Circular C-IRS-05/2023

Procedure for Initial Margin Calculation

BME CLEARING

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Details on procedure for Initial Margin Calculation. Modified due to the discontinuation of the EONIA Benchmark.

This Circular implements the Article regarding "Margins required by BME CLEARING" of the Rule Book and Article 2.10 of the General Conditions, defining the calculation of the Initial Margin (IM), part of the Margin that BME CLEARING demands for open Positions.

BME CLEARING requires that each Clearing Member shall update its Initial Margin on a daily basis. The Initial Margin is calculated at the margin account level.

The IM consists of the following:

1. Base IM Calculation
2. Risk Multiplier
3. Adjustment for position size

The steps for calculating the Initial Margin are given below.

1. Base IM Calculation

The Base IM is calculated as the highest value calculated with the Historical Value-at-Risk method and the Expected Shortfall method. These methods entail calculating the expected loss on a portfolio over a specific time horizon, assuming a certain confidence level.

The historic data to be calculated on the basis of zero coupon interest correspond to **Number of Sessions to Use**, as defined in the Circular "Parameters for calculating Initial Margin". One figure per session will be available for each of the following reference zero coupon curves.

Reference	Term
Euro STR	1, 2 days, 1, 2, 3 weeks, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 18, 21 months, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 20, 25, 30, 40 and 50 years
EURIBOR 1M	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 18, 21 months, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 20, 25, 30, 40 and 50 years
EURIBOR 3M	3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 18, 21 months, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, 20, 25, 30, 40 and 50 years
EURIBOR 6M	6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18 months, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, 20, 25, 30, 40 and 50 years
EURIBOR 12M	12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23 months, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, 20, 25, 30, 40 and 50 years

1.1.M calculation via Historic Value at Risk (H-VaR)

The algorithm for calculating the IM using the Historic VaR (H-VaR) method comprises the following steps:

1.1.1. Creation of the returns chart

On the basis of a historic chart of zero coupon rates of the **Number of Sessions to Use**, the variation is calculated for each zero coupon rate reference and the term between the date "T" and the date "T minus **MPOR**", where **MPOR** is the parameter defined in the Circular "Parameters for calculating Initial Margin". The variation is expressed in basis points (bp). That is, 1 bp corresponds to 0.01%.

The zero coupon rate return for each benchmark (for each of the 5 curves) and term s between the period t and t-MPOR is calculated as:

$$\mathrm{R_t^s} = \mathrm{ZR_t^s} - \mathrm{ZR_{t-MPOR}^s}$$

Where:

- R_t^s: zero coupon rate return according to reference and term s on date t, expressed in bp.
- ZR_t^s: zero coupon rate return according to reference and term s on date t.
- $ZR_{t-\mathrm{MPOR}}^s$: zero coupon rate return according to reference and term s on date t-MPOR.

A historical series of the last **Number of Sessions to Use less MPOR** is obtained, corresponding to the returns for each zero rate reference and term, where all data is of equal weight, irrespective of the time of occurrence.

1.1.2. Creation of Delta-Gamma sensitivities

A Delta-Gamma sensitivities table is built based on the zero rates of the 5 curves considered in order to reduce the computer calculation time. This table contains a Delta value and a Gamma value for each Position of each Member and margin Account and in each reference and term, to be used to calculate the *Historical VaR* and the *Expected Shortfall* of the portfolio.

The Delta value indicates how a portfolio's NPV changes due to minor zero rate shifts. It represents the increase in the portfolio's NPV due to an infinitesimal fluctuation in the value of the zero rate curve for a given term.

The Gamma offers information on how the Delta changes due to small shifts in the zero rate, where the latter arises from the fluctuation in the NPV from the infinitesimal change in the zero rate curve. It represents the non-linearity of the NPV fluctuation with respect to the zero rate curve.

The Delta and the Gamma are calculated with exact analytical formulas obtained from valuation formulas of each product through partial derivatives.

1.1.3. Calculation of Delta and Gamma of Analysed Scenarios, Calculation of Gains and Losses and Selection of Worst-Case Scenarios.

Based on the Delta-Gamma above, the gains/losses of the portfolio of each margin Account for each of the Analysed Scenarios is estimated. That is, the sum total of gains/losses that is generated individually by each reference and term in the total portfolio for each scenario. This calculation is carried out for each curve and is defined as:

$$\mathrm{P\&}G_{\mathrm{i}} = \sum_{\mathrm{s}=1}^{\mathrm{n}} \left(\partial_{\mathrm{s}} \mathrm{R}_{\mathrm{i}}^{\mathrm{s}} + \frac{\gamma_{\mathrm{s}}}{2} (\mathrm{R}_{\mathrm{i}}^{\mathrm{s}})^2 \right)$$

Where:

- $P\&G_i$: This is the portfolio gain or loss for scenario i (i=1, ….Number of Analysed Scenarios)
- ∂_s: Portfolio Delta according to reference and term s.
- R_i^s: Return obtained in section 1.1.1 according to reference and term s for scenario i (i=1, …, Number of Analysed Scenarios), expressed in bp.
- γ_s: Portfolio Gamma according to reference and term s.

Once the portfolio gains/losses for each of the Analysed Scenarios are calculated, **the Worst-Case Scenarios** are selected, that is, the scenarios with the most losses of each margin Account. The number of Worst-Case Scenarios is set in the Circular “Parameters for calculation of Initial Margin”.

1.1.4. NPV and VaR of Worst-Case Scenarios

With the Worst-Case Scenarios selected above, the portfolio is revaluated to obtain its NPV, with a modified zero rate curve. To obtain a modified zero rate curve, the fluctuations of the scenario i are added to or subtracted from the zero curve of the session at each term using the following formula:

$$\mathrm{ZR}_{\mathrm{i\,modified}}^{\mathrm{s}} = \mathrm{ZR}_{0}^{\mathrm{s}} + \mathrm{R}_{\mathrm{i}}^{\mathrm{s}}$$

Where:

- $ZR_{i\,modified}^{s}$: This is the modified zero rate according to reference and term s for scenario i (i=1, …, Worst-Case Scenario).
- ZR_0^s: This is the zero rate according to reference and term s at the time of revaluation.

- R_t^s: This is the return for the zero rate according to the reference and term s in the scenario i (i=1, …, Worst-Case Scenario), expressed in basis points.

Lastly, the Historical VaR is calculated with the **Confidence Level of the Historical VaR** stipulated in the Circular "Parameters for calculation of Initial Margin". Using this confidence level it could be generated the **Worst-Case Scenario with the Confidence Level of the Historical VaR**.

1.2.Expected Shortfall (ES) method of calculating IM

The algorithm for calculating the IM using the Historic VaR (H-VaR) method comprises the following steps:

1.2.1. Creation of the returns chart

The returns chart in the ES method is calculated in the same way as in section 1.1.1.

1.2.2. Adjustment of returns for current volatility

Historical volatility of the returns chart is calculated, obtaining a volatility figure for the reference and term for each of the scenarios obtained previously.

Historical volatility, σ, is calculated with the Exponentially Weighted Moving Average (EWMA) method:

- EWMA is a recursive method that places different weight on each observation, assigning greater weight to more recent observations.
- This weight is determined with a **Decay Factor**, represented by the Greek letter lambda (λ).
- BME CLEARING will use the Decay Factor set out in the Circular "Parameters for calculation of Initial Margin".

The resulting volatility is obtained from i) the volatility calculated on the previous business day weighted by λ and ii) the corresponding return on the calculation date weighted by 1-λ, as follows:

$$\sigma_t^s = \sqrt{\lambda\,(\sigma_{t-1}^s)^2 + (1-\lambda)(R_t^s)^2}$$

Where:

- σ_t^s: Typical deviation in time t for term s.
- $(\sigma_{t-1}^s)^2$: It is the variance in time t for term s.
- $(R_t^s)^2$: It is the return, calculated in 1.1.1., squared in time t for term s, expressed in bp.
- λ: This is the Decay Factor.

Volatility for the oldest scenario is calculated differently, as there is no reference to past values. As an exception, the calculation of volatility is based on the typical deviation of the last MPOR days (return between D and D-MPOR) and is calculated as:

$$\sigma^{s}_{\text{oldest scenario}-\text{MPOR}} = \text{abs}(\, ZR^{s}_{\text{oldest scenario}-\text{MPOR}} - ZR^{s}_{\text{oldest scenario}})$$

When the volatilities are calculated for each historic scenario according to the reference and term s, a volatility for each daily return obtained is added to the table in step 1.

Intraday calculations used the closing data from the previous session.

1.2.3. Creation of a scaled returns chart

The scenario table obtained in 1.2.1 is scaled with the volatilities obtained in 1.2.2. for each zero rate according to reference and term. This calculation is defined as:

$$R^{s}_{t,\text{escalada}} = R^{s}_{t}\frac{\frac{\sigma_0}{\sigma_t}+1}{2}$$

Where:

- $R^s_{t,scaled}$: This is the volatility-scaled return by reference and term s for scenario t.
- R_t^s: It is the return calculated in step 1.2.1, by reference and term s and scenario t.
- σ_0: It is the return calculated in step 1.2.2, by reference and term s and "t_0"=today.
- σ_t: It is the volatility calculated in step 1.2.2, by reference and term s and scenario t.

Intraday calculations used the closing data from the previous session.

1.2.4. Creation of Delta-Gamma sensitivities

The Delta-Gamma sensitivities table is the same as that calculated in section 1.1.2.

1.2.5. Calculation of Delta and Gamma of Analysed Scenarios Calculation of Gains and Losses and Selection of Worst-Case Scenarios

The calculation of Delta-Gamma and of gains and losses is identical to that carried out in section 1.1.3. It should be noticed, however, that although the algorithm and the formulas are the same as in section 1.1.3., in this case the returns used are the scaled returns calculated in 1.2.3. (instead of the returns calculated in 1.1.1. used in 1.1.3.). For this reason, the Worst-Case Scenarios of a method do not necessarily coincide with the Worst-Case Scenarios of the other method.

Once the portfolio gains/losses for each of the Analysed Scenarios are calculated, the Worst-Case Scenarios are selected: that is, those with the largest losses in each margin Account.

1.2.6. NPV of Worst-Case Scenarios and Expected Shortfall

With the Worst-Case Scenarios selected above, the portfolio is revaluated to obtain its NPV, with a modified and scaled zero rate curve. To obtain a modified and scaled zero rate curve, the fluctuations of the scenario i are added to or subtracted from the zero rate curve using the following formula:

$$\mathrm{ZR}^{s}_{\mathrm{i\,modified}} = \mathrm{ZR}^{s}_{0} + \mathrm{R}^{s}_{\mathrm{i\,scaled}}$$

Where:

- $ZR^{s}_{i\,modified}$: This is the modified and scaled zero rate according to reference and term s for scenario i (i=1,..., Worst-Case Scenario).
- ZR^{s}_{0}: This is the zero rate according to reference and term s at the time of revaluation.
- $R^{s}_{i\,scaled}$: It is the volatility-scaled return, calculated in 1.2.3, for the zero rate by reference and term s in the scenario i (i=1,..., Worst-Case Scenario), expressed in basis points.

Once the portfolio NPV in the 20 scenarios with the largest losses is calculated, the **Largest-Loss Scenarios** are selected, as defined in the Circular "Parameters for calculation of Initial Margin" and these are averaged, thus obtaining the Expected Shortfall.

1.3.Final Base IM Calculation

The value of the Base IM of each margin Account is the highest of the values obtained in steps 1.1.4. (Historical VaR) ad 1.2.6. (Expected Shortfall) multiplied by a factor $\sqrt{\frac{n}{5}}$, where n depends on the margin account type:

- Client margin Account: n= **MPOR CLIENT**, parameter set in the Circular "Parameters for calculation of Initial Margin".
- Clearing Member margin Account: n= **MPOR HOUSE**, parameter set in the Circular "Parameters for calculation of Initial Margin".

2. Solvency Multiplier

The **Solvency Multiplier** is a multiplication factor to be applied to the IM obtained in section 1.3 in all the margin Accounts of the analysed Clearing Member. This multiplier is determined on the basis of the solvency level granted by BME CLEARING to the Clearing Member. BME CLEARING sets the Solvency Multiplier in the Circular "Parameters for calculation of Initial Margin".

3. IM adjustment due to size of position

The adjustment of the IM to the size of the position is made when it is possible the market will encounter difficulties in absorbing the hedging transactions necessary to close the position of a member in default. The adjustment is quantified as follows. The Appendix contains a numerical example of the algorithm.

3.1 Calculation of Sensitivity of Member Portfolio

The basis is the sensitivity of each of the terms of the curve of the Clearing Member's portfolio 1 year, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22 and 23 months, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 20, 25, 30, 40 and 50 years.

This sensitivity follows the PV01 (value of one basis point) scheme, which is the impact on the Clearing Member's portfolio of a 1 bp parallel shift in the zero rates curve. PV01 is interpreted as follows:

- Negative PV01 means that a gain is made when interest rates fall, given that it is equivalent to receiving the fixed rate on the IRS (or holding a long position on a fixed-coupon bond).
- Positive PV01 means that a gain is made when interest rates rise, given that it is equivalent to paying the fixed rate on the IRS (or holding a short position on a fixed-coupon bond).

BME CLEARING defines a series of segments or buckets of the curve where it arithmetically adds up the PV01 calculated in the preceding point by the curve term. These **Analysed Buckets** are defined in the Circular "Parameters for calculation of Initial Margin". The arithmetic sum is done with the following formula:

$$\mathrm{mY} = \sum_{\mathrm{n=0}}^{5} \beta_{\mathrm{nY,mY}} \,\mathrm{x}\, \mathrm{PV01}_{\mathrm{nY}}$$

Where *mY* is the sensitivity of the Hedging Bucket *m* years and $\beta_{\mathrm{nY,mY}}$ the distribution coefficient of sensitivity $\mathrm{PV01}_{\mathrm{nY}}$ based on Time apportionment method. This method distributes linearly the maturity tenors between each Hedged Bucket. The following are details on the calculation of distribution coefficients of each hedging Bucket.

For any portfolio and tenor, the number of days between value date and the maturity tenor are calculated. Then, the weights are calculated linearly between the adjacent hedging buckets as follow:

$$\mathrm{w}_{\mathrm{nY,mY}} = \frac{NDays_{mY} - NDays_{nY}}{NDays_{mY} - NDays_{m+1Y}}$$

Where:

- $NDays_{mY}$: number of days between value date and maturity hedging bucket m years, for m = 2, 5, 10, 20 and 30 years.
- $NDays_{nY}$: number of days between value date and tenor n, for n = 1 year, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22 and 23 months, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 20, 25, 30, 40 and 50 years.

The sum of weights for each tenor must be 100%.

3.2 Equivalent Hedge Face Amount

The next step is to calculate the equivalent face amount in a generic IRS (or market one) of hedging transactions. To do this the sensitivity of the generic IRS must be calculated.

To calculate the sensitivity of a generic IRS, the process is similar to that described above for the original portfolio for each of the Analysed Buckets.

The next step is to calculate the Hedging Ratio (HR), using sensitivities sweep method. This method starts to net sensitivities with the sensitivity of the generic IRS from the bucket with more expiration to the bucket with closest expiration and reduces the sensibility of the portfolio to 0. The Hedging Ratio for each Hedged Bucket are calculated as follow:

$$HR_{30Y} = -\frac{\text{PV01}_{\text{portfolio 30Y}}}{\text{PV01}_{\text{generic IRS 30Y,30Y}}}$$

$$HR_{20Y} = -\frac{HR_{30Y} \cdot \text{PV01}_{\text{generic IRS 20Y,30Y}} + \text{PV01}_{\text{portfolio 20Y}}}{\text{PV01}_{\text{generic IRS 20Y,20Y}}}$$

$$HR_{10Y} = -\frac{HR_{30Y} \cdot \text{PV01}_{\text{generic IRS 10Y,30Y}} + HR_{20Y} \cdot \text{PV01}_{\text{generic IRS 10Y,20Y}} + \text{PV01}_{\text{portfolio 10Y}}}{\text{PV01}_{\text{generic IRS 10Y,10Y}}}$$

$$HR_{5Y} = -\frac{HR_{30Y} \cdot \text{PV01}_{\text{generic IRS 5Y,30Y}} + HR_{20Y} \cdot \text{PV01}_{\text{generic IRS 5Y,20Y}} + HR_{10Y} \cdot \text{PV01}_{\text{generic IRS 5Y,10Y}} + \text{PV01}_{\text{portfolio 5Y}}}{\text{PV01}_{\text{generic IRS 5Y,5Y}}}$$

$$HR_{2Y} = -\frac{HR_{30Y} \cdot \text{PV01}_{\text{generic IRS 2Y,30Y}} + HR_{20Y} \cdot \text{PV01}_{\text{generic IRS 2Y,20Y}} + HR_{10Y} \cdot \text{PV01}_{\text{generic IRS 2Y,10Y}} + HR_{5Y} \cdot \text{PV01}_{\text{generic IRS 2Y,5Y}} + \text{PV01}_{\text{portfolio 2Y}}}{\text{PV01}_{\text{generic IRS 2Y,2Y}}}$$

Where:

- HR_{mY}: hedging ratio for hedging bucket m years, for m = 2, 5, 10, 20 and 30 years.
- $\text{PV01}_{\text{portfolio mY}}$: Portfolio sensitivity in the hedging bucket m years, for m = 2, 5, 10, 20 and 30 years.
- $\text{PV01}_{\text{generic IRS nY,mY}}$: generic IRS sensitivity for tenor n years in the hedging bucket m years, for n = 1 year, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22 and 23 months, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 20, 25, 30, 40 and 50 years and m = 2, 5, 10, 20 and 30 years.

The Equivalent Hedge Face Amount will be the Hedging Ratio of each Analysed Bucket multiplied by one million.

The generic IRS side of each bucket must be made in a way that the sensitivity runs in the opposite direction to the term of the portfolio to be hedged, where the two sensitivities offset one another. For example:

Term	Portfolio Sensitivity	Portfolio Side	Hedging Side	Hedging Sensitivity
2Yr	€4,093.42	Pay Fix	Receive Fix	-€4,093.42

3.3 Calculation of illiquidity surcharge

If the Equivalent Hedge Face Amount is larger than the standard size in an Analysed Bucket, an IM adjustment for the size of the position in the Analysed Bucket will be required. If it is equal to or smaller than the standard size, no IM adjustment is needed, except for price spread risk.

This surcharge is calculated in two steps:

3.3.1 Member Survey Market capacity and illiquidity surcharge in basis points

BME CLEARING will annually conduct a Member Survey in which Members will estimate the standard volume the market can absorb in each Analysed Bucket. The survey will also ask about the surcharge in basis points that would be involved in closing multiples of face amounts X times greater than those of the standard volume. For example, the basis points it would cost to close 5 times (x 5) the maximum face amount that can be absorbed by the market per Analysed Bucket.

3.3.2 Calculation of Illiquidity Surcharge for each Analysed Bucket

With the result of the Member Survey, the Illiquidity Surcharge is obtained for each Analysed Bucket and the face amount of the hedging transaction.

To calculate the Illiquidity Surcharge for a face amount of the hedging transaction in the nY section, linear interpolation is made between the applicable segments of the table. For example, if the face amount of the hedging transaction is 3.40 times the maximum size for that segment, the multiplier will be that corresponding to a linear interpolation between

the multiplier of the amount x 2 and the multiplier of the amount x 5, according to the following formula:

$$\text{Surcharge}_{xn} = \text{PB}_{xn} + \left(\text{Face amount}_{\text{Hedging}} - \text{Noc}_{xn}\right) * \frac{\text{PB}_{xn+1} - \text{PB}_{xn}}{\text{Noc}_{xn+1} - \text{Noc}_{xn}}$$

Where

- Surcharge_{xn}: bp of surcharge to cover exact amount of generic IRS.
- PB_{xn}: bp of surcharge for face amount n times higher than market maximum.
- PB_{xn+1}: bp of surcharge for face amount n+1 time higher than market maximum.
- Noc_{xn}: face amount n times higher than market maximum.
- Noc_{xn+1}: face amount n+1 times higher than market maximum
- $\text{Face amount}_{\text{Hedging}}$: face amount of generic heding IRS.

3.4 Amount of Adjustment for Position Size

The Adjustment for Position Size is calculated in this last step.

This Adjustment for Position Size is calculated by multiplying the PV01 of the generic IRS by the Hedging Ratio (both obtained in 3.2) and by the Illiquidity Surcharge for each hedging transactions (obtained in 3.3.2.), as appropriate.

4. Final amount of Initial Margin

For each margin account, the final amount of the Initial Margin will be:

$$\begin{aligned}\text{Margin Account IMa}_i &= \max(\text{Historical VaR, Expected Shortfall }) \text{ x } \text{M}_{\text{Credit Quality}} \\ &+ \text{ Adjustment for Position Size}\end{aligned}$$

Appendix Example of IM Adjustment for Position Size

1. Calculation of Sensitivity of Member Portfolio

Let us assume we have a margin account with a portfolio with the following sensitivities:

Term (Years)	PV01 Term
1	-€5,264.24
2	€1,134.40
3	€8,989.22
4	€6,689.24
5	-€10,553.62
6	-€10,273.63
7	€14,663.49
8	€77,684.90
9	€73,311.16
10	€16,012.70
11	-€116.49
12	€255.85
15	€218.02
20	€544.08
25	€18,347.28
30	€0.00
40	€0.00
50	€0.00
Total portfolio	**€191,642.34**

As an example, the following table presents distribution coefficients that are applied in this example. Each portfolio of each Member will have different coefficients, as they have different sensitivities by term.

	Analysed Buckets				
Term	**2Yr**	**5Yr**	**10Yr**	**20Yr**	**30Yr**
1	100%				
2	100%				
3	67%	33%			
4	33%	67%			
5		100%			
6		80%	20%		
7		60%	40%		
8		40%	60%		
9		20%	80%		
10			100%		
11			90%	10%	
12			20%	80%	
15			10%	90%	
20				100%	
25				25%	75%
30					100%
40					100%
50					100%

In the example, the sensitivity of the 2Yr Bucket is summarised as follows:

$$\text{Sensitivity 2Yr} = 1 * \text{PV01}_{1\text{Y}} + 1 * \text{PV01}_{2\text{Y}} + 0.67 * \text{PV01}_{3\text{Y}} + 0.33 * \text{PV01}_{4\text{Y}} = €4{,}093.42$$

Repeating the procedure for each bucket yields:

Analysed Buckets	PV01 Hedge Bucket
2Yr	€4,093.42
5Yr	€43,193.99
10Yr	€125,315.04
20Yr	€9,866.25
30Yr	€9,173.64
Totals	**€191,642.34**

The portfolio, simplified, as the same total sensitivity as the original portfolio, that is, 99.249€.

2. Equivalent Hedge Face Amount

The sensitivities of the generic IRSs used in this example are shown:

Analysed Buckets	PV01 IRS generic
2Yr	€150,91
5Yr	€451,92
10Yr	€927,42
20Yr	€1.743,27
30Yr	€2.450,04

With these sensitivities, the Hedging Ratios and the Equivalent Hedge Face Amount can be obtained, as shown in the following table:

Term (Years)	PV01 Term	PV01 Hedge Bucket	PV01 generic IRS	RC	Equivalent Hedge Face Amount
1	-€5,264.24				
2	€1,134.40	€4,093.42	€150.91	-96.93	€96,928,276.65
3	€8,989.22				
4	€6,689.24				
5	-€10,553.62	€43,193.99	€451.92	-82.32	€82,315,498.40
6	-€10,273.63				
7	€14,663.49				
8	€77,684.90				
9	€73,311.16				
10	€16,012.70	€125,315.04	€927.42	-129.35	€129,350,336.32
11	-€116.49				
12	€255.85				
15	€218.02				
20	€544.08	€9,866.25	€1.743,27	-5.39	€5,390,689.93
25	€18,347.28				
30	€0.00	€9,173.64	€2,450.04	-4.27	€4,267,264.16
40	€0.00				
50	€0.00				
Total	€191,642.34	€191,642.34			€318,252,065.46

Although the face amounts are taken in absolute values from the viewpoint of the IM adjustment, the hedging side must be taken into account when contracting it in the market.

Term	Portfolio sensitivity	Side	Hedging	Equivalent Hedge Face Amount
2Yr	€4,093.42	Pay fixed	Receive fixed	-€96,928,276.65
5Yr	€43,193.99	Pay fixed	Receive fixed	-€82,315,498.40
10Yr	€125,315.04	Pay fixed	Receive fixed	-€129,350,336.32
20Yr	€9,866.25	Pay fixed	Receive fixed	-€5,390,689.93
30Yr	€9,173.64	Pay fixed	Receive fixed	-€4,267,264.16

3. Calculation of illiquidity surcharge

3.1 Member Survey Market capacity and Illiquidity Surcharge

The following table shows an example of the Member Survey:

Tranche	Maximum face amount in Market	Illiquidity Multiplier and Surcharge				
		X1	**X2**	**X5**	**X10**	**X50**
2Yr	€100,000,000.00	0.6 bp	3 bp	5 bp	8 bp	12 bp
5Yr	€200,000,000.00	0.7 bp	4 bp	6 bp	9 bp	13 bp
10Yr	€40,000,000.00	0.8 bp	5 bp	7 bp	10 bp	14 bp
20Yr	€50,000,000.00	0.9 bp	6 bp	8 bp	11 bp	15 bp
30Yr	€60,000,000.00	1 bp	7 bp	9 bp	12 bp	16 bp

3.2 Calculation of Illiquidity Surcharge for each Analysed Bucket

The following shows the Illiquidity Surcharge for each Analysed Bucket of the example:

Bucket	Equivalent Hedge Face Amount	Illiquidity surcharge (bp)
2Yr	-€96,928,276.65	0.6 bp
5Yr	-€82,315,498.40	0.7 bp
10Yr	-€129,350,336.32	5.82 bp
20Yr	-€5,390,689.93	0.9 bp
30Yr	-€4,267,264.16	1 bp

3.3 Amount of Adjustment for Position Size

The following table shows the final result of the Adjustment for Position Size

Bucket	PV01 generic IRS	Hedge Ratio	Illiquidity surcharge (bp)	Adjustment Position Size
2Yr	€ 150.91	96.93	0.6 bp	€ 8,776.70
5Yr	€ 451.92	82.32	0.7 bp	€ 26,039.99
10Yr	€ 927.42	129.35	5.82 bp	€ 698,480.19
20Yr	€1,743.27	5.39	0.9 bp	€ 8,457.69
30Yr	€2,450.04	4.27	1 bp	€ 10,454.95
			Totals	**€ 752,209.52**

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