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**Resolution No. 1/24**

**of the KDPW_CCP S.A. Management Board**

**dated 6 February 2024**

Pursuant to § 3 sub-paragraph 2, 4 and 8 of the Rules of Transaction Clearing (non-organised trading) and § 19 sub-paragraph 2 of the KDPW_CCP S.A. Statute, the KDPW_CCP S.A. Management Board resolves as follows:

**§ 1**

Appendix No. 6 to the Detailed Rules of the OTC Clearing System, attached to Resolution No. 21/16 of the KDPW_CCP S.A. Management Board dated 17 August 2016 (as amended), shall be replaced by the appendix hereto.

**§ 2**

This Resolution shall enter into force on 21 February 2024.

Maciej Trybuchowski
President of the
Management Board

Sławomir Panasiuk
Vice President of the
Management Board

Appendix 6 to the Detailed Rules of the OTC Clearing System

# MARGIN CALCULATION METHODOLOGY AND DERIVATIVES, REPO AND SELL TRANSACTIONS VALUATION METHODOLOGY

## 1. Overview

This Appendix presents the valuation formulas for interest rate derivatives and repo transactions implemented in the system, as well as the calculation algorithms used to determine the yield curve and to calculate historically simulated value at risk.

## 2. Valuation formulas for different types of financial instruments

### 2.1 Definitions

The valuation of a transaction is performed in the currency of the contract.

The definitions of symbols used in the valuation formulas are presented below.

| | |
|---|---|
| $r_{t,Z}$ | is the rate for curve Z at date t |
| $df_t$ | is the discount factor for a discount curve at date t |
| $df_{Z,t}$ | is the discount factor at date t for curve Z consistent with the instrument tenor |
| znak | is the counterparty sign, possible values: 1 or -1 |
| N | is the contract nominal amount |
| $r_{FRA}$ | is the FRA rate |
| $t(d_1, d_2)$ | is the year fraction between date $d_1$ and $d_2$, calculated according to the relevant convention |
| eff | is the instrument effective date or coupon start date |
| mat | is the instrument maturity date or coupon end date |

### 2.2 FRA valuation

FRAs are agreements where the counterparties determine the interest rate to be used at a future date for a specific amount in the transaction currency for a determined period. The FRA value is determined differently before and after the reference rate is set.

The value is determined as follows:

- before the reference rate is set:

$$PV_{FRA} = znak\ N \left[ df_{eff} - \left(1 + r_{FRA}\ t(eff, mat)\right) df_{eff}\ \frac{df_{Z,mat}}{df_{Z,eff}} \right]$$

- after the reference rate is set:

$$PV_{FRA} = znak \frac{(r_{fixing} - r_{FRA}) N\ t\ (eff, mat)}{1 + r_{fixing}\ t(eff, mat)}\ df_{eff}$$

### 2.3 IRS valuation

Interest Rate Swaps is an agreement to exchange interest rate periodic and are made up of two interest cash flows. One counterparty pays interest calculated at a fixed interest rate (fixed leg) and receives interest calculated at a floating rate (floating leg); the other counterparty does the opposite. The contract value is the difference between the valuation of the received leg and the valuation of the paid leg. The valuation of each IRS leg is presented below.

- Fixed leg valuation:

$$PV_{fixed}(t) = \sum_{j:mat(j)>t}^{M_{fixed}} r_{IRS,j} N_j \, t(eff(j), mat(j)) \, df_j$$

where:

$M_{fixed}$ - is the number of interest periods of the fixed leg
$N_j$ - nominal amount of the contract in interest period *j*
$r_{IRS,j}$ - contractual IRS rate in interest period *j*

- Floating leg valuation:

$$PV_{float}(t) = \sum_{j:mat(j)>t}^{M_{float}} N_j (r_j + m_j) \, t\,(eff(j), mat(j)) \, df_j$$

$$j = \begin{cases} r_{t_{refix_j}, index} & t_{refix_j} \leq t \\ r_{j,\alpha} & t_{refix_j} > t \end{cases}$$

where:

$r_{j,\alpha}$ - is the rate at date *j* for curve *α*, where *j* = 0 (first coupon cash flow) the rate may be set explicitly without an input rate
$r_{t_{refix_j}, index}$ - observed index rate on day $t_{refix_j}$
$M_{float}$ - is the number of interest periods of the floating leg
$m_j$ - is the additive margin (spread) in interest period *j*

### 2.4 Basis Swap valuation

Basis Swaps are a type of interest rate swaps for which both parties pay interest at a different floating rate. The contract value is the difference between the valuation of the received leg and the valuation of the paid leg. The valuation of each leg is presented below.

$$PV_A(t) = \sum_{j:mat(j)>t}^{T} N_j (r_{j,A} + m_{A,j}) \, t(eff(j), mat(j)) \, df_j$$

$$PV_B(t) = \sum_{j:mat(j)>t}^{T} N_j (r_{j,B} + m_{B,j}) \, t(eff(j), mat(j)) \, df_j$$

where:

$$j = \begin{cases} r_{t_{refix_j}, index} & t_{refix_j} \leq t \\ r_{j,\propto} & t_{refix_j} > t \end{cases}$$

$r_{t_{,refix_j},index}$ - the index rate observed on day $t_{refix_j}$

$index$ - rate index for a given floating leg

$r_{j,\propto}$ - is the rate at date *j* for curve $\propto$, where *j* = 0 it is the rate which may be determined for the first cash flow

$T$ - is the number of interest periods

$\mathrm{m_{A,j}}, \mathrm{m_{B,i}}$ - is the additive margin (spread) in the interest period

**2.5 OIS valuation**

OIS are fixed to floating interest rate swaps where the floating leg is indexed to the overnight rate (POLONIA rate in Poland, ESTR in EUR currency). OIS swap two cash flows: a fixed leg which is a one-off cash flow of interest set at a fixed rate determined in the contract for a specific nominal amount, and a floating leg which is a one-off cash flow of interest compounded over every day set at an overnight rate for a specific nominal amount. The settlement amount is the absolute value of the difference between the two legs. The valuation of each leg is presented below.

$$PV_{fixed} = \sum_{j:mat(j)>t}^{T} N\, r_{OIS}\, t(eff(j), mat(j))\, df_j$$

where:

$r_{OIS}$ - set fixed rate of the contract

$$PV_{float}(t) = NR'\, t\ (eff, mat) df_{mat}$$

$$R' = int(R * 10^4 + 0{,}5)/10^4$$

$$R = \left( \prod_{i=1}^{T} \left(1 + r_i t\left(eff(i), mat(i)\right)\right) - 1 \right) / t(eff, mat)$$

where:

T - is the number of interest periods in the term of the contract,

$$r_i = \begin{cases} r_{i,index} + s & i \leq t \\ r_{i,OIS} + s & i > t \end{cases}$$

$r_{i,index}$ - observed the index rate at day i

$r_{i,OIS}$ - OIS curve rate at the start date of interest period i

s - is the additive margin (spread)

$R$ - is the effective interest rate

$R'$ - is the effective interest rate, for PLN instruments rounded off to four decimal places

### 2.6 Valuation of additional cash flows

If there are additional cash flows under the terms of the transaction, their valuation is determined as follows:

$$NPV_{fee} = \sum_{i=1}^{k} znak\ F_i df_i$$

where:

| | | |
|---|---|---|
| *k* | - | number of additional cash flows |
| $F_i$ | - | amount of *i*-th cash flow |
| $znak$ | - | 1 if the additional cash flow is to be received or -1 if the additional cash flow is to be paid |

### 2.7 Valuation of repo transactions

The contract value before the settlement of the first leg is calculated as follows:

$$PV = znak\ (N_{Bonds}\ MarketPrice(t) df_{spot} - GrossAmount1\ df_{t1}) - znak\ (N_{Bonds}\ MarketPrice(t) df_{spot} - GrossAmount2\ df_{t2})$$

where:

| | |
|---|---|
| $N_{Bonds}$ | - is the transaction volume |
| $t1$ | - is the settlement date of the first leg |
| $t2$ | - is the settlement date of the second leg |
| $GrossAmount1$ | - is the settlement amount of the first leg |
| $GrossAmount2$ | - is the settlement amount of the second leg |
| $MarketPrice\ (t)$ | - is the settlement price of bonds on day t (including interest accrued since the last coupon payment date) |
| $df_{spot}$ | - discount factor from day t+2 to current date |
| $df_{t2}$ | - discount factor from day t2 to current date |
| $znak$ | - constant equal to -1 for the repo counterparty and 1 for the reverse repo counterparty |

The repo contract value after the settlement of the first leg is calculated as follows:

$$PV = -znak(N_{Bonds}\ MarketPrice(t) df_{spot} - GrossAmount2 df_{t2})$$

### 2.8 Valuation of sell transactions

$$PV = znak(N_{Bonds}\ MarketPrice(t)\ df_{spot} - GrossAmount\ df_t)$$

where:

| | |
|---|---|
| $znak$ | - constant equal to -1 for the seller and 1 for the buyer |
| $GrossAmount$ | - sell transaction settlement amount |
| $df_t$ | - discount factor from day t to current date |

## 3. Calculating the required initial margin

The required initial margin is equal to the value of Expected Shortfall for a given account while applying the following parameters:

- holding period
- confidence level
- decay rate
- number of historical events (time horizon)
- method used to calculate rates for VaR scenarios

Historical VAR (HVaR) is an alternative margining method. KDPW_CCP may modify the margining method subject to all conditions applicable to model changes under the law.

### 3.1 Overview

KDPW_CCP performs a Value at Risk (HVaR) calculation. The model calculates a potential Profit / Loss (PL) based on historical market movements within the set time horizon. Statistical analysis of the P&L sample space is then used.

Calculation of margins (and other risk measures, if any) is a three-step process:

- generate scenarios from the market history;
- price the portfolio using each of the generated historical scenarios;
- calculate quantile values.

### 3.2 Scenario generation

The HVaR model generates market scenarios based on historical market movements over a specified date range, from today to a specified date in the past.

Scenarios are generated in the date range:

$(t - N)$ do $(t)$

where:

$t$ - is the current business day

$N$ - is the number of the historical observation period

Each scenario *i* is defined as the vector of *n* market inputs that impact the value of the portfolio.

For interest rates, KDPW_CCP calculates $\delta_i$ using the additive movement which includes scaling of the portfolio holding period:

$$\delta_i = r_t + \sqrt{l}(r_{i+1} - r_i)$$

and for fx rates it uses the multiplicative movement:

$$\delta_i = \max\left(0, r_t\left((1 + \left(\frac{r_{i+1}}{r_i} - 1\right)\sqrt{l}\right)\right)$$

### 3.3 Valuation under scenarios

The portfolio is valued as at today's business date for each scenario using the historical market inputs.

This results in the following vector *V* of potential loss:

$$V = \begin{bmatrix} \sum_{c=1}^{Y}(MtM_{1,c} - MtM_{t,c})ExR_{1,c} \\ \sum_{c=1}^{Y}(MtM_{2,c} - MtM_{t,c})ExR_{2,c} \\ \dots \\ \sum_{c=1}^{Y}(MtM_{N,c} - MtM_{t,c})ExR_{N,c} \end{bmatrix}$$

where:

| | |
|---|---|
| $N$ | -is the number of scenarios, |
| $MtM_{i,c}$ | - is the hypothetical value of the portfolio of transactions in currency *c* in scenario *i* in the range 1 to N, |
| $MtM_{t,c}$ | - is the mark to market of the portfolio of transactions in currency *c*, |
| $ExR_{i,c}$ | - is the fx rate under scenario *i*, used to convert the value of the portfolio in currency *c* to PLN. |

Given a portfolio of *m* trades, the potential $PV_i$ is calculated in PLN as:

$$MtM_{i,c} = \sum_{j=1}^{m} f(T_{j,c}, s_{i,c})$$

where:

| | |
|---|---|
| $f$ | - is the function which returns the valuation of transaction $T_j$ in currency *c* in scenario $s_i$ |
| $T_{j,c}$ | - is the j-th trade in currency *c* in the portfolio |
| $s_{i,c}$ | - is scenario *i* for currency *c* |

### 3.4 Calculating the margin

#### 3.4.1 HVaR

In its statistical analysis of a sample of potential Profit / Loss values, KDPW_CCP assumes that scenarios used in the portfolio valuation are assigned equal weights (each scenario has equal probability).

When calculating percentiles, vector values are ordered from lowest (largest loss) to highest (largest profit). Given *N* ranked valued from the sector *V*, the rank *x* L for target percentile *P* is calculated as:

$$x = \frac{P}{100}(N-1) + 1$$

Then splitting *x* into its integer *k* and decimal component *d*, such that $x = k + d$, we calculate the percentile value P ($v_p$) as:

$$v_p = \begin{cases} v_1, & x = 1 \\ v_N, & x = N \\ v_k + d(v_{k+1} - v_k), & 1 < x < N \end{cases}$$

The value $V_p$ is the required level of initial margin.

### 3.4.2 Expected Shortfall

Expected Shortfall is the expected loss exceeding VaR.

To determine the relevant centiles, vector values are arranged from the highest (highest gain) to the lowest (highest loss) from CCP perspective.
Given N ordered vector V values, the next P&L value number for the target centile P is calculated as follows:

$$x = (1 - \frac{P}{100})N$$

Splitting x into an integer *k* and a decimal fraction *d*, where $x = k + d$, Expected Shortfall $es_p$ is calculated as follows:

$$es_p = d\frac{v_{k+1}}{x} + \sum_{j=1}^{k} \frac{v_j}{x}$$

## 4. Definition of projection curves and discount curves

### 4.1 Projection curves

#### 4.1.1 1M curve

| | **PLN** | **EUR** |
|---|---|---|
| 1M | WIBOR | EURIBOR |
| 2M | FRA 1x2 | IRS 2m1s |
| 3M | FRA 2x3 | IRS 3m1s |
| 4M | | IRS 4m1s |
| 5M | | IRS 5m1s |

| | | |
|---|---|---|
| 6M | IRS 6m1s | IRS 6m1s |
| 7M | | IRS 7m1s |
| 8M | | IRS 8m1s |
| 9M | | IRS 9m1s |
| 10M | | IRS 10m1s |
| 11M | | IRS 11m1s |
| 1Y | IRS 1y1s | IRS 1y1s |
| 2Y | IRS 2y1s | IRS 2y1s |
| 3Y | IRS 3y1s | IRS 3y1s |
| 4Y | IRS 4y1s | IRS 4y1s |
| 5Y | IRS 5y1s | IRS 5y1s |
| 6Y | IRS 6y1s | IRS 6y1s |
| 7Y | IRS 7y1s | IRS 7y1s |
| 8Y | IRS 8y1s | IRS 8y1s |
| 9Y | IRS 9y1s | IRS 9y1s |
| 10Y | IRS 10y1s | IRS 10y1s |
| 12Y | IRS 12y1s | IRS 12y1s |
| 15Y | IRS 15y1s | IRS 15y1s |
| 20Y | IRS 20y1s | IRS 20y1s |
| 25Y | | IRS 25y1s |
| 30Y | | IRS 30y1s |
| 40Y | | IRS 40y1s |
| 50Y | | IRS 50y1s |

### 4.1.2 3M curve

| | **PLN** | **EUR** |
|---|---|---|
| 3M | WIBOR | EURIBOR |
| 4M | FRA 1x4 | FRA 1x4 |

| | | |
|---|---|---|
| 5M | FRA 2x5 | FRA 2x5 |
| 6M | FRA 3x6 | FRA 3x6 |
| 7M | FRA 4x7 | FRA 4x7 |
| 8M | FRA 5x8 | FRA 5x8 |
| 9M | FRA 6x9 | FRA 6x9 |
| 10M | FRA 7x10 | FRA 7x10 |
| 11M | FRA 8x11 | FRA 8x11 |
| 1Y | FRA 9x12 | FRA 9x12 |
| 15M | FRA 12x15 | FRA 12x15 |
| 18M | FRA 15x18 | |
| 21M | FRA 18x21 | |
| 2Y | FRA 21x24, IRS 2y3s | IRS 2y3s |
| 3Y | IRS 3y3s | IRS 3y3s |
| 4Y | IRS 4y3s | IRS 4y3s |
| 5Y | IRS 5y3s | IRS 5y3s |
| 6Y | IRS 6y3s | IRS 6y3s |
| 7Y | IRS 7y3s | IRS 7y3s |
| 8Y | IRS 8y3s | IRS 8y3s |
| 9Y | IRS 9y3s | IRS 9y3s |
| 10Y | IRS 10y3s | IRS 10y3s |
| 12Y | IRS 12y3s | IRS 12y3s |
| 15Y | IRS 15y3s | IRS 15y3s |
| 20Y | IRS 20y3s | IRS 20y3s |
| 25Y | | IRS 25y3s |
| 30Y | | IRS 30y3s |
| 40Y | | IRS 40y3s |
| 50Y | | IRS 50y3s |

### 4.1.3. 6M curve

| | **PLN** | **EUR** |
|---|---|---|

| | | |
|---|---|---|
| 6M | WIBOR | EURIBOR |
| 7M | | FRA 1x7 |
| 8M | | FRA 2x8 |
| 9M | | FRA 3x9 |
| 10M | | FRA 4x10 |
| 11M | | FRA 5x11 |
| 1Y | FRA 6x12 | FRA 6x12 |
| 15M | | FRA 9x15 |
| 18M | FRA 12x18 | FRA 12x18 |
| 2Y | FRA 18x24, IRS 2y6s | IRS 2y6s |
| 3Y | IRS 3y6s | IRS 3y6s |
| 4Y | IRS 4y6s | IRS 4y6s |
| 5Y | IRS 5y6s | IRS 5y6s |
| 6Y | IRS 6y6s | IRS 6y6s |
| 7Y | IRS 7y6s | IRS 7y6s |
| 8Y | IRS 8y6s | IRS 8y6s |
| 9Y | IRS 9y6s | IRS 9y6s |
| 10Y | IRS 10y6s | IRS 10y6s |
| 12Y | IRS 12y6s | IRS 12y6s |
| 15Y | IRS 15y6s | IRS 15y6s |
| 20Y | IRS 20y6s | IRS 20y6s |
| 25Y | | IRS 25y6s |
| 30Y | | IRS 30y6s |
| 40Y | | IRS 40y6s |
| 50Y | | IRS 50y6s |

### 4.1.4 OIS curve

| | **PLN** | **EUR ESTR** |
|---|---|---|
| O/N | POLONIA (index) | ESTR |
| 1W | OIS 1W | ESTR 1W |
| 2W | OIS 2W | ESTR 2W |

| | | |
|---|---|---|
| 3W | OIS 3W | ESTR 3W |
| 1M | OIS 1M | ESTR 1M |
| 2M | | ESTR 2M |
| 3M | OIS 3M | ESTR 3M |
| 4M | | ESTR 4M |
| 5M | | ESTR 5M |
| 6M | OIS 6M | ESTR 6M |
| 7M | | ESTR 7M |
| 8M | | ESTR 8M |
| 9M | OIS 9M | ESTR 9M |
| 10M | | ESTR 10M |
| 11M | | ESTR 11M |
| 1Y | OIS 1Y | ESTR 1Y |
| 15M | | ESTR 15M |
| 18M | | ESTR 18M |
| 21M | | ESTR 21M |
| 2Y | | ESTR 2Y |
| 3Y | | ESTR 3Y |
| 4Y | | ESTR 4Y |
| 5Y | | ESTR 5Y |
| 6Y | | ESTR 6Y |
| 7Y | | ESTR 7Y |
| 8Y | | ESTR 8Y |
| 9Y | | ESTR 9Y |
| 10Y | | ESTR 10Y |
| 11Y | | ESTR 11Y |
| 12Y | | ESTR 12Y |
| 15Y | | ESTR 15Y |
| 17Y | | ESTR 17Y |

| | | |
|---|---|---|
| 20Y | | ESTR 20Y |
| 25Y | | ESTR 25Y |
| 30Y | | ESTR 30Y |
| 40Y | | ESTR 40Y |
| 50Y | | ESTR 50Y |

### 4.1.5 Discount rate curves

### 4.1.6 PLN curve

| O/N | POLONIA (index) |
|---|---|
| 1W | OIS 1W |
| 2W | OIS 2W |
| 3W | OIS 3W |
| 1M | OIS 1M |
| 3M | OIS 3M |
| 6M | OIS 6M |
| 9M | OIS 9M |
| 1Y | OIS 1Y |
| 2Y | IRS 2y1s |
| 3Y | IRS 3y1s |
| 4Y | IRS 4y3s |
| 5Y | IRS 5y3s |
| 6Y | IRS 6y3s |
| 7Y | IRS 7y3s |
| 8Y | IRS 8y3s |
| 9Y | IRS 9y3s |
| 10Y | IRS 10y3s |
| 12Y | IRS 12y3s |
| 15Y | IRS 15y3s |
| 20Y | IRS 20y3s |

### 4.1.7 EUR curve

The EUR discount curve is the OIS EUR ESTR curve described in point 4.1.4.

## 5. Sources of market data

Sources of market data for respective types of financial instruments and data include:

1. For instruments cleared in PLN:

1) WIBOR (index) – fixing organised by GPW Benchmark S.A.,
2) POLONIA (index) – fixing organised by the National Bank of Poland,
3) FRA, IRS, OIS (PLN) – market data from available news services and data from transactions sent for clearing to KDPW_CCP,

2. For instruments cleared in EUR:

1) EURIBOR (index) – fixing organised by the European Money Market Institute,[1]
2) ESTR (index) – fixing published by the European Central Bank,
3) FRA, IRS, OIS (EUR) – market data from available news services and data from transactions sent for clearing to KDPW_CCP.

Market data are sourced via the news service ICE Data Derivatives (main news service), Bloomberg or Thomson Reuters on the terms defined below.
In determining reference rates for interest rate derivatives referred to in point 1 (3) and point 2 (4), KDPW_CCP uses in the first place data available from the main news service.
If data from the main news service are incomplete on any clearing day, their availability is limited or the adequacy of the data raises reasonable doubt in the opinion of KDPW_CCP (which impairs the quality of the data), then in order to ensure the safety of transaction clearing KDPW_CCP may determine reference rates based on data sourced from other available new services referred to above, in whole or in part. The principle defined in the preceding sentence shall apply accordingly to data available from the next selected news service.

[1] According to the agreement between KDPW_CCP S.A. and the European Money Market Institute (EMMI), please note that the transaction clearing service is not in any way sponsored, endorsed, sold, or promoted by EMMI, and EMMI has no obligations or liability in connection with the use of any such service. EURIBOR is compiled and calculated on behalf of EMMI. However, EMMI shall not be liable (whether in negligence or otherwise) to any person for any error in EURIBOR or use of the same, whether or not arising from the negligence of EMMI, and EMMI shall not be under any obligation to advise any person of any error therein. EMMI MAKES NO WARRANTY, EXPRESS OR IMPLIED, EITHER AS TO THE RESULTS TO BE OBTAINED FROM THE USE OF EURIBOR, AND/OR THE FIGURE AT WHICH EURIBOR STANDS AT ANY PARTICULAR TIME ON ANY PARTICULAR DAY OR OTHERWISE. EMMI MAKES NO EXPRESS OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE FOR USE WITH RESPECT TO THE SERVICE AND EXCLUDES ALL LIABILITY FOR ANY LOSS OF BUSINESS OR PROFITS OR FOR ANY DIRECT, INDIRECT OR CONSEQUENTIAL LOSS OR DAMAGE ARISING FROM USE OF EURIBOR.