

Result of a Periodic Review of TORF Operational Framework

QUICK Benchmarks Inc.

QUICK Benchmarks Inc. (President and CEO Masahiro Sasaki, hereinafter referred to as “QBS”) has conducted a periodic review of QBS in accordance with Article 47(1) of the TORF Operational Rules. The results are as follows.

QBS will continue to take appropriate actions to comply with the IOSCO Principles and to maintain and improve the transparency, robustness, and credibility of TORF.

1. Results of Review

- QBS concluded that it is appropriate that the underlying market of the TORF (Tokyo Term Risk Free Rate) to be a Japanese Yen OIS market, and transactions through the 3 reporting brokers represent an adequate percentage of the total market. The TORF maintains required representativeness as an interest rate benchmark. Also, QBS concluded that it is not necessary to change the operational framework, including the TORF calculation methods, at this time. However, from the perspective of further increasing the reliability and robustness of the TORF, it is desirable to consider whether we should expand the data available for calculation.
- QBS concluded that the appropriateness of reporting broker's reporting rate generation process has been maintained. For reporting brokers who need to improve their rate generation processes and review practices, QBS instructed them to strengthen their data verification framework and confirmed its implementation.

2. Review of Operational Framework

(1) Background

TORF is intended to show the risk-free rate of Japanese Yen term products at the beginning of the interest rate calculation period (“fixing in advance” method). The TORF is calculated by using the Japanese Yen OIS market as the underlying market and averaging its trading rates, according to the methods specified in the TORF Calculation Guidelines.

TORF is calculated based on the followings:

- a. Transaction rates (executed rates or quote rates presented on the premise of transactions) to ensure transparency and robustness as a financial benchmark.
- b. Reporting data that is centrally-cleared by Japan Securities Clearing Corporation (JSCC) or LCH in order to eliminate the counterparty credit risk, etc. in the Japanese Yen OIS transactions for purpose of measuring risk-free rate.
- c. Transactions executed through reporting brokers with the exception of arm's-length transactions. At present, reporting brokers that provide reporting rates that are used to calculate TORF are only voice brokers as inter-dealer brokers.

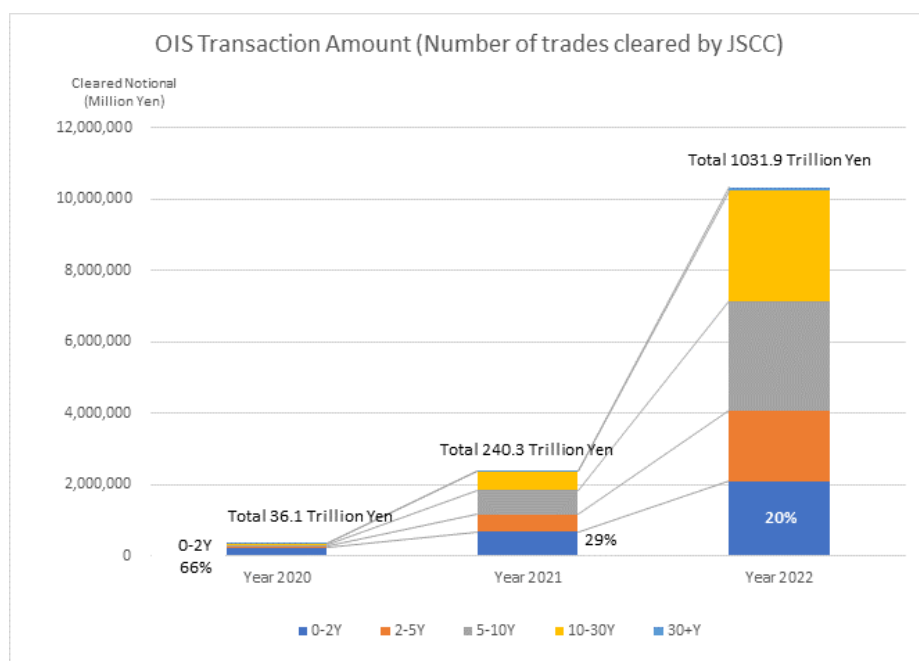
On the basis of these above features and TORF calculation methods, we shall review the following points. These reviews are based on the perspective of confirming the status of maintaining and ensuring the representativeness as an interest rate benchmark (usefulness as a benchmark to be referred to in determining interest rates) of the TORF as a risk-free rate for Japanese Yen term products.

- a. Appropriateness of using the Japanese Yen OIS as the underlying market for the TORF based on the conditions of the Japanese Yen OIS market and other related markets such as the interest rate derivatives market using Tokyo OverNight Average rate, TONA.
- b. Adequacy of 3 reporting brokers' share of transactions in the Japanese Yen OIS market and other factors from the perspective of representativeness as an interest rate benchmark.
- c. Rate trends and the types of reporting data used and corresponding level at the time of calculation of TORF

The value of Japanese Yen OIS transactions increased by about three times over the previous year for short-term transactions of 2-year or less, and by nearly five times over the previous year for medium- to long-term transactions of more than 2-year. Therefore, although the ratio of short-term to total Japanese Yen OIS transaction value has declined, overall Japanese Yen OIS transactions have become more active.

In light of such conditions of the Japanese Yen OIS market, QBS concludes that it is appropriate to consider the Japanese Yen OIS market as the underlying market for the TORF.

Figure 1: Changes in the Japanese OIS transaction amount



*QBS created the figure based on the “Notional of Cleared Trades” published by JSCC.

The interest rate derivatives market using TONA other than the Japanese Yen OIS market was the "Over-Night Call Rate Futures" on the Tokyo Financial Exchange (TFX), but TFX delisted it on March 20, 2023, and listed the "Three-month TONA futures" on the same day instead. In addition, Osaka Exchange plans to list "3-Month TONA Futures" on May 29, 2023.

Article 48.1 of the TORF Operational Rules stipulates that one of the conditions for changing the definition or calculation methods of the TORF is "(1) where there have been any structural changes in the Japanese Yen OIS market or other Japanese Yen interest rate derivatives market that may require changes in the definitions, calculation methods of the TORF". QBS will closely monitor the trading conditions of these interest rate futures after its listing, and whether and, to what extent the listing will have an impact on the Japanese Yen OIS market.

(3) Adequacy of 3 reporting brokers' share of transactions in the Japanese Yen OIS market and other factors from the perspective of representativeness as an interest rate benchmark

Next, we will examine the adequacy of some factors involved in confirming representativeness as an interest rate benchmark assuming that Japanese Yen OIS market is underlying market for the TORF. The foremost important factor to be considered in this examination is the sufficiency of the percentage of transactions in the Japanese Yen OIS market that are executed through the 3 reporting brokers. Nonetheless, the TORF is not calculated based solely on execution rates; even if there is no execution, the TORF can be calculated based on quote rates in the market (order rates presented on the premise of a transaction) based on the waterfall structure of the calculation level. In other words, evaluation based on the amount of transactions is insufficient, as it can be calculated regardless of the number of transactions.

Therefore, in addition to the evaluation based on transaction amount, we also added evaluation from the aspects of the appropriateness of the TORF rate trends calculated based on the waterfall structure, and the types of data used in the calculation based on the same structure and the corresponding calculation level. Through these additional evaluations, we will confirm that the TORF is representative as an interest rate benchmark in relation to the Japanese Yen OIS market, which is the underlying market for the TORF, and provide material for considering whether a revision of the TORF calculation methods is necessary or not.

i. Evaluation by the Transactions Amount

QBS estimated the percentage of Japanese Yen OIS market that is traded by reporting brokers.

Data that can be used to understand the transaction amount of the Japanese Yen OIS market, as stated in (2), there is notional of cleared trade that JSCC publishes monthly. However, while the tenor of TORF is 1, 3 and 6 months, JSCC's monthly data are classified as "0-2 years". Therefore, QBS conducted its own market research and estimated the percentage of transactions by the 3 reporting brokers in the overall Japanese Yen OIS market for 1, 3 and 6 months, which is the underlying market for the TORF, as shown in

Table 1. The estimated percentage of such transactions is around 30% as shown below, down from "slightly less than 40%" in 2021.

Meanwhile, Table 2 shows transaction amount via brokers in the 1, 3 and 6 months Japanese Yen OIS market and the percentage of the transaction amount by the 3 reporting brokers in the transactions executed via brokers², based on QBS's own market research. The percentage is estimated to be approximately 70% or more, as shown below.

² Estimates are based on reporting data reported by 3 reporting brokers and represent the percentage of transactions through reporting brokers that meet the TORF calculation requirements. For example, if spread transactions and other transactions not included in the TORF calculation requirements were added, it is estimated that the percentage of transactions by the 3 reporting brokers would be even higher.

Table 1: Actual and estimated values of trading amount and percentage of reporting broker transactions in the Japanese Yen OIS market, etc. ³

	Tenor	Actual or Estimated Value
a. Japanese Yen OIS transaction amount (Cleared by JSCC) ⁴	0 to 2 Years	211.3 trillion yen (Actual)
b. Percentage and estimated value of 1, 3, and 6 months items in a.	1, 3 and 6 months	Approx. 30 %, 50-70 trillion yen (Estimate)
c. Japanese Yen OIS Transaction amounts in the data reported by the 3 reporting brokers (TORF Reporting subjected data including cleared by LCH) ⁵	1, 3 and 6 months	28.9 trillion yen (Actual)
d. Cleared by JSCC in c.	1, 3 and 6 months	18.7 trillion yen (Actual)
e. Percentage of reporting brokers' transactions in the Japanese Yen OIS market in 1, 3 and 6 months (d/b)	1, 3 and 6 months	Approx. 30% (Estimate)

Table 2: Estimated percentage of transactions through brokers by 3 reporting brokers ⁶

	Tenor	Actual/Estimated Value
a. Estimated Amount of 1, 3 and 6 months in Japanese Yen OIS transaction amount (Cleared by JSCC) (Table 1.b.)	1, 3 and 6 months	50-70 trillion yen (Estimate)
b. Percentage of a. and estimated amount via brokers	1, 3 and 6 months	Approx. 40%, 20-30 trillion yen (Estimate)
c. Japanese Yen OIS transaction amount of the data reported by the 3 reporting brokers (only cleared by JSCC) (Table 1 .d)	1, 3 and 6 months	18.7 trillion yen (Actual)
d. Percentage of transactions through brokers accounted for by the 3 reporting brokers ⁷ (c / b)	1, 3 and 6 months	Just over 70% (Estimate)

³ Estimates are based on actual reported data, published statistical data, market research conducted by QBS, etc., for the sole purpose of verifying and examining the TORF operational framework at QBS, and is not guaranteed to be accurate. QBS assumes no responsibility for any indirect or direct damages resulting from the use of such estimates.

⁴ Calculated based on “Notional of Cleared Trades” published by JSCC” (https://www.jpj.co.jp/jsc/en/interest_rate_swap.html)

⁵ Transactions (in notional amount) that meet requirements based on the reported data by 3 reporting brokers.

⁶ Same as footnote³

⁷ Same as footnote²

In addition to voice broking, there are also electronic trading platforms (ETPs) for Japanese Yen OIS trading, but we have not received any information that 1-6 months Japanese Yen OIS trading has become significantly more active on ETPs. On the other hand, from the institutional side, the obligation to use ETPs is limited to tenors of 5, 7 and 10 years among the Japanese Yen OIS. If ETP trading using CLOBs (Central Limit Order Book) becomes more active, QBS will continue to closely monitor the status of ETP trading, as it will be necessary to seriously consider the adoption of "Order pair with notional amount information on CLOB", which is currently planned as the second level in the waterfall structure in the TORF Calculation Guidelines.

ii. Evaluation by Rate Trends

In confirming the representativeness as an interest rate benchmark, it is necessary to check the appropriateness of the execution rates and the quote rates on which the transactions are based, which are used in the TORF calculation, from the aspect of rate trends, to ensure that they properly reflect the value of the Japanese Yen OIS market. Therefore, we investigated the consistency with other rates referring to the Japanese Yen OIS market, as shown in Figure 2: Comparison between TORF Rates and JSCC Settlement Rates. JSCC published settlement rates (red dotted line) shown in this graph is the rate used by JSCC to calculate margins for interest rate swap transactions, and is calculated by obtaining quotes as of 15:02 from information vendors and broker dealers.⁸

TORF rates and JSCC settlement rates differ not only in the calculation methods but also in the data used for the calculation. Specifically, the TORF uses only the execution rates and quoted rates presented on the premise of a transaction for Japanese Yen OIS⁹, while JSCC settlement rates are based on quote rates (indicative data submitted, but not based on the premise of a transaction) "obtained from information vendors and broker dealers". Although there are differences between the two rates due to differences in calculation methods and data used in the calculations, the trends in 2022 for 3 and 6 months are

⁸ <https://www.jpx.co.jp/jscce/en/cash/irs/margin.html>

⁹ The interest rate benchmark, TORF, is designed to comply with the Principles for Financial Benchmarks by the International Organization of Securities Commissions (IOSCO). Consistent with Principle 6 (Benchmark Design) and Principle 7 (Data Sufficiency) of the Principles, and in order to accurately reflect the actual trading conditions in the Japanese Yen OIS market, data used for the purpose of supplementing execution rates is limited to quoted rates on the assumption of trading. (Principles for Financial Benchmarks Final Report <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD415.pdf>)

generally consistent as shown in Figure 2: Comparison between TORF Rates and JSCC Settlement Rates.

However, the difference from the JSCC settlement rate for the 1 month is more prominent than in the 3 month and 6 month. The average divergence was 0.0142%, well above the 0.0019% for the 3 month and 0.0020% for the 6 month. As described below, there were by far more days for TORF 1 month which "previous day's value was adopted" than for other tenors due to the fact that there was no current day's rate or quote rates (based on the premise of a transaction), while the JSCC settlement rates were calculated using quotes including indicative data (not based on the premise of a transaction) that are not used to calculate the TORF. We believe that the discrepancy was caused by such differences in the data used.

Table 3: Difference between TORF and JSCC Settlement rates¹⁰

Tenor	Minimum	Maximum	Average
1 Month	0.0002% (0.0000%)	0.0393% (0.0171%)	0.0142% (0.0045%)
3 Month	0.0000% (0.0000%)	0.0129% (0.0122%)	0.0019% (0.0014%)
6 Month	0.0000% (0.0000%)	0.0241% (0.0055%)	0.0020% (0.0010%)

iii. Evaluation by types of reporting data used and corresponding level at the time of calculation of TORF

As described in the previous section, TORF employs waterfall structure in its calculations so that it can be calculated based on an objective and mechanical method without being affected by the trading volume (see Appendix for details on the waterfall methodology). Table 4 shows the percentages of the calculation order based on the waterfall structure in order to verify what percentage of the execution rates and quote rates were used for the calculation during the period.

Table 4: Percentage of TORF calculation by Level¹¹

	1M	3M	6M
Level 1	0.4% (0.0%)	27.5% (23.8%)	32.4% (19.0%)
Level 2	— ¹²		
Level 3	0.0% (23.2%)	1.2% (16.1%)	0.0% (21.4%)
Level 4	0.0% (0.0%)	0.0% (0.0%)	0.0% (0.6%)
Level 5	5.3% (3.0%)	26.2% (16.1%)	24.2% (19.6%)
Previous Day's official Rate	94.3% (73.8%)	45.1% (44.0%)	43.4% (39.3%)

¹⁰ Maximum, minimum, and average absolute value of difference between TORF rate and JSCC settlement rate (2021 in parentheses).

¹¹ Rounded off at the two decimal places (2021 in parentheses). Explanation of each level is described in the Table 6.

¹² Level 2 adopts quote data with notional amount submitted on CLOB (Central Limit Order Book) in the calculation, however it is not adopted at present.

In the calculation of the TORF, indicative data which is submitted but not based on the premise of a transaction is not used, but executed rate of an actual transaction or quote rate submitted on the premise of a transaction are used.

For both the 3 month and 6 month, more than 50% of the days were calculated based on the current day's rates, but the percentage was lower than the previous year. For the 1 month, the ratio of the number of days in which calculations were made based on the current day's rate (total percentage of days other than the previous day's value adoption) was even lower than the previous year, falling below 10%.

A closer look by level shows that while the percentages of the first and fifth levels themselves were rather higher than in 2021, but the third level dropped significantly.

iv. A summary of TORF's representativeness as an interest rate benchmark in light of the Japanese Yen OIS market condition

As shown in Table 1, the percentage of transactions by reporting brokers in the overall 1, 3 and 6 months of the JPY OIS market (around 30%) has declined compared to the estimate for 2021 (around 40%). This decline is mainly due to the expansion of "non-brokerage transactions" in the Japanese Yen OIS market, such as negotiated transactions and dealer-to-client transactions. Although transactions are based on TONA, the Japanese Yen risk-free rate, not all of the transactions can necessarily be used to calculate the TORF. This is because, in the case of transactions other than through brokers, there may not be sufficient competition in the determination of transaction rates.

On the other hand, transactions through brokers are considered to be an extremely important observation target in the measurement of the term risk-free rate because of the principle of competition among dealers. The amount of transactions via brokers (see (2) in Table 2, approximately 20-30 trillion yen) more than doubled from the previous year, and the percentage of transactions via brokers accounted for by the 3 reporting brokers (see (4) in Table 2, over 70%) remained at about the same level as in the previous year. In terms of "adequacy of reporting brokers' share of transactions in the Japanese Yen OIS market", it can be said that the current definition and calculation methods of TORF meet the level required to maintain TORF's representativeness as an interest rate benchmark.

However, as indicated in "iii. Evaluation of types of reporting data used and corresponding level at the time of calculation of TORF", the percentage of days for which the TORF was calculated based on the current day's rates has generally declined from the previous year. In particular, we believe that it is desirable to initiate a study to improve the situation where the percentage of days when the 1 month of TORF is calculated based on the current day's rate is less than 10% (Table 4).

(4) Reasonableness of reporting rate generation process by reporting brokers

QBS reviews the data reported by reporting brokers in its daily calculation operations. In addition, during the periodic monitoring, we confirms that the reporting broker's reporting rate generation process is appropriate and that there are no errors or tampering of any kind, by checking the trend of each execution rate and quote rate, comparing rates among reporting brokers, comparing rates among calculation levels, and conducting hearings as necessary.

As a result, during the periodic monitoring from November 2021 to January 2022¹³, it was found that a reporting broker had failed to report execution rates from December 2021 to early February 2022¹⁴. In addition, during the periodic monitoring from May to July 2022, it was revealed that a reporting broker did not report one execution data¹⁵. During the periodic monitoring from August to October 2022, it was also discovered that a reporting broker was not reporting some of their quote data due to a glitch in their system settings¹⁶.

With regard to each of these events, we ordered the reporting broker to formulate measures to prevent recurrence, as well as to strengthen the verification of reporting data and the internal communication system, and confirmed its implementation. As well, for reporting broker who has been the subject of misreporting or omissions, we have also required them to review their data reporting framework, including their system parameters.

¹³ <https://www.torf.co.jp/en/monitoringresults11-1/>

¹⁴ This is published in the "Result of a Periodic Review of TORF Operational Framework" in 2021.

¹⁵ https://www.torf.co.jp/en/news2208_01/

¹⁶ https://www.torf.co.jp/en/news2212_01/

We believe that the adequacy of the reporting broker's process for generating reporting rates is maintained through this periodic monitoring and confirmation process.

QBS will continue to monitor the adequacy of the generation process, including the status of the reporting rate confirmation framework, and will continue to take steps to strengthen reporting broker management as necessary.

(5) Others

As noted in the “Results of periodic monitoring of TORF Official Rates, etc.” for August-October 2022, QBS also identified issues during the applicable period under review regarding the QBS’s operational framework of benchmark, specifically, the operational framework of TORF calculation and the management framework of reporting brokers.

As shown in Appendix 1 of the TORF Code of Conduct¹⁷, QBS requires reporting brokers to report "execution time in hours, minutes, seconds" and "quote presented time (updated time) in hours, minutes, seconds". Nevertheless, since the start of TORF calculation on April 26, 2021, seconds have not been reported with respect to certain reporting broker, and data for which such seconds were not reported were uniformly treated as "00 seconds" (hereinafter referred to as the "Event").

Relevant departments in charge of operation and monitoring of TORF calculation respectively, did not consider the “Event” to be a particular problem, based on the judgment that it was an unavoidable response to the nature of the practice of voice broking. However, the miscalculation caused by the reporting broker's omission of the report led QBS to investigate and review the matter internally, and as a result, QBS decided to disclose the “Event” to the public in the previous “Results of periodic monitoring of TORF Official Rates, etc.” and to share it again in this report.

The proper measure to address this “Event” was to revise the TORF Calculation Guidelines and the TORF Code of Conduct to ensure that there is no discrepancy between the reporting framework of reporting brokers and these regulations. However, it is understood that changing the date and time items from seconds to minutes would not

¹⁷ <https://www.torf.co.jp/wp-content/uploads/CodeofConductEN.pdf>

only require a rule revision procedure, but could also affect the reporting system of each company, including reporting brokers, who currently report in seconds.

QBS plans to take appropriate action, including revision of regulations, but until such a drastic action is completed, we have decided to take the following actions.

"If seconds are not reported in the date and time items of the execution data or trade quote data, they shall be uniformly deemed to be '00 seconds'."

After reviewing the impact of this “Event” on the TORF calculated values, it was confirmed that this “Event” had no impact on the TORF calculated values from the start of the TORF calculation and publication until the last day of the applicable period this review.

To maintain and improve the transparency, robustness, and reliability of the TORF, QBS is constantly reviewing its own calculation and publication process and will disclose any issues.

3. Conclusion

As stated above, it is appropriate that the underlying market of the TORF to be Japanese Yen OIS market. Also, the adequacy of the percentage of transactions that the 3 current reporting brokers account for in this market is considered to meet the required level. Furthermore, taking into account the rate trends, the types of data used in the calculations based on the waterfall structure, and the corresponding calculation levels, there are no items that fall under Article 48 (Changes in the definitions or calculation methods of the TORF), paragraph 1 of the TORF Operational Rules in term of representativeness as interest rate benchmark of the TORF¹⁸. Therefore, there is no need to revise the operational framework, including the calculation method of TORF, at this point.

However, given that the percentage of days for which calculations are based on the current day's rate is declining in all tenors, it would be desirable to begin considering whether there are any measures to improve the reliability and robustness of the data, such as expanding the available data.

¹⁸ (i) where there have been any structural changes in the Japanese Yen OIS market or other Japanese Yen interest rate derivatives market that may require changes in the definitions, calculation methods of the TORF

(ii) where underlying interest which the TORF seeks to measure is no longer generally used or is not functioning, and hence is deemed to be not fulfilling its role as a reliable benchmark.

We will continue to strictly monitor the appropriateness of the reporting brokers' reporting rate generation process through confirmation and periodic monitoring during daily calculation operations. For those reporting brokers that need to improve their reporting rate generation process and data verification framework, we designated to take necessary measures, such as strengthening their reporting process to QBS, including measures to address potential risk factors.

[Appendix]

TORF Calculation¹⁹

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 the official rate objectively and mechanically without using expert judgement.

(1) Use of execution rates and quote rates

If a transaction is executed, the execution rate will be 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 (order rate submitted based on the premise of a transaction, same applies below) will be used. 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.

(2) 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 minimum execution principal amount on voice broker.” As a result, calculations can be made from active transaction to thin transaction without using expert judgement.

¹⁹ Based on TORF Calculation Guidelines

Table 5: Summary of TORF Calculation Process

(1) Separation	<ul style="list-style-type: none">• Separate reporting data by tenor• Separate execution date and quote data
(2) Extract	<ul style="list-style-type: none">• 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) Judgement	<ul style="list-style-type: none">• Level judgement by tenor
(4) Calculate	<ul style="list-style-type: none">• Calculate the rate according to the calculation method of each level
(5) Publish	<ul style="list-style-type: none">• Publication of the official rates for the three tenors at 17:00 JST

Table 6: Waterfall Methodology for TORF Calculation

Level 1 Executed transaction (execution) data	<ul style="list-style-type: none"> • Execution data executed on a voice broker or CLOB
Level 2 Order pair with notional amount information on CLOB	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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.

*If there is no data corresponding to Levels 1 through 5, the official rate of the previous day is used as the official rate of the day for the relevant tenor.