}}}{\text{base}_{\text{index}}}$$

Calculation of the Overall Mark-To-Market Margin for each single currency

The Overall Mark-To-Market Margin is equal to the sum of all the Mark-To-Market Margins calculated for each transaction.

Overall Mark-To-Market Margins = Σ Mark-To-Market Margins per each transaction.

A negative Mark-To-Market Margin is a debit for the member towards the CCP; a positive Mark-To-Market Margin is a theoretical credit for the member.

b) Calculation of Additional Margins

The methodology is based on the following steps:

Selection, evaluation and classification of transactions to be included in Additional Margins calculation

A. Selection of transactions

The following positions are evaluated:

1. For cash transactions, all unsettled transactions at Initial Margin calculation date;
2. For repo transactions, all transactions whose "cash" leg has already been settled and its "forward" leg is still unsettled.

B. Transaction evaluation

In order to obtain a single net balance for each security (identified by its ISIN code), long and short² positions are algebraically summed (at their re-evaluated countervalue), independently of the transaction type (cash or repo) from which they have arisen.

C. Classification of portfolio securities

Corporate Bonds

Net positions in corporate bonds calculated at sub-step b) above are then divided in Classes, according to their time to expiry. The Classes are numbered from q to z.

Annex 1 provides an example of the classification.

Determination of marginable positions

In order to take into consideration the opposite sensitivity to interest rate variations of positions of different signs, positions are reduced by a procedure that – keeping into consideration correlations between securities sorted by Classes – determines the “Marginable Positions” that is the unbalanced positions on which margins must be calculated.

In order to achieve such aim, a sequence of offsetting priorities is determined according to a specific list (see [Annex 2 - Priority and Intra / Inter Class offset – Example](#)); positions are offset within the same Class (*Intra* Class Priority) and subsequently among different contiguous Classes (*Inter* Class Priority). A Cross-Position Offsetting Factor is associated to each Priority.

Therefore, according to the established priority sequence, long and short positions within the same class are decremented by an amount equal to the Cross-Position Offsetting Factor applied to the smaller of the two positions.

Decrement Long Position Class n = Long Position Class n - [priority n Cross-Position Offsetting Factor × min (Long Position Class n; Short Position Class n)]

Decrement Short Position Class n = Short Position Class n - [priority n Cross-Position Offsetting Factor × min (Long Position Class n; Short Position Class n)]

When Inter Class Priorities are considered, both the long and the short position of one Class is decremented of an amount equal to pertinent Inter Class Cross-Position Offsetting Factor applied to the smaller between the position itself and the position of opposite sign of the other Class.

Decrement Long Position Class n = Long Position Class n - [priority nm Cross-Position Offsetting Factor × min (Long Position Class n; Short Position Class m)]

Decrement Short Position Class n = Short Position Class n - [priority nm Cross-Position Offsetting Factor × min (Long Position Class m; Short Position Class n)]

Decrement Long Position Class m = Long Position Class m - [priority nm Cross-Position Offsetting Factor × min (Long Position Class m; Short Position Class n)]

Decrement Short Position Class m = Short Position Class m - [priority nm Cross-Position Offsetting Factor × min (Long Position Class n; Short Position Class m)]

For each Class the results obtained by the application of Priority *n* Cross-Position Offsetting Factor is the starting point for the application of Priority *n+1* Cross-Position Offsetting Factor.

Countervalues are rounded to the nearest unit before and after each calculation.

Annex no.2 provides an example of a priority list.

Calculation of Unadjusted Additional Margin

For each Class, long and short “Marginable Positions” – which have been obtained through the above-described procedure – are compared and the largest (in absolute value) among them is multiplied by a coefficient (Deposit Factor) specifically established for that Class.

Unadjusted Additional Margin per Class = Class Deposit Factor × Max (Long Marginable Position; Short Marginable Position)

The result is rounded to the nearest unit.

Unadjusted Additional Margins for each Class are then summed up in order to obtain the total Unadjusted Additional Margins:

Total Unadjusted Additional Margins = Σ Unadjusted Additional Margin per each Class.

Adjusted Additional Margins

Unadjusted Additional Margins as per step Calculation of Unadjusted Additional Margin above are multiplied by an *Adjustment Factor*, whose value can be set at member level, in order to obtain *Adjusted Additional Margins*.

Adjusted Additional Margins = Unadjusted Additional Margins × Adjustment Factor

Adjusted Additional Margins are rounded to the nearest unit.

All Additional Margins are always indicated with a positive sign

c) Calculation of Initial Margins for each single currency

Initial Margins for each single currency are equal to the sum of Mark-To-Market Margins and Additional Margins related to the same currency. Should the amount Mark-To-Market Margins credit be larger than the amount of Additional Margin debits, Initial Margins separately calculated are set to zero.

Initial Margins separately calculated = Min (Mark-To-Market Margins – Adjusted Additional Margins; 0)

d) Calculation of Initial Margins in Euro

Initial Margins separately calculated must be then converted in Euro at the related exchange rate; the haircut applied to convert in Euro will depend on the specific currency:

Initial Margins € = Initial Margins separately calculated * ER * (1+H)

For each member, Total Initial Margins are the sum of all of the converted Initial Margins.

If Total Initial Margins are a debit for the member, calculation of Total Initial Margins can provide the following results:

- a) if Total Initial Margins are larger than Total Initial Margins collected the previous day, members are compelled to deposit the difference;
- b) if Total Initial Margins are smaller than the Total Initial Margins collected the previous day, the excess may be withdrawn by the member.

e) Determination of parameters

The parameters used by the Margins Calculation Procedure are periodically revised and, if the case, updated in order to keep into account market conditions, volatility trends and the evolution of financial instruments.

The parameters subject to periodical revision are:

- Number of Classes;
- Cross-Position Offsetting Factor;
- Deposit Factor;
- Adjustment Factor (at member level);
- Class "Borders";
- Priority List;
- Increasing Percentage (for fail positions).

Annex 1 - Classification and Deposit Factor – Example

TITOLI CORPORATE

| Classe | Vita residua | Unità | Classe | Intervallo del margine |
|--------|--------------|-------|--------|------------------------|
| XXXI | (0-3] | years | XXXI | 9,00% |
| XXXII | (3-5] | years | XXXII | 11,00% |
| XXXIII | (5-7] | years | XXXIII | 13,00% |
| XXXIV | (7-10] | years | XXXIV | 17,00% |
| XXXV | >10 | years | XXXV | 30,00% |

Annex 2 - Priority and Intra / Inter Class offset – Example

CORPORATE BONDS

| Class | Intraclass Offset |
|--------|-------------------|
| XXXI | 5% |
| XXXII | 5% |
| XXXIII | 5% |
| XXXIV | 5% |
| XXXV | 5% |

Annex 3 - Initial Margin Calculation of Fail Positions

Even for failed positions (like as for the ordinary ones), the Margin Calculation is separated for each settlement currency.

Fail positions for the counterparty *in bonis*, are margined for each single currency, with the same methodology described above, keeping these positions segregated from the ordinary ones.

To fail positions for the counterparty *in malis*, an increasing percentage on margins for each day of fail is applied. Therefore cannot be reduced as described in Determination of marginable positions (neither inter Class nor intra Class) but are margined one by one independently from other positions in the same Class. Unadjusted Additional Margins, calculated as explained in Calculation of Unadjusted Additional Margin, must be multiplied by an Increasing Percentage (parametric and equal for all fail positions independently from their Class) applied for each day of fail:

Unadjusted Additional Margin per fail transaction = (Class Deposit Factor × TRA) + (Class Deposit Factor × TRA × Increasing Percentage × number of days of fail)

In case of more of one fail on the same security in consecutive days the Increasing Percentage is applied for the number of days pertinent to each part of the fail for the counterparty *in malis*:

e.g. on the day F there is a fail on the security A for 1,000, with an Increasing Percentage of 10% a Deposit Factor of 0,10%:

Unadjusted Additional Margin per fail transaction = (0,10% × 1.000) + (0,10% × 1.000 × 10% × 1)

If the next day the net fail position on the security A is 2,500, the Increasing Percentage is applied as follows:

Unadjusted Additional Margin per fail transaction = ((0,10% × 1.000) + (0,10% × 1.000 × 10% × 2)) + ((0,10% × 1.500) + (0,10% × 1.500 × 10% × 1))

The result is rounded to the nearest unit. No increasing Percentage is applied to the counterparty *in bonis*.

In the calculation of the TRA the accrued coupon is not re-evaluated for the days of the fail; the same is also for Repo that are considered, in case of fail, at the same way of cash transactions.

Moreover, in case of fail for Repo, the cash leg (that is so margined only in case of fail) is margined separately and distinctively from the forward leg at the same way of two different cash transactions.

The Total Unadjusted Additional Margins for failed positions separately calculated are equal to the sum of Unadjusted Additional Margins for failed positions separately calculated and of Unadjusted Additional Margins for failed positions separately calculated:

Even for failed positions (like as for the ordinary ones), Initial Margins separately calculated must be then converted in Euro at the related exchange rate; the haircut applied to convert in Euro will depend on the specific currency.

Initial Margins € = Initial Margins separately calculated * (1+H) * ER

Total Initial Margins for failed positions are the sum of all of the converted Initial Margins for failed positions.

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