June 30, 2017
039/2017-DP

C I R C U L A R L E T T E R

To: B3 Market Participants – BM&FBOVESPA Segment

Re: **New Methodology for the Calculation of Trading Tunnels for the Option, Futures and Forward Markets**.

B3 hereby informs you that as of **July 10, 2017**, it will implement a new methodology for the calculation of auction and rejection tunnels at the BM&FBOVESPA PUMA Trading System, for BOVESPA and BM&F segment option contracts; for BM&F segment futures contracts and structured transactions; and for BOVESPA segment forward contracts.

The new methodology will bring enhancements to the pricing models of securities and derivatives, principally:

- New functionality for the BM&F segment which allows use of the prices of the most liquid contract months as a basis for a dynamic update to the reference price (tunnel center) for calculation of the auction and rejection tunnels of the less-liquid months of the same contract;

- Changes to the calculation model of the auction and rejection tunnels for BM&F and BOVESPA segment option contracts, whereby pricing is executed with volatility shocks (addition or subtraction of values), using the maximum and minimum prices for the underlying of the option, which are calculated in a predetermined period;

- Validation of the dynamic of price and fee parameters upon forward trade registration using as upper and lower price limits the maximum and

minimum trading prices of the underlying in the cash market and the interpolation of the DI rate x fixed interest rate for the term of the forward.

B3 may change the parameters used in its calculations at any time during the trading session, with no previous notice to the market. The methodology used for the calculation of the auction and rejection tunnels, for each security or derivative, is available at www.bmfbovespa.com.br, at Regulation / Regulations and manuals / Operational / Trading Tunnel.

The procedures of the new methodology are described in Annexes I - New Methodology of the Futures Market Auction and Rejection Tunnels; II – New Methodology of the Option Market Auction and Rejection Tunnels; and III – New Methodology of the Forward Market Auction and Rejection Tunnels of this Circular Letter.

Further information is available from the Operations Department, by telephone at (+55 11) 2565-4680/4213/4304 or by email at controledeoperacoes@bvmf.com.br.

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Annex I to Circular Letter 039/2017-DP

New Methodology of the Futures Market Auction and Rejection Tunnels

This document presents the procedures for determining the center of the tunnel for the calculation of the auction and rejection tunnels of derivatives futures contracts, whose underlyings are interest rates and exchange rates, agricultural and energy commodities, foreign currencies and stock indices.

The procedures include the following definitions:

- **Pivot point**: month(s) considered to have the greatest liquidity for the same contract, which will be used as the basis for updating other contract months considered to be less liquid;

- **Update period**: time in which the system will update the center of the tunnel, independently of the price fluctuation of the security or derivative;

- **Update percentage**: percentage value that if reached will update the center of the tunnel. This percentage will be calculated in relation to the last calculated price and, in the absence of this, in relation to the settlement price;

- **Calculation by the differential**: definition of the center of the tunnel by the calculation of the differential between the settlement prices of the contract months of a same product.

1. One-Day Interbank Deposit Futures Contracts (DI1) and Futures Contracts Referencing the Average Rate for One-Day Repurchase Agreements (OC1)

The interpolation method will be used, with an algorithm for constructing Brazilian real-denominated interest rate curves, using the liquid contract months as a base.

Pivot point designated derivatives will be those maturing in the first two months, as well as those with January, April, July and October contract months that present high liquidity in accordance with B3's analysis. As of the first contract that is considered a pivot point, there will be the exponential extrapolation of the contract months up until the next one that is considered a pivot point. When the term structure of interest rates does not cover the entire time horizon that one wishes to analyze, it will be necessary to extrapolate the constructed yield.

Example:

Contract month	Pivot point	Calculation
1st	Yes	Pivot point
2nd	Yes	Pivot point
3rd	No	Interpolation
4th	Yes	Pivot point
5th	No	Interpolation
6th	Yes	Pivot point
7th	No	Extrapolation
8th	No	Extrapolation

*The definitions of the contract months that will effectively be used as a pivot point are available at www.bmfbovespa.com.br, Regulation / Regulations and manuals / Operational / Trading Tunnel Parameters.

1.1 Interpolation formula

$$PIn = \left((1 + PR_a)^{\frac{DUa}{252}} \times \left(\frac{(1 + PR_p)^{\frac{DUp}{252}}}{(1 + PR_a)^{\frac{DUa}{252}}} \right)^{\frac{DUn - DUa}{DUp - DUa}} \right)^{\frac{252}{DUn}} - 1$$

where:

- PI_n = price of the nth futures contract month resulting from the exponential interpolation;
- PR_a = reference price of expiry *a* (defined as pivot point) immediately preceding the interpolated expiry (expiry *n*);
- PR_p = reference price of the expiry *p* (defined as pivot point) immediately preceding the interpolated expiry (expiry *n*);
- DU_n = number of business days between the calculation date and the date of the interpolated expiry *n*;
- DU_a = number of business days between the calculation date and the expiry date *a*;
- DU_p = number of business days between the calculation date and the expiration date *p*.

1.2 Extrapolation formula

$$PE_{n+1} = \left[(1 + PR_n)^{\frac{DUn}{252}} \times \left(\frac{(1 + PR_n)^{\frac{DUn}{252}}}{(1 + PR_{n-1})^{\frac{DUn-1}{252}}} \right) \right]^{\frac{252}{DUn+1}} - 1$$

where:

- PE_{n+1} = price of the nth expiry of the DI1 Futures contract resulting from the extrapolation;
- PR_n = reference price of the last available rate;
- PR_{n-1} = reference price of the penultimate available rate;
- DU_{n+1} = number of business days between the calculation date and the date of the extrapolated expiry *n*+1;

- D_n = number of business days between the calculation date and the date of expiry *n*;

- D_{n-1} = number of business days between the calculation date and the date of expiry *n-1*.

2. Ibovespa Futures Contract (IND), Mini Ibovespa Futures Contract (WIN), US Dollar Futures Contract (DOL) and Mini US Dollar Futures Contract (WDO)

The calculation method to be used is through the settlement price differential between expiries, using the first contract month as pivot point and converging to the second contract month on the next expiry date.

In this method the first contract month's differential in settlement points is added to the rest.

Example:

Contract Month	Pivot point	Settlement	Differential	Calculated
1st	Yes	67,555	–	66,730
2nd	No	68,561	1,006	67,736
3rd	No	69,466	905	68,641
4th	No	70,247	781	69,422
5th	No	71,106	859	70,281
6th	No	72,055	949	71,230
7th	No	72,906	851	72,081
8th	No	73,946	1,040	73,121

*The definitions of the contract months that will be effectively used as pivot point are available at www.bmfbovespa.com.br, Regulation / Regulations and manuals / Operational / Trading Tunnel Parameters.

3. **Cash-Settled Crystal Sugar Futures Contract (ACF), Cash Settled Live Cattle Futures Contract (BGI), 4/5 Arabica Coffee Futures Contract (ICF), 6/7 Arabica Coffee Futures Contract (KFE), Anhydrous Fuel Ethanol Futures Contract (ETN), Cash Settled Hydrous Ethanol Futures Contract (ETH), Cash-Settled Corn Futures Contract (CCM), Cash-Settled Mini Crude Oil Futures Contract at the Price of the CME Group Light Sweet Crude Oil (WTI) Futures Contract, Cash-Settled Soybean Futures Contract at the Price of the CME Group Mini-Sized Soybean Futures Contract (SJC), FRA on ID x US Dollar Spread (FRC) and Forward Rate Agreement on One-Day Repurchase Agreements x US Dollar Spread (FRO)**

   The calculation method to be used is through the settlement price differential between expiries, using the first contract month as pivot point or the contract month(s) that B3 considers to be most liquid.

   In this method the differential in settlement points of the contract month defined as pivot point is added to the rest.

4. General considerations

In the case of the unavailability or partial availability of the inputs used for the methodology described in this document and/or upon the occurrence of events of an economic or operational nature that might adversely affect the synchronism of the prices that are calculated or the application of the corresponding methodology, B3 shall at its sole discretion arbitrate the center of the tunnel.

Annex II to Circular Letter 039/2017-DP

New Methodology of the Option Market Auction and Rejection Tunnels

This documents sets out the procedures for determining the auction and rejection tunnels of options on equities, on ETFs, on futures and on indices.

The procedures involve the following definitions:

- **Volatility**: for the calculation of the trading tunnels (auction and rejection) of the options on equities, on ETFs, on futures and on indices, volatility surfaces will be necessary, being available at www.bmfbovespa.com.br, at Services / Market Data / Historical data / Derivatives / Previous trading session / File: “Equities Market – Equities Volatility Surface (Delta x Volatility)” for options on equities, on ETFs and on indices; and “Derivatives Market – Standardized Option Deltas” for options on futures. Volatilities may be updated during the trading session by the Operations Department;

- **Price of the underlying**: for the calculation of trading tunnels (auction and rejection), it will be necessary to monitor the maximum and minimum prices of the underlying for a period during the current trading session;

- **Volatility shock**: addition of an absolute value to or its subtraction from the volatility of an option; , if it is a percentage, it must be calculated in relation to the volatility of the option and this value must then be added to or subtracted from the volatility. The volatility shock values for the upper and lower trading tunnel and for the upper and lower rejection tunnel may be different among themselves.

  Example:

Option	Volatilty	Lower auction shock	Upper auction shock	Lower rejection shock	Upper rejection shock
IBOVJ38	39.36	10%	20%	40%	50%

*The definitions of the contract months that will effectively be used as pivot point are available at www.bmfbovespa.com.br, Regulation / Regulations and manuals / Operational / Trading Tunnel Parameters.

- **Minimum Band Amplitude (MBA)**: absolute value defined for the center of the auction and rejection tunnel which will be added to and subtracted from the center of the auction tunnel (calculated by the volatility shock).

To determine the lower limit of the auction tunnel the minimum price of the underlying of the call option, calculated over a period, will be inserted into the pricing formula. In the same way, for put options there will be insertion of the maximum value of its underlying calculated over a period. The volatility inserted into the call or put option pricing formula will undergo a downward shock.

To determine the lower limit of the rejection tunnel the same method is applied, with a percentage on the volatility that is different to that used for the auction tunnel.

To determine the upper limit of the auction tunnel the maximum price of the underlying of the call option, calculated over a period, will be inserted into the pricing formula. In the same way, for put options there will be insertion of the minimum value of its underlying calculated over a period. The volatility inserted into the call or put option pricing formula will undergo an upward shock.

To determine the upper limit of the rejection tunnel the same method is applied, with a percentage on the volatility that is different to that used for the auction tunnel.

The tunnels calculated with the greatest amplitude between the Minimum Band Amplitude (MBA) and Volatility Shock will be used.

In the case of the unavailability or partial availability of the inputs used for the methodology described in this document and/or upon the occurrence of events of an economic or operational nature that might adversely affect the synchronism of the prices that are calculated or the application of the

corresponding methodology, B3 shall at its sole discretion arbitrate the center of the tunnel.

The price determination of underlyings has different methodologies per type of instrument, as described below.

1. Options on equities and ETFs

These will use the traded price of their respective underlyings during the trading session.

2. Options on futures contracts

To calculate the price of the underlying, a pivot point will be defined from which there shall be use of the calculation methodology by the differential between the settlement prices of the furthest month to the nearest. For options on indices with odd months and for serial options, there shall be the calculation of a synthetic settlement price using the interpolation between the settlement prices of the months that are available for trading.

For options with months that are considered pivot points, there shall be the use of the prices traded during the trading session; and for the other months the settlement price differentials shall be added to the price at which the underlying security identified as a pivot point was traded.

Example:

Calculation of the price of the underlying security with the US Dollar futures contracts whereby DOLK17 is the pivot point:

US Dollar futures	Price of the underlying	Settlement	Difference between settlements	Observations
DOLK17	3,135.00	3,161.297	–	The price of the underlying is the price of the last trade with DOLK17
DOLM17	3,159.38	3,185.677	24.38	The price of the underlying is the difference of the settlements added to the price of the last trade with DOLK17 (3135+24.38)

US Dollar futures	Price of the underlying	Settlement	Difference between settlements	Observations
DOLN17	3,180.59	3,206.892	45.59	The price of the underlying is the difference of the settlements added to the last trade with DOLK17 (3135+45.59)
DOLQ17	3,199.73	3,226.026	64.73	The price of the underlying is the difference of the settlements added to the price of the last trade with DOLK17 (3135+64.73)
DOLU17	3,220.90	3,247.202	85.90	The price of the underlying is the difference of the settlements added to the price of the last trade with DOLK17 (3135+85.90)
DOLV17	3,236.84	3,263.135	101.84	The price of the underlying is the difference of the settlements added to the price of the last trade with DOLK17 (3135+101.84)
DOLX17	3,254.47	3,280.766	119.47	The price of the underlying is the difference of the settlements added to the price of the last trade with DOLK17 (3135+119.47)

*The definitions of the contract months that will be used as the pivot months are available at www.bmfbovespa.com.br, Regulation / Regulations and manuals / Operational / Trading Tunnel Parameters.

3. Call and Put Options on the One-Day Interbank Deposit Futures Contract (IDI) and Call and Put Options on the Index of the Average Rate of One-Day Repurchase Transactions (ITC)

For calculation of the underlying of options on DI1 the formula below shall be used, using the DI1 rate (for options on IDI) and OC1 rate (for options on ITC) traded in the current trading session and using the Spot index.

3.1. Formula for the calculation of IDI and ITC

$$IDI/ITC_f = IDI/ITC_s \times \left(1 + r_{DI/OC\,1}\right)^{DU/252}$$

where:

- $\mathrm{IDI/ITC_f}$ = corresponds to the reference Forward Index (underlying of the options);
- $\mathrm{IDI/ITC_s}$ = corresponds to the Spot Index;

- $r_{DI/OC\,1}$ = the considered rate;

- DU = the number of business days up until the expiration date.

Example:

Calculation of the underlying for options on IDI expiring in September 2017:

$$IDI_{f\ SEP/17} = IDI_s \times \left(1 + r_{DI1\ SEP/17}\right)^{DU/252}$$

$$IDI_{f\ SEP/17} = 233{,}669.55 \times (1 + 0.10165)^{92/252}$$

$$IDI_{f\ SEP/17} = 242{,}075.806$$

4. Options on gold

Will have the Gold Spot (OZ1) contract as underlying, with a round lot of 250g (OZ1D).

5. Options on indices

Methodology for calculation of the underlying is similar to the methodology for the calculation of the price of the underlying of options on futures, in which the difference is calculated between the settlements of indices with the pivot point (month with the greatest liquidity) and this difference is added to the price of the last trade with the pivot point index.

To calculate the price of the underlying of an index expiring on an odd month, there must be interpolation of the settlements between the two indices with the nearest expirations to find its value and execute the methodology described in the paragraph above.

Example:

Expiration	Index Future	Price of the Underlying	Settlements	Difference between settlements	Business Days	Comments
May 17, 2017	INDK17	64,956	–	-414	16	The price of the underlying is the difference of the settlements added to the price of the last trade with INDM17 (-414 + 65,370)
Jun. 14, 2017	INDM17	65,370	64,509	–	36	The price of the underlying is the price of the last trade with INDM17 (pivot point)
Jul. 12, 2017	INDN17	65,784	64,923	414	55	The price of the underlying is the difference of the settlements added to the price of the last trade with INDM17 (414+65,370)
Aug. 16, 2017	INDQ17	66,334	65,473	964	80	The price of the underlying is the difference of the settlements added to the price of the last trade with INDM17 (964+65,370)
Sep. 13, 2017	INDU17	66,706	65,845	1,336	99	The price of the underlying is the difference of the settlements added to the price of the last trade with INDM17 (1,336+65,370)
Oct. 18, 2017	INDV17	67,181	66,320	1,811	123	The price of the underlying is the difference of the settlements added to the price of the last trade with INDM17 (1,811+65,370)

* The definitions of the expirations that will be used as the pivot points are available at www.bmfbovespa.com.br, Regulation / Regulations and manuals / Operational / Trading Tunnel Parameters.

INDM17 is the pivot point and INDK17, INDN17 are INDU17 synthetic index odd months. To discover the INDK17, INDN17 and INDU17 settlements a log-linear interpolation was executed between the settlements and business days. For example, to discover the INDN17 settlement a log-linear interpolation was performed between the settlements and business days (DS) for INDM17 and INDQ17.

The column headed “Difference between settlements” shows the difference in settlements between the desired expiration and the pivot month. For example, the difference between the settlements for INDN17 is equal to its settlement subtracted from the settlement of the INDM17 pivot point (64,923 – 64,509 = 414).

The differences between settlements shall be added to the price of the last trade of the pivot point, which shall be used in pricing the options as with the underlying. For example, the price of the underlying of an IBOV11 option that expires in September 2017is obtained by adding 1,336 to the price of the last trade with INDM17 and using this value (1,336 + 65,370 = 66,706).

5.1. Log-linear interpolation formula used

$$p(x,y) = y_0 * \left(\frac{y_1}{y_0}\right)^{\frac{x-x_0}{x_1-x_0}}$$

where:

- y_0 = represents the settlement price of the previous index;
- y_1 = represents the settlement price of the subsequent index;

- x = represents the business days until the expiration of the index for settlement price discovery;

- x_0 = represents the business days until the previous expiration;

- x_1 = represents the business days until the subsequent index expiration.

If there is an odd month prior to the pivot point, the negative of the difference between the settlements of the following even month is used as the difference between settlements (as demonstrated in the example of the above item).

6. Options on the One-Day Interbank Deposit Futures Contract (DI1)

To define the auction and rejection tunnels there shall be the application of percentages defined by B3 on the option premiums published at www.bmfbovespa.com.br, at Services / Market Data / Historical data / Derivatives / Previous Trading Session / File: “Derivatives Market: Option Reference Premiums”.

7. General provisions

In the case of the unavailability or partial availability of the inputs used for the methodology described in this document and/or upon the occurrence of events of an economic or operational nature that might adversely affect the synchronism of the prices that are calculated or the application of the corresponding methodology, B3 shall at its sole discretion arbitrate the center of the tunnel.

Annex III to Circular Letter 039/2017-DP

New Methodology of the Forward Market Rejection Tunnels

This document presents the procedures to determine the rejection tunnels for forward market contracts in the BOVESPA segment.

The procedures involve the following definition:

- **Reference rate:** will be represented by the interpolation of the DI rate x fixed interest rate for the term of the forward of the previous day, calculated by B3, between the dates closest to the expiration of the forward.

Verification of the rejection tunnel parameters shall occur upon registration of the declaration.

1. Validation of the price parameter

This shall occur on the value entered in the price field of the declaration, which shall reflect the value of the instrument on the cash market before the forward's interest rate charge.

The price limits may be configured automatically or manually.

1.1. Automatic

The maximum and minimum price parameters shall automatically follow trading of the underlying in the cash market.

1.1.1. Calculation formula for the maximum and minimum price

$$Value_{Max} = P.\ Max_{cash}$$

$$Value_{Min} = P.\ Min_{cash}$$

where:

- $Value_{Max}$ = maximum value defined for acceptance of the forward declaration;

- $Valor_{Min}$ = minimum value defined for acceptance of the forward declaration;

- P. Max_{cash} = maximum price traded on the cash market for the underlying;

- P. Min_{cash} = minimum price traded on the cash market for the underlying.

Example:

Event	**$Value_{Máx}$**	**$Value_{Mín}$**
1st trade of the day with the underlying at 12.78	12.78	12.78
New maximum price of the underlying at 12.81	12.81	12.78
Rejection of the forward declaration at 12.75, as the minimum price is defined at 12.78	12.81	12.78
Rejection of the forward declaration at 12.86, as the maximum price is defined at 12.81	12.81	12.78
New minimum price of the underlying at 12.73	12.81	12.73
Forward declaration executed at 12.75	12.81	12.73

* The definitions of the expirations that will be used as the pivot points are available at www.bmfbovespa.com.br, Regulation / Regulations and manuals / Operational / Trading Tunnel Parameters.

1.2. Manual

B3 shall define the maximum and minimum price parameters independently of the maximum and minimum prices of the underlying.

Example:

Event	**Value$_{Máx}$**	**Value$_{Mín}$**
Manual entry of the upper limit at 12.85, and of the lower limit , defined at 12.72	12.85	12.72
Rejection of the forward declaration at 12.86 as the maximum price is defined at 12.85	12.85	12.72
Forward declaration executed at 12.75	12.85	12.72

* The definitions of the expirations that will be used as the pivot points are available at www.bmfbovespa.com.br, Regulation / Regulations and manuals / Operational / Trading Tunnel Parameters.

2. Validation of the rate parameter

This shall occur on the DI rate x fixed interest rate of the previous day, interpolated by the closest dates to the expiration of the forward transaction.

After definition of the term there shall be the calculation of the maximum and minimum values of the tunnel based on the premium and discount value permitted by B3.

2.1. Formula for calculation of the maximum and minimum rate values based on the entered term and the DI rate x fixed interest rate variation

$$Rate_{Max} = [1+(DI_{a.d} + premium_{Max})]^{t}$$

$$Rate_{Min} = [1+(DI_{a.d} + discount_{Max})]^{t}$$

where:

- $DI_{a.d.}$ = daily variation of the DI rate x fixed interest rate;
- $premium_{Max}$ = maximum premium rate permitted by B3;

- $discount_{Max}$ = maximum discount rate permitted by B3;

- t = number of calendar days of the forward.

3. General provisions

In the case of the unavailability or partial availability of the inputs used for the methodology described in this document and/or upon the occurrence of events of an economic or operational nature that might adversely affect the synchronism of the prices that are calculated or the application of the corresponding methodology, B3 shall at its sole discretion arbitrate the center of the tunnel.