# TORF Calculation Guidelines

QUICK Benchmarks Inc.

## 1. Introduction

(1) Purpose of This Guidelines

This calculation guidelines sets forth the method for calculating Tokyo Term Risk Free Rate ("TORF"), which is calculated and published by QUICK Benchmarks, Inc. ("QBS").

This calculation guidelines is provided in accordance with Article 1.2(5) of the TORF Operational Rules and supplements the definition of TORF in Article 4.1(1) of the TORF Operational Rules.

(2) Definition of Terms

A) OIS transactions

OIS stands for Overnight Index Swap. Japanese Yen OIS transaction is an interest rate swap in which the average uncollateralized overnight call rate (Tokyo Overnight Average rate: TONA) for Japanese yen is used as the reference floating rate. The execution rate or the quote rate submitted by the reporting brokers for TORF calculation are the fixed rate to be swapped with TONA which is a floating rate.

B) CLOB

CLOB stands for Central Limit Order Book. A centralized limit order book It is a system in which over-the-counter limit orders (Bid and Offer) are centralized on a single board and matched according to the principles of price and time priority. As there is practically no trading on CLOB for Japanese Yen OIS transactions at the beginning of the publication of the TORF production rate, it is not subject to data acquisition.

C) Execution data

Executed transaction data. The data that was executed at the reporting broker.

D) Quote data

Quote data is an order data submitted on the premise of a transaction.

Indicative data, which is submitted but not based on the premise of a transaction, such as the data delivered by brokers and financial institutions via information terminals etc., is not used in the TORF production rate.

E) Quote rate

Quote rate is the interest rate portion of the quote data.

F) Order with notional amount information

This phrase is used in Level 2 through Level 4, and in the context of this guidelines, refers to a firm order (i.e., an order submitted with the explicit intention of executing a trade) that includes not only the rate but also notional amount information. Orders that contain not only the rate but also the notional amount information are treated as orders with a higher probability of execution and a stronger willingness to execute, because the notional amount can be agreed upon at the time of execution.

G) Order pair

An order for which both the Bid and Offer sides are submitted at the same time. An order that is in a so-called "matching" state.

H) Centrally-cleared transaction

Over-the-counter (OTC) derivatives transactions, including Japanese yen OIS transactions, that are cleared by a central counterparty (CCP). In OTC derivative transactions, if one party defaults on its obligations, the impact will spread to the counterparties. In contrast, clearance at a CCP insulates both parties from default by the original counterparty because the counterparty is replaced by the CCP. The CCP in Japan is the Japan Securities Clearing Corporation (JSCC), and the CCP in the UK is LCH.

## 2. Overview of TORF

(1) Overview of TORF

TORF refers to the respective averages of three different rates (6th decimal place is rounded half up to the 5th decimal place) calculated by QBS using the method specified in the Calculation Guidelines, for each period of the 1-month, 3-month and 6-month transaction rates (Note 1) submitted by reporting brokers to QBS in accordance with the provisions of the Code of Conduct.

If, for some reason, some of the rates are not reported by the broker, they are calculated for each period using the rates that have been reported, using the method described above.

(Note 1)    Execution rates and quote rates for Japanese Yen OIS transactions in the

Japanese interest rate swap market from 15:00 JST on the previous business day to 15:00 JST on the day of calculation. 365-day basis, spot start.

**Table 1: TORF Overview**

| Benchmark name | TORF (Tokyo Term Risk Free Rate) |
|---|---|
| Calculation and publication | QBS |
| Data source | Japanese yen OIS market data, 365-day basis |
| Tenor | 1 month, 3 months, 6 months |
| Reference time | 15:00 JST on a Tokyo business day |
| Publication time | Around 17:00 JST on the same day |
| Digits | 5th decimal place (6th decimal place is rounded half up), Unit: %. |
| Minimum number of reporting companies | 2 companies |

(2) Features of TORF

The main feature of the TORF is that it uses the transaction rate of the Japanese Yen OIS market, rather than an interest rate benchmark that relies on the rate submitted by the panel banks.

In addition, TORF has the following two features to more accurately reflect the value of the Japanese Yen OIS market and to calculate rates objectively and mechanically without using expert judgment.

A) Use of execution rates and quote rates

If a transaction is executed, the execution rate is used as the highest priority, and if a transaction is not executed or does not meet the specified criteria even if it is executed, the quoted rate is used. In addition to using the best bid and offer of the voice broker for the quote rate, it is assumed that quote rates on CLOB will also be used in the future. When there is active transaction, the rate is calculated based on the execution rate, and when there is little or no transaction, the rate can be calculated based on the quote rate, therefore the rate can always be calculated objectively.
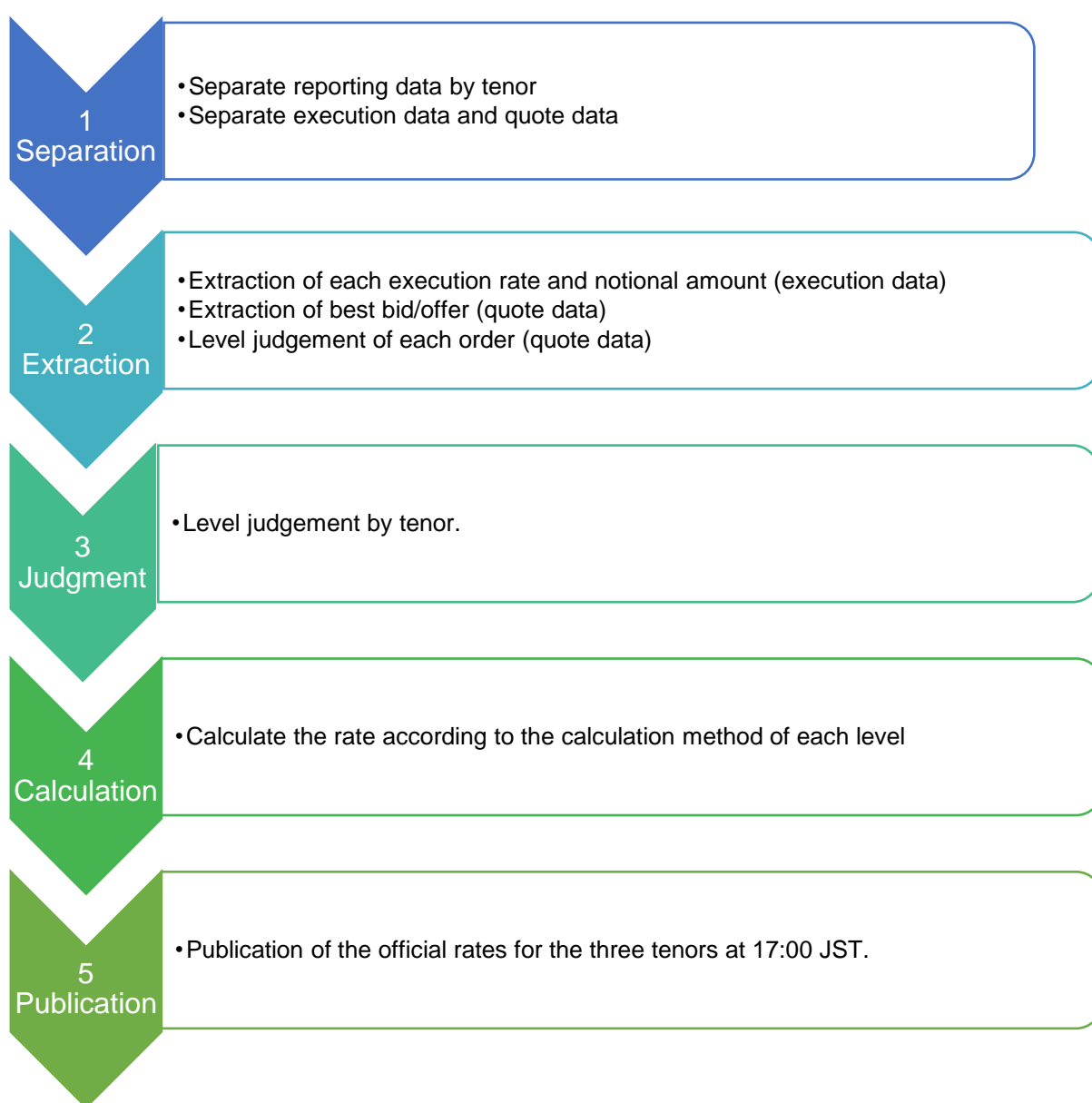
B) Adoption of waterfall methodology

It is designed to use the execution rate as the highest priority, and to use the quote rate if the execution does not meet the criteria. With regard to the quote rate, priority is set using "waterfall methodology" in the form of "quote rate on CLOB (when CLOB data is adopted)", "order pair specifying notional amount on voice broker", "order specifying notional amount on voice broker (single quote status)", and "order pair that can be traded as long as it is at least the

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minimum execution principal amount on voice broker." As a result, calculations can be made from active transaction to thin transaction without using expert judgment.

## 3. Overview of the calculation process

After receiving the reporting data from the reporting broker, the following process is used for the calculation. The details are described in the next chapter.

Figure 1 **Overview of the calculation process**

**1 Separation**
- Separate reporting data by tenor
- Separate execution data and quote data

**2 Extraction**
- Extraction of each execution rate and notional amount (execution data)
- Extraction of best bid/offer (quote data)
- Level judgement of each order (quote data)

**3 Judgment**
- Level judgement by tenor.

**4 Calculation**
- Calculate the rate according to the calculation method of each level

**5 Publication**
- Publication of the official rates for the three tenors at 17:00 JST.

A) Separate reporting data from each reporting broker by tenor, and further separate each tenor's data into execution data and quote data

B) Extraction of execution rate and notional amount (execution data)

  Extraction of best bid and best offer, level judgement of quote data using waterfall methodology (quote data)

C) Level judgment for each tenor

D) Calculate the rate according to each level

E) Publication

## 4. Reporting Rate Processing

This chapter describes the processes in "1 Separation" and "2 Extraction" in "Figure 1" described above.

(1) Requirements for Reporting Data

A) Transaction Requirements

Transactions observed at the reporting broker that meet all of the following requirements are eligible for adoption of the reporting rate. The "execution data" and "quote data" that match the following transactions is the reporting data adopted for the TORF calculation.

**Table 2: Transaction requirements eligible for adoption in reporting rates**

| Transaction requirements to be adopted in reporting data |
|---|
| Spot start (starts two business days after the execution of the contract) |
| Outright trading of Japanese Yen OIS (single transaction not combined with other transactions) |
| A tenor of 1 month, 3 months, or 6 months |
| On a 365-day basis. |
| Transactions during Tokyo business days |
| Centrally-cleared transaction (transactions supposed to be cleared at either JSCC or LCH) |
| Transactions that have been executed or are valid for orders between 15:00:01 JST on the previous business day and 15:00:00 JST on the current business day |

B) Requirements for execution data

In order for execution data to be used for TORF calculation, at least the items in Table 3 below must be included in the data executed in transactions that

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meet the "A) Transaction Requirements" above.

**Table 3 Items Required for Execution Data**

| Items that should be included in the execution data |
| --- |
| Execution rate |
| Notional amount |
| Date, time, minutes and seconds of the execution (the time entered into the verification system shall be considered as the execution) |
| CCP information |

It is assumed that execution data will be reported by CLOBs in the future in addition to voice brokers, but the items required for execution data are the same for both voice brokers and CLOBs.

C) Requirements for quote rate

In order for quote data to be used in the TORF calculation, at least the items in Table 4 below are required among the orders for transactions that meet the "1) Trading Requirements" above.

**Table 4 Items Required for Quote Data**

| Items that should be included in the quote data |
| --- |
| Quote rate |
| Direction of the order (Bid / Offer, etc.) |
| Notional amount (Note 2) |
| Date, time, minutes and seconds of submission (information update) |
| *Information for determining the best quote (if the quote data to report includes a quote other than the best quote) |
| *Rate status (information that distinguishes between actual orders, reference orders, etc.) (This is necessary if the quote data to be reported includes reference orders, etc.) (e.g., actual order: "Firm", reference order: "Refer", etc.) |
| CCP information (Note 3) |

(Note 2)    If the notional amount is not specified at the time of order, this item may be left as no data (Null).

(Note 3)    If the order supposed to be a centrally-cleared transaction but CCP is not specified at the time of order, this item may be left as no data (Null).

It is assumed that quote data will be reported by voice brokers as well as CLOB in the future. In that case, the quote data items assumed to be necessary in the CLOB are the four items in Table 4 above, excluding the items marked with "*".

(2) Extraction of Execution Data

The requirements for extracting execution data from reported data are as follows. The data is extracted as execution data when all of the following requirements are met.

**Table 5 Requirements for Extraction of Execution Data**

| Requirements for extraction of execution data | |
|---|---|
| | **Meets Table 2: Transaction Requirements** |
| | An outright transaction of Japanese Yen OIS |
| | A tenor of 1 month, 3 months, or 6 months |
| | The start date is two business days after the execution date (spot start) (Note 4) |
| | Either "JSCC" or "LCH" as the clearing organization |
| | On a 365-day basis. |
| | Transactions during Tokyo business days |
| | Transactions executed between 15:00:01 JST on the previous business day and 15:00:00 JST on the current business day |
| | **Includes Table 3: Items Required for Execution Data.** |
| | The "Execution Rate" field contains a number. |
| | The "Notional Amount" field contains a number greater than zero. |
| | ("Date, time, minutes and seconds of the execution" is included. |

(Note 4)     If the time and date of execution is before 15:00:00 JST, it is treated as the same day, and if it is after 15:00:01 JST, it is treated as the next business day.

(3) Extraction of Quote Data

    A) Requirements for extraction of quote data

        The requirements for extracting quote data from reported data are as follows. The data is extracted as quote data when all of the following requirements are met.

**Table 6: Requirements for Extraction of Quote Data**

| Requirements for extraction of quote data | |
|---|---|
| **Meets Table 2: Transaction Requirements** | |
| | An outright transaction of Japanese Yen OIS |
| | A tenor of 1 month, 3 months, or 6 months |
| | The start date is two business days after the execution date (spot start). |
| | Clearing organization includes either "JSCC" or "LCH", or both of them, or is blank (null) (Note 5) <br> Example: "JSCC" => OK, "JSCC, LCH" => OK, "(Null)" => OK <br>     "CME" => NG (does not meet transaction requirements) |
| | On a 365-day basis. |
| | Transactions during Tokyo business days |
| | Orders that are valid between 15:00:01 JST on the previous business day and 15:00:00 JST on the current business day |
| **Includes Table 4: Items Required for Quote Data.** | |
| | The "Rate Status" is "Firm Order" (Note 6) |

(Note 5)    "This item may be left blank if "Clearing organization is blank (Null)" indicates that "JSCC or LCH is not designated as the clearing organization, but there is a possibility of clearing with either JSCC or LCH.

(Note 6)    An order placed with a clear intention to make a transaction. If the reporting broker's reporting data includes reference orders, etc., one of the requirements is that this item be an "actual order".

B)  Making a Transition of the Best Quote (best price)
    The best quote is extracted from the quote data that meets the above "(1) Requirements for extraction of quote data" and the transition is recorded. The procedure for making a transition in this case is as follows.

**Table 7: Procedure for Making a Transition of the Best Quote**

| Procedure for making a transition of the best quote (done for each broker and each tenor) | |
|---|---|
| 1 | For each broker and tenor, the best price 15:00 JST on the previous business day is used as the starting best price, and the best prices from that time 24:00 JST on the previous business day are extracted in chronological order. |
| 2 | All orders are reset at midnight of the day (all orders are treated as if they were all cancelled at the same time as of midnight) (Note 7) |
| 3 | Extracts and records the best prices from midnight to 15:00 JST of the day in chronological order. |

(Note 7)    Regarding the reset (cancellation) of the previous day's orders, all reporting brokers often send cancellation data in the early morning Japan time. However, if there is a difference in the timing of cancellation for each order, there is a possibility that an unintended best quote may appear depending on the order of cancellation. Therefore, order cancellations associated with the change of day do not depend on the reporting broker's cancellation data, but are cancelled simultaneously by QBS in advance.

C) Rules for making the best quote

The rules in the above section "(2) making a transition of the best quote (best price)" are as follows.

**Table 8: Rules for Making a Transition of the Best Quote**

| Rules for making a transition of the Best Quote |
|---|
| The best quote is made a transition for each reporting broker. |
| Bid (fixed rate payment): <br> The one with the highest bid rate is the best quote (best bid) |
| Offer (fixed rate received): <br> The one with the lowest offer rate is the best quote (best offer) |
| Regardless of the clearing organization, notional amount at the same rate in the same direction (within Bid or Offer) are treated as a total. |
| When any of the following occurs due to a new order or change or cancellation of an existing order, the transition is recorded as a change in the best quote data. <br>     If there is a change in the rate of Best Bid or Best Offer <br>     If there is a change in the total notional amount of the Best Bid or Best Offer <br>     If there is a change in the number of orders at the Best Bid or Best Offer (e.g., if the number of orders at the same rate increases) |
| Refer (order information for reference only, not necessarily with the clear intention to trade) is not treated as an actual order (Firm Order). |
| If a Firm order is converted to a Refer, the order is considered cancelled. |
| If Bid or Offer is cancelled, the data for the cancelled order is deleted, but if another order is set at the same rate, the rate and notional principal information for that order is retained. |
| If the Bid rate is greater than the Offer rate, it is considered an error value and will not be used in subsequent calculations. |
| If the Bid rate and Offer rate are equal, it is considered a valid value. |
| If data with the same time stamp exists in the same report data, it is processed in the order described in the report data. |

## 5. Level Judgement Based on Waterfall Methodology

This chapter describes the process of "level judgement for each order (quote data)" in "2 Extraction" in the aforementioned "Figure 1".

In "(3) Extraction of Quote Data" of the previous chapter, the process of extracting quote data and recording the transition of the best quote was explained. Each of the best quotes recorded in this way is judged the level, and the level judged data is used to determine the
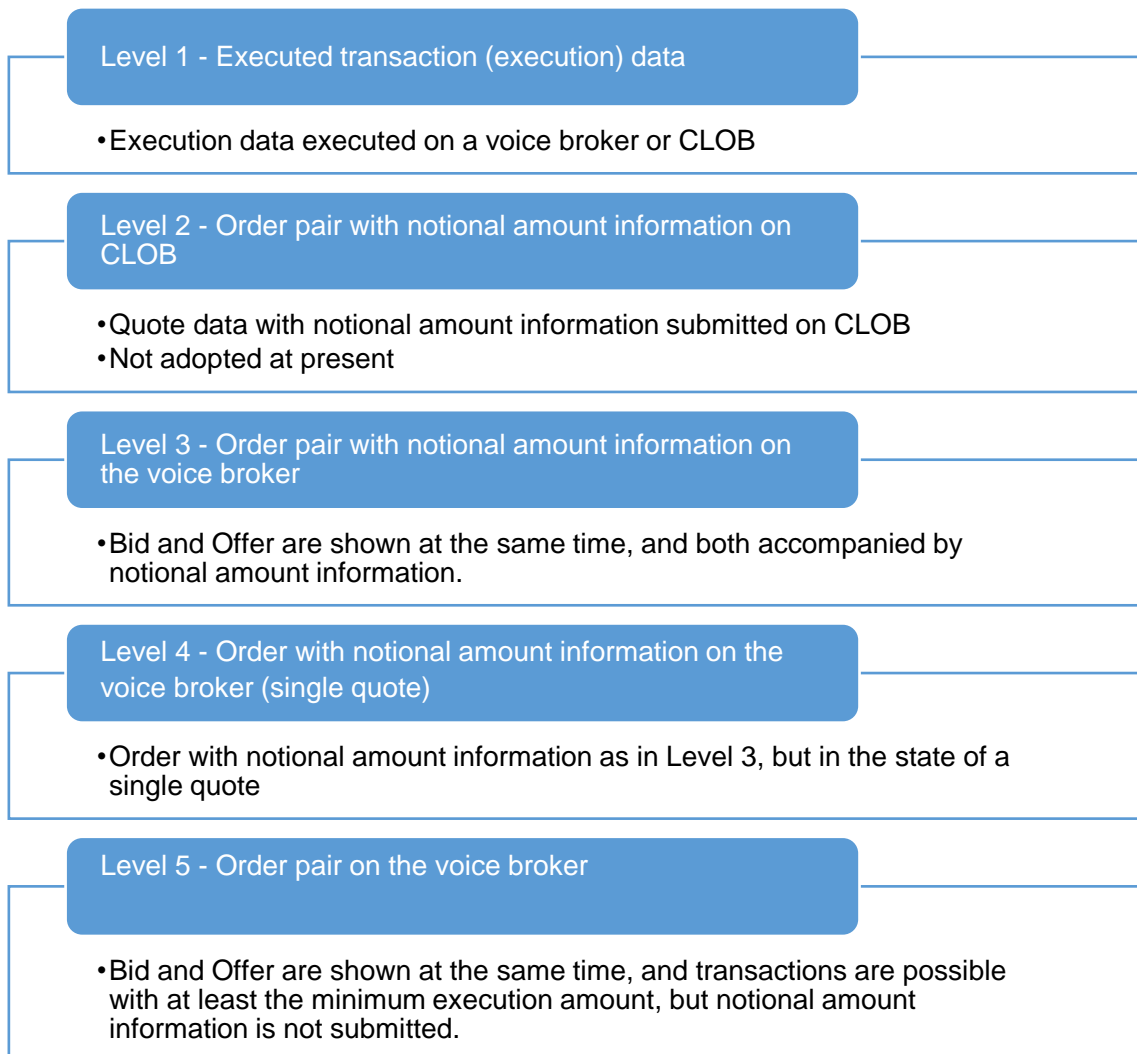
calculation level for each tenor for TORF calculation.

First, we present the overview of each level in waterfall methodology, and then explain the method of level judgement for each order.

(1)  Overview of Waterfall Methodology

In TORF calculation, Waterfall Methodology with the following priorities is adopted from the perspective of using actual transaction (execution) data as the highest priority.

**Figure 2: Waterfall Methodology of TORF Calculation**

Level 1 - Executed transaction (execution) data

- Execution data executed on a voice broker or CLOB

Level 2 - Order pair with notional amount information on CLOB

- Quote data with notional amount information submitted on CLOB
- Not adopted at present

Level 3 - Order pair with notional amount information on the voice broker

- Bid and Offer are shown at the same time, and both accompanied by notional amount information.

Level 4 - Order with notional amount information on the voice broker (single quote)

- Order with notional amount information as in Level 3, but in the state of a single quote

Level 5 - Order pair on the voice broker

- Bid and Offer are shown at the same time, and transactions are possible with at least the minimum execution amount, but notional amount information is not submitted.

(2) Details of Waterfall Methodology

Waterfall methodology shown in (1) above will be explained for each level.

Each data extracted by the method of "(2) Extraction of execution data" and "(3) Extraction of quote data" in the previous section is judged for its level according to the following conditions.

The data from each reporting broker judged level in this way is combined for each tenor to determine the calculation level for each tenor.

A) Level 1 - Executed transaction (execution) data

The data extracted by the method described in "4 (2) Extraction of execution data" is treated as the Level 1 execution data.

B) Level 2 - Order pair with notional amount information on CLOB

The explanation is omitted because it is not adopted at present.

C) Level 3 - Order pair with notional amount information on the voice broker

Among the data extracted by the method described in "4 (3) Extraction of Quote Data", those that meet all of the following conditions.

**Table 9: Details of the Requirements for Level 3**

| Requirements for "Level 3 - Order pair with notional amount information on the voice broker" |
| --- |
| The Bid / Offer rate and the notional amount each contain a valid value. |
| The notional amount of Bid and Offer is equal to or greater than the respective thresholds (if thresholds have been set). |
| Either the last data of the same broker is not a Level 3 candidate, or the last data of the same broker is a Level 3 candidate and there is a change in either the Bid / Offer rate. (If the last data of the same broker is Level 3 and there is no change in either the Bid or Offer rate, the relevant quote data is not used in the calculation.) |

D) Level 4 - Order with notional amount information on the voice broker (single quote)

Among the data extracted by the method described in "4 (3) Extraction of Quote Data", those that meet all of the following conditions.

*If there is at least one data of Level 4 for both Bid and Offer that meets this requirement in the same tenor of the same reporting broker, it is used as the Level 4 data. (If a reporting broker has an order with notional amount on either

the Bid side or the Offer side, it is not used as Level 4 data, even if it has an order with notional amount on the opposite side in a different broker.

**Table 10: Details of the Requirements for Level 4**

| Requirements for "Level 4 - Order with notional amount information on the voice broker (single quote)" |
|---|
| The Bid rate and notional amount have valid values and the Offer notional amount is null, or the Offer rate and notional amount have valid values and the Bid notional amount is null. |
| The notional amount of the Bid or Offer that contains the rate is greater than or equal to the threshold (if a threshold has been set) |
| Compared to the last data of the same broker, there is a change in the rate of the order side with the rate and the notional amount, or there is a change in either notional amount of the Bid or the Offer. <br><br> (Compared to the last data of the same broker, if there is no change in the Bid or Offer notional amount, and there is no change in the order-side rate with a valid notional amount, the relevant quote data is not used in the calculation.) |

E) Level 5 - Order pair on the voice broker

Among the data extracted by the method described in "4 (3) Extraction of Quote Data", those that meet the requirements 1 and 2 below.

**Table 11: Details of the Requirements for Level 5**

| Requirements for "Level 5 - Order pair on the voice broker" |
|---|
| The quote rate of Bid and Offer each has a valid number. |
| Either the last data of the same broker is not a Level 5 candidate, or the last data of the same broker is a Level 5 candidate and there is a change in either the Bid / Offer rate.<br>(If the last data of the same broker is Level 5 and there is no change in either the Bid or Offer rate, the relevant quote data is not used in the calculation. |
| *If the number of data in Level 3 is less than the threshold, the order pair that should have been treated as Level 3 is added to Level 5. |
| *If the notional amount of Level 4 is less than the threshold value, or if Level 4 data on both sides cannot be calculated because the relevant data is not found, and if there is data with a quote rate that does not contain any value in the notional amount on the opposite side of the order that should have been treated as Level 4, the order is added to Level 5 as a pair. |

## 6. Judgement and Calculation Method of Each Level

In this chapter, the process of "3 Judgment" and "4 Calculation" in the above-mentioned "Figure 1" is explained.

For each tenor, we combine the data reported by the reporting brokers and determine whether the data meets the level judgment criteria from Level 1 to Level 5 listed below. Calculate the rate using the calculation method of the matched levels. On the other hand, if the criteria is not met, the data moves to a lower level.

    (1) Judgment and Calculation Method of Level 1

        A) Criteria

            Calculated as Level 1 if all of the following requirements are met when combining data from all reporting brokers.

**Table 12: Criteria for Level 1**

| Criteria for Level 1 |
|---|
| Among the data of all reporting brokers, there is at least one executed transaction data that corresponds to Level 1. |
| The total notional amount is equal to or greater than the threshold (if a threshold has been set). The threshold values are shown in Chapter 8. The same applies to Level 2, 3, 4 and 5. |

B) Calculation method (notional weighted trimmed average based on the executed transaction)

It is calculated by the following procedure.

i) The actual transaction data is arranged in ascending or descending order by execution rate, and the data is excluded outside the exclusion criteria percentile value (Note 8) of the outlier test based on the notional amount.

ii) Weighted average by notional amount of the actual transaction data excluding outliers

$$Notional\ Weighted\ Average = \frac{\sum Rate_i * Notional_i}{\sum Notional_i}$$

Notional Weighted Average: Calculated rate based on weighted average of notional amount

i: Serial number of Level 1 data

$Rate_i$: Execution rate for data serial number i

$Notional_i$: Notional amount in data serial number i

(Note 8)    (*) Based on examples of domestic and overseas interest rate benchmarks, the 25th percentile is set at the beginning of the production rate.

(2) Judgment and Calculation Method of Level 2

It is omitted because it is not adopted at present.

(3) Judgment and Calculation Method of Level 3

There are two cases for Level 3: "Level 3A" (when the Bid and Offer quote rates are the same) and "Level 3B" (when the Bid rate is lower than the Offer rate).

In Japanese yen OIS transactions, there are rare cases where the two parties agree on the rate, but in the process of matching the terms and conditions, there is a

disagreement on the notional amount or the clearing organization between JSCC and LCH. In such a case, the "Bid rate = Offer rate" state is set just before the execution.

At such a stage where the "Bid rate = Offer rate", each trader on both sides is considered to be collating various conditions based on the assumption that the contract is executed, and therefore, the data should be fully respected as calculation data. In addition, as described below, Level 3 is based on a quality weighted average using the difference (spread) between the Bid and Offer rates, which cannot be calculated when the spread is zero. For this reason, the quality weighted average cannot be used when "Bid rate = Offer rate" occurs in Level 3. Therefore, the data with such "Bid rate = Offer rate" is used as the highest priority, and a simple average is performed for it.

Based on the above, there are two cases for Level 3: "Level 3A" (a combination of Bid rate = Offer rate in Level 3) and "Level 3B" (an order pair with Bid rate < Offer rate in Level 3).

A) Level 3A
   i)   Criteria
   Calculated as Level 3A if all of the following requirements are met when combining data from all reporting brokers.

**Table 13: Criteria for Level 3A**

| Criteria for Level 3A |
|---|
| Levels 1 and Level 2 are not adopted. |
| Among the data of all reporting brokers, there is at least one order pair that corresponds to Level 3 and has the same Bid and Offer rates. |
| The number of order pairs corresponding to Level 3A, i.e., classified as Level 3 and with "Bid rate = Offer rate," is greater than or equal to the threshold (if the threshold for the lower limit of the number of order pairs has been set). |
| For the order pair corresponding to Level 3A, the notional amount of each Bid and Offer is greater than or equal to the threshold (if a threshold per data has been set). |

   ii)   Calculation method (simple average of order pair where Bid rate = Offer

rate)

Perform a simple average for the quote rates for each order pair where the Bid rate and Offer rate are the same.

$$Average = \frac{\sum Rate_i}{N}$$

Average: Calculated rate based by simple average

N: Number of data

$Rate_i$:Rate of the order pair for data serial number i

B) Level 3B

i) Criteria

Calculated as Level 3B if all of the following requirements are met when combining data from all reporting brokers.

**Table 14: Criteria for Level 3B**

| Criteria for Level 3B |
|---|
| Levels 1, Level 2 and Level 3A are not adopted. |
| Among the data of all reporting brokers, there is at least one pair of data that corresponds to Level 3. |
| The number of order pairs corresponding to Level 3B is greater than or equal to the threshold (if a threshold has been set). |
| For the order pair corresponding to Level 3B, the notional amount of each Bid and Offer is greater than or equal to the threshold (if a threshold per data has been set). |

ii) Calculation method (quality weighted average using Bid-Offer spread)

It is calculated by the following procedure.

(a) The simple average of the Bid rate and Offer rate is the Mid rate, and the difference between the Offer rate and Bid rate is the Spread.

$$MidRate_i = \frac{(BidRate_i + OfferRate_i)}{2}$$

$$Reciprocal\_Spread_i = \frac{1}{(OfferRate_i - BidRate_i)}$$

(b) Then perform a weighted average on the Mid rate by the reciprocal of the spread.

$$Quality\ Weighted\ Average\ = \frac{\sum MidRate_i * Reciprocal\_Spread_i}{\sum Reciprocal\_Spread_i}$$

i: Data serial number

MidRate$_i$: Mid rate for data serial number i

BidRate$_i$: Bid rate for data serial number i

OfferRate$_i$: Offer rate for data serial number i

Reciprocal_Spread$_i$: Reciprocal of the spread between Bid and Offer for data serial number i

Quality Weighted Average: Calculated rate based on quality weighted average

(4) Judgment and Calculation Method of Level 4

A) Criteria

Calculated as Level 4 if all of the following requirements are met when combining data from all reporting brokers.

**Table 15: Criteria for Level 4**

| Criteria for Level 4 |
|---|
| Levels 1 through 3 are not adopted. |
| Among the data of the same reporting broker, there is at least one data for Bid and Offer each that corresponds to Level 4. |
| The total notional amount of quote data corresponding to Level 4 is greater than or equal to the threshold (if a threshold has been set). |
| For the quote data corresponding to Level 4, the notional amount is greater than or equal to the threshold (if a threshold per data has been set). |

B) Calculation method (simple average based on tradable quote rate)

Perform a simple average for the averages of the Bid and Offer rates that correspond to Level 4.

$$Averaged\_BidRate = \frac{\sum BidRate_i}{BidN}$$

$$Averaged\_OfferRate = \frac{\sum OfferRate_i}{OfferN}$$

$$Average = \frac{(Averaged\_BidRate + Averaged\_OfferRate)}{2}$$

i: Data serial number

Averaged_BidRate: Average of Bid rates

$BidRate_i$: Bid rate for data serial number i

BidN: Number of Bid rates (number of data)

Averaged_OfferRate: Average of Offer rates

$OfferRate_i$: Offer rate for data serial number i

OfferN: Number of Offer rates (number of data)

Average: Calculated rate based by simple average

(5) Judgment and Calculation Method of Level 5

As with Level 3, there are two cases for Level 5: "Level 5A" (when the Bid and Offer quote rates are the same) and "Level 5B" (when the Bid rate is lower than the Offer rate). The reason for this is the same as the purpose of "Judgment and calculation method of Level 3."

A) Level 5A

i) Criteria

Calculated as Level 5A if all of the following requirements are met when combining data from all reporting brokers.

**Table 16: Criteria for Level 5A**

| Criteria for Level 5A |
|---|
| Levels 1 through 4 are not adopted. |
| Among the data of all reporting brokers, there is at least one order pair that corresponds to Level 5 and has the same Bid and Offer rates. (As for the data excluded from Level 3A because it was less than the threshold, it should be treated as Level 5A.) |
| The number of order pairs corresponding to Level 5A is greater than or equal to the threshold (if a threshold has been set). |

ii) Calculation method (simple average of order pair where Bid rate = Offer rate)

Perform a simple average for the quote rates for each order pair where the Bid rate and Offer rate are the same.

$$Average = \frac{\sum Rate_i}{N}$$

Average: Simple average

N: Number of data

Rate$_i$:Rate of the order pair for data serial number i

B) Level 5B

i) Criteria

Calculated as Level 5B if all of the following requirements are met when combining data from all reporting brokers.

**Table 12 Criteria for Level 5B**

| Criteria for Level 5B |
|---|
| Levels 1 through 4 and Level 5A are not adopted. |
| Among the data of all reporting brokers, there is at least one pair of data that corresponds to Level 5. (As for the data excluded from Level 3B because it was less than the threshold, it should be treated as Level 5B.) |
| The number of order pairs corresponding to Level 5B is greater than or equal to the threshold (if a threshold has been set). |

ii) Calculation method (quality weighted average using Bid-Offer spread)

It is calculated by the following procedure.

(a) The simple average of the Bid rate and Offer rate is the Mid rate, and the difference between the Offer rate and Bid rate is the Spread.

$$MidRate_i = \frac{(BidRate_i + OfferRate_i)}{2}$$

$$Reciprocal\_Spread_i = \frac{1}{(OfferRate_i - BidRate_i)}$$

(b) Then perform a weighted average on the Mid rate by the reciprocal of the spread.

$$Quality\ Weighted\ Average = \frac{\sum MidRate_i * Reciprocal\_Spread_i}{\sum Reciprocal\_Spread_i}$$

i: Data serial number

MidRate$_i$: Mid rate for data serial number i

BidRate$_i$: Bid rate for data serial number i

OfferRate$_i$:Offer rate for data serial number i

Reciprocal_Spread$_i$: Reciprocal of the spread between Bid and Offer for data serial number i

Quality Weighted Average: Calculated rate based on quality weighted average

## 7. No Data Corresponding to Level 1 through 5 or Treated as Less Than the Threshold of Level 5

If there is no data corresponding to Levels 1 through 5, or if the data does not satisfy the threshold for Level 5, the official rate of the previous day is used as the official rate of the day for the relevant tenor.

(Indicative data used in the prototype rate, which is not always available for trading, is not used.)

## 8. About Thresholds

The "threshold" is shown in the chapter "6 Judgement and Calculation Method of Each Level". This system is introduced to increase the robustness of the TORF and to prevent the TORF from being influenced by small amounts or a small number of transactions.

The following thresholds are not to be introduced at the beginning of TORF calculation and publication because data collection needs to be considered first until OIS trading is activated.

## 9. Amendment and Abolition of this Calculation Guidelines

The amendment or abolishment of this Calculation Guidelines shall be subject to the approval of the TORF Oversight Committee and the decision of the Board of Directors. If the revision of this Calculation Guidelines is due to a review of the definition or calculation method of TORF, such review of the definition or calculation method shall be based on the procedures set forth in Article 48 of the TORF Operational Rules.

### Supplementary Provisions

1. Effective date

These rules shall be implemented from April 26, 2021.

2. Revision

October 13, 2021