APPROVED
by resolution of the Executive Board
National Clearing Centre
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Moscow Exchange's FX & Precious Metals Market Risk Methodology

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Content

1. Terms and Definitions

1.1. This Risk Methodology uses the following terms and definitions:

Underlying Asset	Foreign currency and/or precious metals allowed for trading without full prefunding (on margin).
Current Financial Statements	Clearing Members' financial statements as of the last reporting date submitted to the Clearing Centre to the extent and within timeframes established in the Clearing Rules.
Currency Pair	A unit of FX and the quote currency or one of precious metal and the quote currency traded on Moscow Exchange's FX and Precious Metals Markets.
Upper/Lower Risk Bands	The maximum (minimum) rates for trades in FX/Precious Metals used by the Clearing Centre to assess market risks for trades without full prefunding (on margin). There are three levels in the Risk Assessment Range.
Upper/Lower Price Bands for Swap Deals	The minimum (maximum) swap price for the relevant time interval between the first and the second settlement dates used by the Clearing Centre to assess Interest Rate Risk for trades without full prefunding. There are three distinguished levels.
Upper/Lower Price Band	The maximum/minimum spot order price levels applicable during trading hours in FX/Precious Metals Market.
Volatility	The degree of price variability. In terms of quantity, it is measured as a standard deviation of changes or relative changes of exchange-quoted rates for FX/Precious Metals during the Risk Assessment Period.
Moment of Risk Parameters Calculation	The time at which risk parameters are calculated in accordance with the Clearing Rules.
Risk Assessment Range	The range of exchange-quoted FX/Precious Metals rates that are determined so that, with given probability levels, market-based FX/Precious Metals rates do not exceed their boundaries upon the expiry of the Risk Assessment Period. Intervals between the boundaries (bands) and the Central Rate may be determined as a fraction (percent) of the Central Rate, and also in the FX/precious metal rate bps. Three Risk Assessment Range levels are determined.
Instruments with full prefunding	Instruments of the Moscow Exchange's FX and Precious Metals Markets which require 100% prefunding.

Instruments without full prefunding (on-margin)	Instruments of the Moscow Exchange's FX and Precious Metals Market which do not require 100% prefunding.
Clearing Centre	The Bank National Clearing Centre (Joint–stock company).
Concentration limit, first and second level	Limits determining net obligations (net requirements) for Clearing Members on a given settlement code. The limits are based on Margin rates and Interest Rate Risk rates Level 1, 2 and 3 accordingly.
Non-business days	Days on which the Moscow Exchange's FX and Precious Metals Markets are closed.
Risk Assessment Period	The interval which the Clearing Centre finds sufficient to detect and handle a Clearing Member's failure to fulfil its obligations under trade and/or margin requirements.
Clearing Rules	The National Clearing Centre's Clearing Rules for the FX and Precious Metals Markets.
Estimated rate	The estimated rate for FX/precious metal instruments is based on their current quotes on OTC market before the opening (if unavailable, cross-rates are used).
Business day	A day which may also be a weekend or a holiday, on which Moscow Exchange's FX and Precious Metals Market is open for at least one of the instruments.
Synthetic Swap	A combination of directionally offsetting spot and futures orders on the same underlying. The synthetic swap is formed on the non-arbitrage principle for the purpose of setting indicative swap rates and interest rate risk monitoring.
On-screen Order	Order placed during trading on the FX & Precious Metals Market which is a direct trade (on-screen) order.
On-screen Trade	A trade based on an order-book trade order.
Inter-product spread discount	A reduction (credit) to the combined amount of initial margin requirements for the instruments in a product / assets group eligible for spreading.
Margin Rate	The estimated exchange quoted price variability with the set confidence probability level during the Risk Assessment Period. Margin Rates for three levels are determined.
Interest Risk Rate	Possible change in the Indicative Rate (% per annum) during the Risk Assessment Period. There are three rate levels.

Market Liquidity Risk Rate	The measure used to adjust the Margin Rate/Interest Risk Rate value.
Futures contracts	Deliverable futures with pre-determined delivery dates.
Price Range	Interval of FX rates/Precious Metals prices restricting the order prices in regular trading. For swap orders, Price Bands are set separately.
Central Rate	The rate calculated in accordance with this Methodology and used to determine Price and Risk Bands.
***Key Dates (*Key expiry date)**	Key date is referred to as the expiry dates for the second leg of On-screen Swap Trades and contracts as well as Future contracts.
Central Indicative Swap Rate	Swap-spread determined by the Clearing Centre for a certain interval of time in accordance with this Methodology.

1.2. Any terms not expressly defined herein have the meanings ascribed to them by the laws and regulations of the Russian Federation, regulations of the Bank of Russia, internal documents of the National Clearing Centre, and the Trading Rules of the Moscow Exchange for the FX and Precious Metals Market.

1.3. This Methodology uses the following symbols (sub-indices mean business days; it is assumed that risk parameters are assessed as of the Moment of Risk Parameters Calculation on the day *i*):

№	Parameter	Symbol
1	Business day on which risk parameters for the next business day are determined (sub-index).	i
2	Central Rate calculated on business day *i* for all currency pairs.	Rc_i
3	The first, second, and third level of Margin Rate determining the Risk Bands. It is calculated as a fraction of the Central Rate Rc_i for Underlying Assets.	S_1_i S_2_i S_3_i
4	Interest Risk Rate of the first, second and third level. Determined for Key Dates.	Δ_1_i Δ_2_i Δ_3_i
5	Margin Rate estimate. Based on Underlying Assets as a fraction of the Central Rate Rc_i.	V_i
6	Interest Risk Rate estimate. Determined for Key Dates. In percent per annum.	$V(\text{interest\_risk})_i$
7	Tentative margin rate. Based on the Underlying Assets and is a fraction of the Central Rate Rc_i.	S_i^p
8	Tentative Interest Risk Rate. Determined for Key Dates. In percent per annum.	Δ_i^p
9	Relative rate change on day *i*. Determined for Underlying Assets and is a fraction of the Central Rates.	r_i

10	Maximum intraday price deviation from the Central Rate Rc_{i-1} during the trading day *i*. Determined for Underlying Assets and is a fraction of the Central Rate Rc_{i-1}.	$r\max_i$
11	Relative interest rate change on day *i*. Determined as a spread to the Central Rate. In percent per annum.	$r(\text{interest\_risk})_i$
12	Weighing ratio used in calculating Central Rate volatility and interest rate volatility. Determined at the moment of risk-parameter calculation on day *i*.	a_i
13	Holiday factor. Determined at the Moment of Risk Parameters Calculation on day *i* for Underlying Assets.	G_i
14	Number of holidays in the Risk Assessment Period. The value depends on the number of non-operational days in the next Risk Assessment Period for a given currency pair. Determined during risk parameters calculation on day *i* for Underlying Assets.	m_i
15	Exchange rate volatility on day *i.* Determined at the Moment of Risk Parameters Calculation on day *i*.	σ_i
16	Interest rate volatility on day *i.* Determined during risk parameters calculation on day *i* for instruments without full prefunding when settlement dates coincide with the swaps maturity, first leg maturity TOM. In percent per annum.	$\sigma(\text{interest\_risk})_i$
17	Minimum Margin Rates of the first (second, third) level. Values are calculated for each Underlying Asset, in %.	$S\_1\_\min$ $S\_2\_\min$ $S\_3\_\min$
18	Minimum Interest Risk Rate of the first level. In percent per annum.	$\Delta\_1\_\min$
19	Maximum Margin Rate.	$S\_\max$
20	Central Indicative Swap Rate calculated during business day *i.* Determined for Key Dates, in RUB.	$SWAPCRate_i$
21	Interest Rate Risk (upward/downward scenarios) in rubles calculated during business day *i.* Determined for on-margin instruments, in RUB.	$SWAPHRate_i$ $SWAPLRate_i$
22	RUB rollover rate	SD_{RUB}
23	FX rollover rate	SD_{VAL}
24	Market liquidity risk rate for spot trades, in %.	*b*
25	Market liquidity risk rate for swap trades, in %.	*b_IR*
26	Volatility multiplier, determined for Margin Rate calculation based on exchange rate volatility or for Interest Risk Rate calculation based on interest rate volatility. May vary depending on the volatility estimates.	*t*
27	Time restriction on Margin Rate reduction, in business days.	*n*
28	Time restriction on Interest Risk Rate reduction, in business days.	*n(interest_risk)*
29	Minimum Margin Rate movement (step) set as a fraction of Central Rates Rc_i for Underlying Assets.	*h*
30	Minimum Interest Risk Rate movement (step), in percent per annum of the Central Rate Rc_i for instruments without full	*h(interest_risk)*

	prefunding when settlement dates coincide with the swaps maturity, first leg maturity TOM.	
31	Ratio of the Risk Assessment Range to the Price Band. Set for Underlying Assets.	*x*
32	Ratio of the swap Indicative Rates to the swap Price Band. Set for instruments without full prefunding when settlement dates coincide with the swap maturity dates, first leg maturity TOM.	*swapx*
33	Maximum best quotes proximity to the Price Band. Set in fractions of the Price Band range.	*w*
34	Upper weighing ratio.	$a_{верхняя}$
35	Lower weighing ratio.	$a_{нижняя}$
36	Number of first on-screen trades not included into the calculation of the maximum relative price deviation during a trading day, for Underlying Assets.	*q*
37	The period of time during which the best quotes are closest to the Price Band. Upon this period expiry the Price Band is to be shifted in the course of trades. In seconds.	*u*
38	Band shift ratio	*Shift*
39	Minimal step for Interest Risk Rate. Set per each Underlying Asset as fraction of Central rate.	*h_IR*
40	Underlying Assets combined in a spreading group	*Group*
41	Inter-product spread discount. Set as a fraction for each spreading group	*Skidka(Group)*
42	A flag for EWMA model for Margin Rate calculation	*isEWMA*
43	A flag for EWMA model for Interest Rate Risk calculation	*isEWMA_IR*
44	A flag for risk monitoring. Set for each Underlying Asset	*isMonitoring*
45	A Futures contract price for FX or precious metal	*Fut*
46	Upper/Lower value of Price Range for a Futures contract on FX or precious metal	*SCHFFut* *SCHLFut*
47	Synthetic Swap price	*SSwap_Fut*

2. General Provisions

2.1. This Methodology has been developed in accordance with the Clearing Rules to describe the procedure of risk parameters and swap transactions parameters selection and calculation.

2.2. This Methodology, amendments and supplements thereto and their effective date have been approved by the authorised executive body of the National Clearing Centre.

2.3. This Methodology is disclosed on the Clearing Centre's website.

3. Risk Management Parameters

3.1. This Methodology describes the rules to determine the following risk parameters:

- Central Rate;
- Central Indicative Swap Rates

- Margin Rates and Upper/Lower Risk Bands of the first, second, and third levels;
- Interest Rate Risk (upward/downward scenarios) of the first, second, and third levels;
- Upper/Lower Price Bands;
- Concentration Limits of the first and second level.

3.2. Other parameters listed in paragraph 1.3 herein are deemed technical and are employed in determination of risk parameters listed in paragraph 3.1 herein.

3.3. Parameters listed in paragraph 1.3 of this Methodology (items 2-16 and 20-21 and 45-47), are calculated at the Moment of Risk Parameters Calculation on each business day.

3.4. Parameters listed in paragraph 1.3 of this Methodology (items 17-19 and 24-44), and Concentration Limits of the first and second level are approved by the resolution of the authorised executive body of the Clearing Centre and subject to revision when necessary.

3.5. The list of Underlying Assets is to be determined by the Clearing Centre's authorised executive body and posted on the Clearing Centre's website.

3.6. The initial levels of risk parameters listed in paragraph 3.2-3.3 for new Assets accepted for clearing are set by the resolution of the authorised executive body of the Clearing Centre.

4. Central Rate Definition Algorithm

4.1. Central Rates are determined at the Moment of Risk Parameters Calculation on each business day.

4.2. Central Rate for Underlying Assets calculated for corresponding transactions maturing on the settlement day following the date of trade execution (excluding off-screen trades and swaps).

4.3. Central Rate for trades with full prefunding is calculated for corresponding trades with maturity date coinciding with the transaction date (excluding off-screen trades).

4.4. The Central Rate is set as:

4.4.1. the average weighted rate for trades executed within 30 minutes preceding the Moment of Risk Parameters Calculation, in case more than 20 corresponding trades have been executed during this period of time;

4.4.2. the average weighted rate for the last 20 trades executed before the Moment of Risk Parameters Calculation, if fewer than 20 corresponding trades have been executed during the last 30 minutes before the Risk Parameters Calculation Period;

4.4.3. the average weighted rate for trades executed during the current business day before the Moment of Risk Parameters Calculation, if fewer than 20 corresponding trades have been executed during the given period;

4.4.4. the Bank of Russia's rate for the corresponding currency, or the value determined by the Clearing Centre based on its own expertise, if no

corresponding trades were executed during the current business day before the Moment of Risk Parameters Calculation.

5. Setting Upper and Lower Risk Bands

5.1. Upper/Lower Risk Bands setting is based on the exponentially weighted moving average (EWMA) approach to volatility calculation.

5.2. Risk bands are calculated each business day *i* at the Moment of Risk Parameters Calculation.

5.2.1. Relative rate variation r_i is calculated as follows:

$$r_i = \max\left[\left|\frac{Rc_i - Rc_{i-2}}{Rc_{i-2}}\right|; \left|r\max_i\right|\right], \quad (5.1)$$

i.e. the maximum of two values below:

- Relative two-day Central Rate variation;
- Maximum relative intraday deviation of the prices in TOM instrument during business day *i* from Central Rate Rc_{i-1}; the first off-screen trades *q* shall not be so included into the calculation to avoid unrepresentative data at the start of trading. If the number of respective trades is insufficient, $r\max_i$ is equal to 0.

5.2.2. Weighing ratio a_i is determined.

5.2.2.1. If the relative rate change $\mathrm{r_i}$ exceeds σ_{i-1} on the previous business day, $a_i = a_{upper}$, otherwise $a_i = a_{lower}$:

$$a_{\mathrm{i}} = \begin{cases} a_{upper}, \textit{если } \mathrm{r_i} > \sigma_{i-1}; \\ a_{lower}, \textit{если } \mathrm{r_i} \le \sigma_{i-1}. \end{cases} \quad (5.2)$$

5.2.2.2. If in the interval of two trading days *i-2* and *i* there was more than one holiday, a_i is equal to 0.

Hereinafter, 'holiday' means:

- for currency pair USD/RUB: a non-business day in Russia, even if this is a business day in the US.
- for currency pair EUR/RUB: a non-business day in Russia, even if this is a business day in Germany.
- for Precious Metals/RUB: a non-business day in Russia, even if this is a business day either in the US, UK, or China.
- for other currencies/RUB: a non-business day in Russia, even if this is a business day in the country of issue.

5.2.3. Holiday ratio G_i is defined for the upcoming Risk Assessment Period[1]:

$$G_i = \sqrt{1 + \frac{m_i}{2}}. \quad (5.3)$$

Parameter m_i for a particular instrument is determined as the total number of Non-business days for a given currency pair in the upcoming Risk Assessment Period.

[1] Divider 2 means that the Risk Assessment Period equals to 2 business days by default.

5.2.4. Volatility is recalculated acc to the formula:

$$\sigma_i = \sqrt{(1-a_i)\cdot\sigma_{i-1}^2 + a_i \cdot r_i^2}\ . \quad (5.4)$$

If price change r_i exceeds Margin rate S_{i-1} and in the interval between business days *i* and *i-2* there is no more than one holiday, then along with volatility derived from formula (5.4), the following value is determined:

$$\sigma_i^* = \frac{r_i}{t}. \quad (5.5)$$

In this case volatility σ_i is calculated using the formula: $\sigma_i = \max(\sigma_i, \sigma_i^*)$.

In the above formula (5.5) and hereinafter, t is the volatility multiplier based on retrospective analysis and backtesting.

5.2.5. Tentative Margin Rate S_i^p is determined by the following algorithm:

if $ceiling\left(\frac{t\cdot\sigma_i}{h}\right)\cdot h \geq S_{i-1}^p + h$, then $S_i^p = ceiling\left(\frac{t\cdot\sigma_i}{h}\right)\cdot h$; otherwise

if $ceiling\left(\frac{t\cdot\sigma_i}{h}\right)\cdot h \leq S_{i-1}^p - h$ and the period from the last change of the tentative margin ratio equals at least *n* Business days, then $S_i^p = S_{i-1}^p - h$; otherwise $S_i^p = S_{i-1}^p$,

Where *ceiling* is the function of rounding up to integer.

5.2.6. Minimum Margin Rates of the three levels $S\_1\_\min$, $S\_2\_\min$, $S\_3\_\min$ are determined with the following purposes:

- to restrict model risk in case of too low volatility estimates if market conditions achieve the levels pre-defined in the stress scenarios;
- to prevent suspension of trading in the event of substantial Price Band narrowing.

5.2.7. Margin Rate estimate V_i is determined with consideration that it may only vary discreetly with the minimum step of *h*:

$$V_i = \min\left(ceiling\left(\frac{\max(S_i^p * G_i + b; S\_1\_\min)}{h}\right) * h;\ S\_\max\right). \quad (5.6)$$

5.3. The final first level Margin Rate S_1_i is equal to the Margin Rate estimate V_i

$S\_1_i = V_i$.

5.4. Values for second/third level Margin Rates S_2_i and S_3_i are determined by calculating volatility at the time of risk assessment level 2 and 3 subject to minimum and maximum Margin Rates for Underlying assets for trades without full prefunding:

$$S\_2_i = \min\left(ceiling\left(\frac{\max\left(\sqrt{\frac{rh\_2}{rh\_1}} \cdot (S_i^p * G_i + b); S\_2\_\min \right)}{h} \right) \cdot h; S\_\max \right),$$

$$S\_3_i = \min\left(ceiling\left(\frac{\max\left(\sqrt{\frac{rh\_3}{rh\_1}} \cdot (S_i^p * G_i + b); S\_3\_\min \right)}{h} \right) \cdot h; S\_\max \right).$$

5.5. If the flag for EWMA model for Margin Rate calculation (isEWMA) is set "FALSE" then the Margin Rates are set equal to the minimum Margin Rate levels.

5.6. Upper Risk Band, level 1, 2, 3 is calculated acc to the formula below:

$PtH\_1_i = P_i \cdot (1 + S\_1_i)$,

$PtH\_2_i = P_i \cdot (1 + S\_2_i)$,

$PtH\_3_i = P_i \cdot (1 + S\_3_i)$.

5.7. Upper Risk Band, level 1, 2, 3 is calculated acc to the formula below:

$PtL\_1_i = P_i \cdot (1 - S\_1_i)$,

$PtL\_2_i = P_i \cdot (1 - S\_2_i)$,

$PtL\_3_i = P_i \cdot (1 - S\_3_i)$.

5.8. The Clearing Centre's authorised executive body has the right to adjust the Margin Rate and Risk Assessment Range before and during trading.

6. Rollover Rates

6.1. Rollover Rate is the interest rate employed in calculating the price of a swap trade executed by a defaulting Clearing Member and the Clearing Centre. Rollover Rate is determined in % per annum.

6.2. Rollover Rate may be denominated in RUB or FX depending on the swap trade's direction. In the swap price formula in the Clearing Rules the rate is indicated in % per annum and is the value below depending on the swap trade direction:

6.2.1. If a defaulting Clearing Member buys FX/precious metals for RUB in the first leg of the swap trade executed and sells currency/precious metals in the second leg, the swap rate is equal to SD_{VAL}.

6.2.2. If a defaulting Clearing Member sells FX/precious metals for RUB in the first leg of the swap trade and buys currency/precious metals for RUB in the second leg, the swap rate is equal to SD_{RUB}.

6.3. In some cases the Clearing Centre is fully entitled to unilaterally change Rollover Rate for all or some of the Clearing Members including setting the Rates equal zero.

7. Central Indicative Swap Rate and Interest Risk Rate Calculation

7.1. Central Indicative Swap Rates are calculated over the course of trading on day *i* at the Moment of Risk Parameters Calculation using the following algorithm:

7.2. If swap trades with expires «TODTOM» are conducted over the current business day, the average weighted Swap Rate *Rate_(Y0,Y1,%)* is calculated from the average weighted rate over the current business day (WA).

7.3. If no «TODTOM» swaps have been executed during the current business day, the Swap Rate *Rate_(Y0,Y1,%)* used for calculation of the previous Central Indicative Swap rate is used OR the Swap Rate *Rate_(Y0,Y1,%)* is calculated taking into account a relevant maturity quote from Reuters / Bloomberg terminal conditional on such quote providing an improvement to the Rage (bid quote is higher or ask quote is lower).

7.4. The Swap trades rate denominated in % annual *Rate_(Yn,Ym,%)* is calculated which expiries correspond to swap transactions and swap contracts Yn/Ym traded on FX/Precious Metals Market on day (*i+1*) with first leg TOM (hereinafter Long Term Swaps).

7.4.1. The value of Swap Rate in % annual *Rate_(Y1,Y2,%)* for each instruments with expiries «TOMSPT» is set equal *Rate_(Y0,Y1,%)* .

7.4.2. If in the trading system of the FX/Precious Metals Market of the Moscow Exchange there has been an order-book quote and/or in Reuters and/or Bloomberg terminals there has been a swap quote with «TOMSPT» maturity improving the quote (higher bid or lower ask), the Central Indicative Swap Rate may be calculated by using such a quote.

7.4.3. For other Long Term Swaps, Central Indicative Swap Rates *Rate_(Y1,Ym,%)* are calculated as follows:

7.4.3.1. If the National Foreign Exchange Association publishes the Indicative NFEA FX Swap Rate for an instrument for the corresponding period, the swap rate in percent per annum is based on the NFEA's FX Swap Rate. If on the current day the NFEA FX Swap Rate has not been published or has not been available for other reasons, previous central value is used. If in the trading system of Moscow Exchange's FX/Precious Metals Market there was a order-book quote and/or in Reuters and/or Bloomberg terminals there was a swap quote with the respective term with a higher bid or lower ask the Central Iindicative Swap Rate may be based on this quote.

7.4.3.2. If the National Foreign Exchange Association does not publish the NFEA FX Swap Rate for the instrument, the swap rate in percent per annum is based on average value of the best bids and offers placed in the trading system of Moscow Exchange's FX/Precious Metals Market. If Reuters and/or Bloomberg terminal contains a quote for a swap trade (respective maturity) with a higher bid or lower ask, the Indicative Swap Rate may be based on this quote.

7.4.4. If necessary, the authorised executive body of the Clearing Centre is entitled to change swap rates for the purposes of calculating the Central Indicative Rates in a manner different form the aforementioned procedure.

7.4.5. For each maturity, further denoted as YX, and corresponding to Futures expiry dates, beside dates for the second leg of Long Term Swap, are calculated at the Moment of Risk Parameters Calculation in the following manner:

*Bid_SSwap(Y0,YX,%) = (Bid_Fut(YX) –Rc)/Rc *365 /T(YX),*

*Ask_SSwap(Y0,YX,%) = (Ask_Fut(YX) –Rc)/Rc *365 /T(YX),*

*Last_SSwap(Y0,YX,%) = (Last_Fut(YX) –Rc)/Rc *365 /T(YX),*

Where as *Last_Fut(YX), Bid_Fut(YX) and Ask_Fut(YX)* are the prices of close price and best prices for Futures contract with YX expiry.

In case of no such quotes for one or several Synthetic Swaps exists, a linear interpolation method between the Long Term Swaps rates of different maturity is utilizes, calculated in p. 7.4.1-7.4.4.

7.4.6. The value of Synthetic Swap Rate *Rate_(Y0,YX,%)* for Key expires YX is calculated as the median among the values described in the previous paragraph.

7.4.7. Central Indicative Swap Rates (in % annual) at Key expires corresponding to maturities of the second leg Swap trades Ym and Futures contract expires YX are calculated as follows:

SWAPCRate_(Y0,Y1,%) = Rate_(Y0,Y1,%),

SWAPCRate_(Y0,Y1,%) = Rate_(Y0,Y1,%),

SWAPCRate_(Y0,Ym,%) =

*[Rate_(Y0,Y1,%)*T(Y1)+ Rate_(Y1,Ym,%)*(T(Ym)-T(Y1))] / T(Ym).*

Where as *T(Yn)* is determined as period corresponding to expiry Yn in days.

7.4.8. Central Indicative Swap Rates *SWAPCRate_(Y0,Ym,%)* for broken dates are calculated by linear interpolation method.

7.5. Central Indicative Swap Rates *SWAPCRate_(Y0,Ym,RUB)* for each Ym is calculated as

*SWAPCRate(Y0,Ym, RUB) = (SWAPCRate(Y0,Ym, %)*T(Ym) *Rc) / 36500.*

Interest Risk Rate of 1st, 2nd and 3rd levels are calculated every Business day *i* at the Moment of Risk Parameters Calculation.

7.6. Interest Risk Rate corresponding to Key expiry date is calculated daily at the Moment of Risk Parameters Calculation on the day *i* using the exponential weighting method:

7.6.1.1. Relative interest rate change is calculated as follows:

$$r(\text{interest\_risk})_i = \max\left[\begin{array}{l}\left|\dfrac{SWAPCRate_i / Sn_i - SWAPCRate_{i-2} / Sn_{i-2}}{Rc_{i-2}}\right|; \\ \left|\dfrac{SWAPCRate_i / Sn_i - SWAPCRate_{i-1} / Sn_{i-1}}{Rc_{i-1}}\right|\end{array}\right] * 36500, \quad (7.1)$$

where *Sn* is the number of calendar days indicated in the swap trade price.

7.6.2. Weighing coefficient a_i is determined.

- If relative interest rate Change $r(\text{interest\_risk})_i$ exceeds estimated volatility $\sigma(\text{interest\_risk})_{i-1}$ on the previous business day, then $a_i = a_{upper}$, otherwise $a_i = a_{lower}$:

$$a_i = \begin{cases} a_{upper}, & \text{если } r(\text{interest\_risk})_i > \sigma(\text{interest\_risk})_{i-1}; \\ a_{lower}, & \text{если } r(\text{interest\_risk})_i \le \sigma(\text{interest\_risk})_{i-1}. \end{cases} \quad (7.2)$$

- If in the interval between the two business days *i-2* and *i* there was more than one holiday, weighing coefficient a_i is equal to 0.

7.6.3. G_i is determined using the same procedure as in 5.2.3

7.6.4. Interest rate volatility is recalculated using the formula:

$$\sigma(\text{interest\_risk})_i = \sqrt{(1-a_i)\cdot\sigma(\text{interest\_risk})_{i-1}^2 + a_i \cdot r(\text{interest\_risk})_i^2} \quad (7.4)$$

If price change $r(\text{interest\_risk})_i$ exceeds Interest Risk Rate Δ_{i-1} and in the interval between business days *i* and *i-2* there is no more than one holiday, then along with volatility calculated using the formula in (7.4), the value below will be calculated as follows:

$$\sigma(\text{interest\_risk})_i = \frac{r(\text{interest\_risk})_i}{t} \quad (7.5)$$

In this case the volatility $\sigma(\text{interest\_risk})_i$ is the maximum value of the two (7.4), (7.5).

In (7.5) and hereinafter t is a volatility multiplier based on retrospective analysis and backtesting.

7.6.5. Tentative Interest Risk Rate Δ_i^p is calculated using the following algorithm:

If $ceiling\left(\frac{t\cdot\sigma(\text{interest\_risk})_i}{h(\text{interest\_risk})}\right)\cdot h(\text{interest\_risk}) \geq \Delta_{i-1}^p + h(\text{interest\_risk})$

then, $\Delta_i^p = ceiling\left(\frac{t\cdot\sigma(\text{interest\_risk})_i}{h(\text{interest\_risk})}\right)\cdot h(\text{interest\_risk})$

Otherwise, if $ceiling\left(\frac{t\cdot\sigma(\text{interest\_risk})_i}{h(\text{interest\_risk})}\right)\cdot h(\text{interest\_risk}) \leq \Delta_{i-1}^p - h(\text{interest\_risk})$

and the time since the last change of the Tentative Interest Risk Rate is less than *n(interest_risk)* business days,

then $\Delta_i^p = \Delta_{i-1}^p + h(\text{interest\_risk})$;

otherwise $\Delta_i^p = \Delta_{i-1}^p$,

where *ceiling* is the function of rounding up to integer.

7.6.6. Interest Risk Rate $V(\text{interest\_risk})_i$ is determined with consideration that the calculated interest rate may only vary discretely with the minimum step $h(\text{interest\_risk})$

$$V(\text{interest\_risk})_i = ceiling\left(\frac{\max(\Delta_i^p * G_i + b\_IR; \Delta\_1\_\min)}{h(\text{interest\_risk})}\right) * h(\text{interest\_risk}). \qquad (7.6)$$

7.6.7. The final value of the Interest Risk Rate of the 1st level is equal to the calculated Interest Risk Rate $V(\text{interest\_risk})_i$

$$\Delta\_1_i = V(\text{interest\_risk})_i$$

7.6.8. Second level Interest Risk Rate (Δ_2_i) is determined through recalculating the volatility during the Risk Assessment Period (second level) considering the minimum Interest Risk Rate (second level) $\Delta\_2\_\min$ and the minimum step of the Interest Risk Rate *h_IR*:

$$\Delta\_2_i = ceiling\left(\frac{\Delta\_1 * \sqrt{\frac{rh\_2}{rh\_1}}}{h(\text{interest\_risk})}\right)\cdot h(\text{interest\_risk}).$$

7.6.9. Third level Interest Risk Rate (Δ_3_i) is determined by recalculating the volatility during the Risk Assessment Period (third level) considering the minimum Interest Risk Rate of the third level $\Delta\_3\_\min$ and the minimum step of the Interest Risk Rate *h_IR*:

$$\Delta\_3_i = ceiling\left(\frac{\Delta\_1 * \sqrt{\frac{rh\_3}{rh\_1}}}{h(\text{interest\_risk})}\right)\cdot h(\text{interest\_risk}).$$

7.6.10. If the Interest Rate Risk calculation flag *isEWAMA_IR* is set to "FALSE" then the Interest Rate Risk levels are set equal to the minimum level of Interest Rate Risk.

7.6.11. Authorised executive body of the Clearing Centre is entitled to set the final Interest Risk Rate that may differ from the calculated value of the Interest Risk Rate estimate.

7.6.12. Interest Rate Risk (upward/downward scenarios) of J-level (J= 1,2,3) for Key expiry dates Ym, corresponding to the second leg expires of "Long Term Swap" for every asset is determined in the following way:

$$H\Delta\_J(Ym) = L\Delta\_J(Ym) = \Delta\_J(Ym)$$

Where $H\Delta\_J(Ym), L\Delta\_J(Ym)$ are the Interest Rate Risk upward/downward scenarios.

For Key expiry dates, corresponding to Futures contracts expiries, the Interest Rate Risk (upward/downward scenarios) are set by linear interpolation method.

7.7. Interest Rate Risk (upward/downward scenarios) of J-level (J= 1,2,3) for broken dates, are calculated by linear interpolation. Interest Rate Risk with expiry longer than the maximum Key expiry date is set equal to the maximum Key expiry date.

7.8. Interest Rate Risk (upward/downward scenarios) of J-level (J= 1,2,3) in rubles for Ym is calculated as

$$SWAPHRate\_J(Y0, Ym, RUB) = \frac{\left[SWAPCRate\_(Y0, Ym, \%) + H\Delta\_J(Ym)\right] * T(Ym)}{365 * 100} * Rc$$

$$SWAPLRate\_J(Y0, Ym, RUB) = \frac{\left[SWAPCRate\_(Y0, Ym, \%) - L\Delta\_J(Ym)\right] * T(Ym)}{365 * 100} * Rc$$

8. Price Bands Definition

8.1. To control the maximum deviation for a market order price the following Price Bands are determined for FX and Precious Metals orders:

- Price Bands to limit spot order prices for FX and Precious Metals.
- Price Bands to limit swap order prices. For each swap instrument, a separate Price Band is to be determined depending on the swap maturity.
- Price Bands to limit futures order prices. For each futures, a separate Price Band is to be determined depending on the maturity.

8.2. Upper/Lower Price Band for spot orders (currency pair Vall1/Val2) value for each delivery Ym is defined as

$$RcH\_(Ym) = \frac{Rc(Val1)}{Rc(Val2)} * (1 + \frac{S\_1(Val1)}{x}) * (1 + \frac{(SWAPCRate\_(Y0, Ym, \%) + \frac{H\Delta\_1(Ym)}{swapx}) * \left[T(Ym) - T(Y0)\right]}{365 * 100})$$

$$RcL\_(Ym) = \frac{Rc(Val1)}{Rc(Val2)} * (1 - \frac{S\_1(Val1)}{x}) * (1 + \frac{(SWAPCRate\_(Y0,Ym,\%) - \frac{L\Delta\_J(Ym)}{swapx}) * [T(Ym) - T(Y0)]}{365 * 100})$$

8.3. Upper/Lower Price Band levels for Futures contract orders and for deliverable Futures or forward contract orders with flexible expiry date YX are calculated as follows:

$$SCHFUT\_(YX) = RcH(Y0) + SWAPHRate\_1(Y0, YX, RUB)$$

$$SCLFUT\_(YX) = RcL(Y0) + SWAPLRate\_1(Y0, YX, RUB)$$

8.4. The procedure of defining the Price Band to limit order prices for a SWAP on currency pair Val1/Val2 for each expiry date Yn/Ym is the following:

8.4.1. Upper/Lower Price Band for SWAP trades denominated in % annual for each date Ym are defined :

$$SWAPHRate\_(Y0,Ym,\%) = SWAPCRate\_(Y0,Ym,\%) + \frac{H\Delta\_1(Ym)}{swapx}$$

$$SWAPLRate\_(Y0,Ym,\%) = SWAPCRate\_(Y0,Ym,\%) - \frac{L\Delta\_1(Ym)}{swapx}.$$

8.4.2. Upper/Lower Price Band for SWAP trades in currency Val2 and currency pair Val1/Val2 with expiry dates corresponding to SWAP Yn/Ym expiry dates are calculated as :

$$SWAPCHRate\_(Yn,Ym,Val1,Val2) = \frac{\left(FwdRate\_(Yn,Ym,\%) + \frac{H\Delta\_1(Ym,Val1)}{swapx}\right) * [T(Ym) - T(Yn)]}{365 * 100} * \frac{Rc(Val1)}{Rc(Val2)}$$

$$SWAPCLRate\_(Yn,Ym,Val1,Val2) = \frac{\left(FwdRate\_(Yn,Ym,\%) - \frac{L\Delta\_1(Ym,Val1)}{swapx}\right) * [T(Ym) - T(Yn)]}{365 * 100} * \frac{Rc(Val1)}{Rc(Val2)}$$

Where as if Val2 =RUB then $FwdRate\_(Yn,Ym,\%)$ is defined as

$$FwdRate\_(Yn,Ym,\%) = \frac{SWAPC\_Rate\_(Y0,Ym,\%) * T(Ym) - SWAPC\_Rate\_(Y0,Yn,\%) * T(Yn)}{T(Ym) - T(Yn)}$$

Alternatively, it is calculated as

$$\left[\frac{100 + FwdRate\_(Yn,Ym,\%,Val1) * (T(Ym) - T(Yn))/365}{100 + FwdRate\_(Yn,Ym,\%,Val2) * (T(Ym) - T(Yn))/365} - 1\right] * \frac{36500}{(T(Ym) - T(Yn))}.$$

9. Price Bands Shift before Opening and during Trading (price corridor expansion)

9.1. The Price Band may be changed for any instrument before the start of and during trading (though no later than the end time set forth in the Clearing Rules for changing risk parameters), in case of receiving an automatic alert to move the bands, except cases stated in clause 9.2 hereof.

9.2. If case of no significant changes in the market or if the orders and trades volume is insufficient, the Clearing Centre's authorised executive body may decide to keep the Price Band unchanged despite the automatic alert to move the band.

9.3. For the currency pairs with Risk Monitoring flag is set to "FALSE" the alerts are suppressed and the bands are not moved as the result.

9.4. One of the following events serves as a signal to move the Price Band in order to control order prices on FX/Precious Metals, except swap orders:

- Bid approaches the Upper Band by a value that is lower than the value of $w*(RtH - RtL)$, and this situation persists during the time period determined by risk parameter u;
- Ask approaches the Lower Band by a value that is lower than the value of $w*(RtH - RtL)$, and this situation persists during the time period determined by risk parameter u;
- Before opening, estimated exchange rate differs from the Price Band by less than value of $w*(RtH - RtL)$, or is out of the price corridor.

The following events serve as a signal to move the Price Band to control swap orders' prices:

- Best on-screen sell/buy quote approaches the Upper Band by a value less than value $w*(SWAPcH - SWAPcL)$, and this persists during the time period determined by the risk parameter *u*;
- Best on-screen buy/sell quote approaches the Lower Band by a value less than value $w*(SWAPcH - SWAPcL)$, and this persists during the time period determined by risk parameter *u*.
- Before opening, estimated exchange rate differs from the Price Band by less than value $w*(SWAPcH - SWAPcL)$, or is out of the price corridor.

For the Futures contracts any of the above serves as signal to move the correspondent Price Band.

9.5. If the alert message is not sent automatically and the exchange rate is approaching the Price Band by a value less than *w* on the OTC market or is outside the price corridor, then the Clearing Centre's authorised executive body may decide to move the Price Band.

9.6. If a decision is made to move Upper/Lower Price Band, the band is shifted up/down by $Shift*(RcH - RcL)$. For spot trades and delivery Futures contracts used TOD trades Upper/Lower Price Band set at the Moment of Risk Parameters Calculation on day *i-1* from the Central Rate. For SWAP trades - the Central Indicative Swap Rate and in correspondence with the algorithm described in paragraph.

9.7. If Price Bands for spot trades were shifted Upper/Lower Price Band for Futures Contracts are calculated as follows:

$$SCHFUT\_(YX, RUB) = newRcH(Val1, Val2) + SWAPCHRate\_(Y0, YX, Val1, Val2)$$

$$SCLFUT\_(YX, RUB) = newRcL(Val1, Val2) + SWAPCLRate\_(Y0, YX, Val1, Val2)$$

9.8. In case of Price Band levels adjustment as per paragraphs 9.3-9.4 of the Methodology the Clearing Centre discloses the information with regards to such adjustment in the Clearing System not later than 15 minutes after the adjustment

is made as well as at Clearing Centre and Moscow Exchange web-sites not later than in 30 minutes upon the adjustment.

10. Expanding the Risk Assessment Range (three levels) for Instruments without full Prefunding before Opening and during Trading

When the spot Price Band is shifted the new Risk Bands are defined as follows:

- If the Upper Price Band is moved, then the Upper Risk Limit Level 1 is determined as follows:

$$RtH = RtH_{i-1} + \left(RcH - RcH_{i-1}\right)$$

where
RtH – new value of the Upper Risk Band;
RcH – new value of the Upper Price Band;
RtH_{i-1} - value of the Upper Risk Band on day *i-1*;
RcH_{i-1} – value of the Upper Price Band on day *i-1*.
Risk Bands of the second and third levels are moved by $RtH_i - RtH_{i-1}$.

- If the Lower Band of the price corridor is moved, the Lower Band of the first level Risk Assessment Range is determined as follows:

$$RtL = RtL_{i-1} + \left(RcL - RcL_{i-1}\right)$$

where
RtL – new value of the Lower Risk Band;
RcL – new value of the Lower Price Band;
RtL_{i-1} – value of the Lower Risk Band on day *i-1*;
RcL_{i-1} – value of the Lower Price Band on day *i-1*.
Risk Bands of the second and third levels are moved by $RtL_i - RtL_{i-1}$.

11. IR Risk Bands Shift before Opening and during Trading

11.1. In case of a Price Band shifting alert for SWAP trades with Yn/Ym expires or a Price Band shifting alert for Synthetic Swap Y0/Ym the following values are changed: $H\Delta\_J(Ym)$ or $L\Delta\_J(Ym)$, depending on the change direction by the amount of $\frac{2 * Shift * \Delta\_1(Ym)}{swapx}$.

11.2. The new value for Key date Ym Interest Rate Risk are defined as :

$$shift\_H\Delta\_J(Ym) = H\Delta\_J(Ym) + \frac{2 * Shift * \Delta\_1(Ym)}{swapx}$$ for the upward scenario:

$$shift\_L\Delta\_J(Ym) = L\Delta\_J(Ym) + \frac{2 * Shift * \Delta\_1(Ym)}{swapx}$$ for the downward scenario.

Interest Rate Risk (upward/downward scenarios) of J-level (J=1,2,3) for dates Yn that are different to the Key expiry dates are linearly interpolated.

11.3. Interest Rate Risk (upward/downward scenarios) of J-level (J=1,2,3) in rubles for Key dates Ym upon the Band adjustment are recalculated as :

$$shift\_SWAPHRate\_J(Y0,Ym,RUB) = \frac{\left[SWAPCRate\_(Y0,Ym,\%) + shift\_H\Delta\_J(Ym)\right]*T(Ym)}{365*100} * Rc$$

$$shift\_SWAPLRate\_J(Y0,Ym,RUB) = \frac{\left[SWAPCRate\_(Y0,Ym,\%) - shift\_L\Delta\_J(Ym)\right]*T(Ym)}{365*100} * Rc$$

11.4. The Upper and Lower Price Bands for swap trades denominated in % annual for each Key date Ym are defined as :

$$shift\_SWAPCHRate\_(Y0,Ym,\%) = SWAPCRate\_(Y0,Ym,\%) + \frac{shift\_H\Delta\_1(Ym)}{swapx}$$

$$shift\_SWAPCLRate\_(Y0,Ym,\%) = SWAPCRate\_(Y0,Ym,\%) - \frac{shift\_L\Delta\_1(Ym)}{swapx}$$

11.5. The Upper and Lower Bands for swap trades in RUB with the expirty dates corresponding to swap settlement dates Yn/Ym upon shift are recalculated as follows:

$$shift\_SWAPCHRate\_(Yn,Ym,Val1,Val2) = \frac{\left(FwdRate\_(Yn,Ym,\%) + \frac{shift\_H\Delta\_1(Ym,Val1)}{swapx}\right)*\left[T(Ym)-T(Yn)\right]}{365*100} * \frac{Rc(Val1)}{Rc(Val2)}$$

$$shift\_SWAPCLRate\_(Yn,Ym,Val1,Val2) = \frac{\left(FwdRate\_(Yn,Ym,\%) - \frac{shift\_L\Delta\_1(Ym,Val1)}{swapx}\right)*\left[T(Ym)-T(Yn)\right]}{365*100} * \frac{Rc(Val1)}{Rc(Val2)}$$

Where as if Val2 = RUB than $FwdRate\_(Yn,Ym,\%)$ is defined as

$$FwdRate\_(Yn,Ym,\%) = \frac{SWAPC\_Rate\_(Y0,Ym,\%)*T(Ym) - SWAPCRate\_(Y0,Yn,\%)*T(Yn)}{T(Ym)-T(Yn)}$$

or alternatively as

$$\left[\frac{100 + FwdRate\_(Yn,Ym,\%,Val1)*(T(Ym)-T(Yn))/365}{100 + FwdRate\_(Yn,Ym,\%,Val2)*(T(Ym)-T(Yn))/365} - 1\right] * \frac{36500}{(T(Ym)-T(Yn))}.$$

11.6. The Upper/Lower Price Band for Futures contracts upon the shift are calculated as

$$SCHFUT\_(YX) = RcH(Val1,Val2) + shift\_SWAPCHRate\_(Y0,YX,Val1,Val2),$$

$$SCLFUT\_(YX) = RcL(Val1,Val2) + shift\_SWAPCLRate\_(Y0,YX,Val1,Val2).$$

12. Narrowing Risk Assessment Ranges and Price Bands before Opening

12.1. Before opening on business day *i* following a holiday when the Holiday Factor $G_i > 1$ was applied to determine the risk parameters, the Clearing Centre checks whether the Risk Assessment Ranges for Instruments without full prefunding can be narrowed.

12.2. The Risk Assessment Range bands are recalculated for the current day in accordance with the algorithm stated in section 5 hereof with $G_i = 1$.

12.3. The Price Bands are determined in accordance with section 8 hereof based on values calculated in accordance with clause 12.2 hereof.

12.4. If the estimated exchange rate for relevant instruments is within the half of the Price Band calculated as per clause 12.3 hereof, the Risk Assessment Range and the Price Band are to be reviewed. Otherwise, they are not set.

12.5. In specific circumstances, the Clearing Centre's authorised executive body may decide to narrow the Risk Assessment Range and the Price Band in a way different from the procedure described above.