15, May 2024

Risk department
LCH SA

Contingent Variation Margin

The Contingent Variation margin aims to cover the CCP against market value losses (i.e. difference between the current market price and the transaction price of the security).

The calculation is based on the following steps:

1. Retrieval of market data
2. Selection of Trade Legs to be included in calculation of Contingent Variation Margins
3. Calculation of the accrued coupon
4. Determination of Repo Interests
5. Determination of the Mark to Market Repo Rate
6. Determination of Transaction Revaluated Amount
7. Calculation of Contingent Variation margin per transaction
8. Calculation of the Overall Contingent Variation Margin

1. Retrieval of market data

The following market data are obtained through data provider:

- Daily ESTR rate is retrieved at 9:00 am (Paris Time) from the European Central Bank.
- Euribor rates are obtained in the morning (Paris Time) from the European Banking Federation.
- the ESTR swap rates are obtained at cob from Reuters.

The rates used in the calculation are obtained by linear interpolation between the two closest knot points of the reference yield curve.

2. Selection of trade legs

The following positions are evaluated:

a. For sell and purchase Transactions, all unsettled Trade Legs at the Margin calculation date;
b. For repo transactions (including €GCPlus repo), all transactions whose 2nd leg is still unsettled.
c. For €GCPlus allocations, all allocations on VEB.

3. Calculation of the accrued coupon

The time interval to be considered in coupon accrual calculation changes according to the type of contract:

For cash transactions, the accrued coupon is calculated from the last coupon date to the settlement/delivery date.

For Repo transactions and €GCPlus allocations, the accrued coupon is calculated from the last coupon payment date to the first business day following the calculation date.

4. Determination of Repo interest

The repo interest of the transaction (RI) between the repo starting date and the maturity date is given by the following formula:

$$RI = \frac{T \times TA \times RR}{360 \times 100}$$

with

T the number of days between the starting date and the maturity date of the repo transaction,

TA the initial traded amount,

$\frac{RR}{100}$ the repo rate of the transaction in %.

- Indexed rate repos

In this case, RR is given by the following formula:

$$\frac{RR}{100} = \frac{(t+1) \times e_a}{T} + \frac{(T-t-1) \times e_s}{T} + s$$

With

t the number of calendar days between the starting date and calculation date $t \in [\![0; T-1]\!]$, (this statement applies to the entire document)

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e_a the average of the ESTr rate (in %) between the starting date and one business day after the calculation date

e_s the ESTr Swap Rate (in %) between one business day after the calculation date and maturity date.

s the negotiated spread of the repo (in %)

The Repo interest amount is rounded to the nearest integer Euro.

5. Determination of the Mark-To-Market Repo Rate

$\frac{RR'}{100}$ the Mark-To-Market repo rate (in %) between the calculation date plus one business day and the maturity date

RR' is estimated by linear interpolation of the Repo Rate curve.

6. Determination of the Transaction Revaluated Amount

- **Cash Bond and Repo transactions and €GCPlus allocations**

The Transaction Revaluated Amount (TRA) is equal to the nominal value (NV) of the traded security, revaluated at the settlement price (P), plus the accrued coupon (AC), multiplied by the mark to market repo rate on the time period remaining for the underlying transaction.

$$\mathbf{TRA} = \mathbf{NV} \times \left(\frac{\mathbf{P} + \mathbf{AC}}{\mathbf{100}}\right) \times \left(\mathbf{1} + \frac{\boldsymbol{RR'} \times (\boldsymbol{T} - \boldsymbol{t} - \mathbf{1})}{\mathbf{360} \times \mathbf{100}}\right)$$

- **Inflation bond index transactions**

In case of bond indexed on inflation rate, the Transaction Revaluated Amount (TRA) is equal to the nominal value (NV) of the traded security, revaluated at the settlement price (P), plus the accrued coupon (AC), multiplied by the mark to market repo rate on the time period remaining for the underlying

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transaction. This amount is multiplied by the inflation index Iidx available for the intended settlement date:

- LCH SA uses always the inflation factor of the day of the margin call (for both cash and repo transactions), which is the first working day after the calculation date.

The TRA is calculated as follows:

$$\mathbf{TRA} = \mathbf{NV} \times \left(\frac{\mathbf{P} + \mathbf{AC}}{\mathbf{100}}\right) \times \left(\mathbf{1} + \frac{\boldsymbol{RR'} \times (\boldsymbol{T} - \boldsymbol{t} - \mathbf{1})}{\mathbf{360} \times \mathbf{100}}\right) \times \mathbf{Iidx}$$

7. Calculation of Contingent Variation Margin per transaction

The Contingent Variation Margin is given by the following formula.

a) For cash transactions and €GCPlus allocations:
b)

$$\boldsymbol{Contingent\ Variation\ Margin} = \frac{\boldsymbol{TRA} - \boldsymbol{TA}}{\mathbf{1} + \frac{\boldsymbol{r} \times (\boldsymbol{T} - \boldsymbol{t} - \mathbf{1})}{\mathbf{360}}} \times \boldsymbol{sgn}$$

c) For repo transactions: Both Classic repos and Buy-Sell Back are considered separately.

- Classic Repo Transactions (includiing €GCPlus repos):

$$\boldsymbol{Contingent\ Variation\ \ Margin} = \frac{\boldsymbol{TRA} - \boldsymbol{TA} - \boldsymbol{RI}}{\mathbf{1} + \frac{\boldsymbol{r} \times (\boldsymbol{T} - \boldsymbol{t} - \mathbf{1})}{\mathbf{360}}} \times \boldsymbol{sgn}$$

With

$\boldsymbol{r}$ the Ester swap rate (in %) between the calculation date and the maturity date of the repo.

$\boldsymbol{sgn}$ +1 for the holder of a repo (sell bond spot and buy it back forward),

-1 for the holder of a reverse repo (buy bond spot and sell it back forward).

- Buy-Sell Back Repo Transactions:

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By definition of a Buy-Sell Back transaction, a corrective term should be considered in the valuation of the second cash leg. This additional term corresponds to the sum of all the coupons capitalization between the coupon payment dates and the maturity date of the transaction.

Regarding the initial transaction, this corrective term ($\boldsymbol{C_0}$) will consider all the coupons that will drop between the first working day after the settlement date of the first leg and the maturity of the transaction. These coupons are capitalized using the initial repo rate RR.

$$\boldsymbol{C_0 = \sum_i C_i \times \left(1 + \frac{RR \times (T - t_i)}{360 \times 100}\right)}$$

With

$(\boldsymbol{T - t_i})$ the number of days from the coupon payment date to the settlement date of the second leg.

$\boldsymbol{C_i}$ the ith coupon

Regarding the revaluated transaction, this corrective term ($\boldsymbol{C'}$) will consider only the upcoming coupons that will drop between the first working day after the calculation date and the maturity of the transaction. These coupons are capitalized using the Mark-To-Market repo rate RR'.

$$\boldsymbol{C' = \sum_j C_j \times \left(1 + \frac{RR' \times (T - t_j)}{360 \times 100}\right)}$$

With

$\boldsymbol{(T - t_j)}$ the number of days from the coupon payment date to the settlement date of the second leg.

$\boldsymbol{C_j}$ the jth coupon

As a result:

$$\boldsymbol{Contingent\ Variation\ Margin = \frac{TRA - C' - (TA - C_0 + RI)'''}{1 + \frac{r \times (T - t - 1)}{360}} \times sgn}$$

With

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r the Euribor rate (in %) between the calculation date and the maturity date of the repo.

sgn +1 for the holder of a repo (sell bond spot and buy it back forward),

-1 for the holder of a reverse repo (buy bond spot and sell it back forward).

8. Overall Contingent Variation margin

The Overall Contingent Variation Margin is equal to the sum of the Contingent Variation Margins on all transactions.

$$\textbf{Overall Contingent Variation Margin} = \sum_{i} \textbf{Contingent Variation Margin}_{i}$$

where a negative Contingent Variation margin is a debit for the member towards the CCP;
a positive Contingent Variation margin is a theoretical credit for the member.

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