April 15, 2022

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 not necessary to change the operational framework, including the TORF calculation method, at this time.
- We continue to monitor the market condition closely, as we have observed significantly low trading volume of Japanese Yen OIS in some tenors.
- As the incident of erroneous reporting by some reporting brokers, we will strictly monitor the appropriateness of the process of generating reporting rates by reporting brokers and take necessary measures to strengthen controls over such reporting brokers when problems are recognized.

2. Review of Operational Framework

(1) Background

TORF (Tokyo Term Risk Free Rate) 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 market to be evaluated and averaging its trading rates according to the method specified in the TORF Calculation Guidelines.

In order to eliminate the credit risk of the counterparty in the interest rate derivatives transactions, the reporting data used in the TORF calculation methodology is limited to centrally-cleared transactions by Japan Securities Clearing Corporation (JSCC) or LCH, and is limited to transactions executed through brokers. At present, reporting brokers that provide reporting rates that are used to calculate TORF are only voice brokers.

Below, we will examine the condition of the Japanese Yen OIS market and other interest rate derivatives market using the Tokyo OverNight Average rate (TONA), which is subject to evaluate, and the adequacy of reporting brokers' share of entire market. In addition, we will verify the reasonableness of the reporting broker's reporting rate generation process, taking into account the results of periodic monitoring conducted by the QBS.

(2) Japanese Yen OIS market and other related market such as interest rate derivatives market using TONA

The trends of the Japanese Yen OIS market in 2021 is as follows (2020 in parentheses).

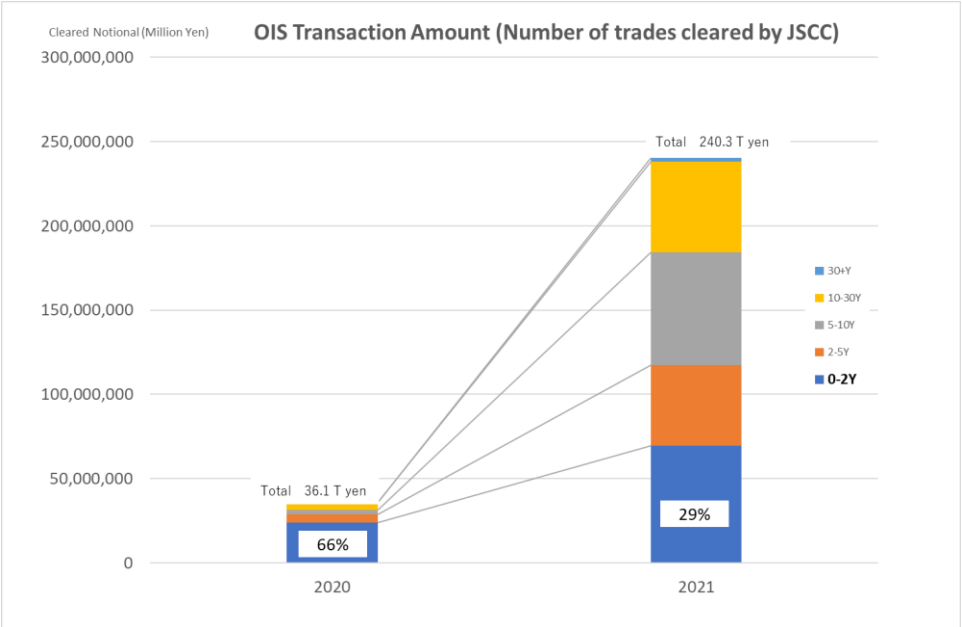
- Japanese Yen OIS market total amount 240.3 trillion Yen (36.1 trillion Yen)
  - Less than 2 years 69.6 trillion Yen (23.8 trillion Yen)

The shift to TONA, the risk-free rate for the Japanese Yen, following the permanent cessation of the publication of the Japanese Yen Libor, has led to a shift in the interest rate swap market from LIBOR swaps to Japanese Yen OIS transactions based on TONA, mainly in the med-to-long term. The amount of Japanese Yen OIS transactions exceeded six times that of the previous year.

With the rapid increase in med-to-long term Japanese Yen OIS transactions, the share of less than 2 years fell from 66% in 2020 to 29% in 2021, but the amount of transactions of less than 2 years still increased about three times that of the previous year. There are three tenors that TORF calculates that are 1, 3, and 6 months tenors out of the range of less than 2 years, but based on QBS's own market research, etc., it is estimated that 1, 3, and 6 months tenors account for about 30% of the amount of transactions of less than 2 years category.

In the light of the growth of Japanese Yen OIS transactions, it is considered appropriate to set the TORF evaluation market as the Japanese Yen OIS market.

Figure 1: Changes in the Japanese OIS transaction amount[1]



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

Other than Japanese Yen OIS market, interest rate derivatives market using TONA "Over-Night Call Rate Futures" is listed on Tokyo Financial Exchange (TFX), however trading is suspended at this time.

(3) Adequacy of reporting brokers' share of transactions in the Japanese Yen OIS market

Next, we will examine the adequacy of the share of transactions accounted for by reporting brokers in the Japanese Yen OIS market. However, the TORF is not simply calculated based on the execution rate; even if there is no execution, it can be calculated based on the quote rate in the market (order data presented on the premise of a transaction) based on the waterfall structure of the calculation order. In other words, evaluation based on the amount of transactions is not sufficient, as it can be calculated regardless of the number of transactions.

[1] Calculated based on "Notional of Cleared Trades" published by JSCC" (https://www.jpx.co.jp/jscc/en/interest_rate_swap.html)

Therefore, in addition to the evaluation based on transaction amount, we also added evaluation from the aspects of the appropriateness of TORF rate trends calculated based on the waterfall structure, the order of calculation indicating the type of data used in the calculation, and the appropriateness of the rates reported by the reporting brokers.

Assessment period is from April 26, 2021 to December 30, 2021 (168 business days).

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 indicated in (2) there is notional of cleared trade that JSCC publishes monthly. However, while the tenor of TORF is 1, 3, 6 months, JSCC's monthly data is classified as "0-2 years". Therefore, QBS conducted its own market research and estimated the percentage of transactions by reporting brokers in the overall Japanese Yen OIS market for 1, 3 and 6 months, which is the market where TORF is evaluated, as shown in Table 1. The percentage is estimated to be approximately 40% as shown below.

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 three reporting brokers in the transactions executed via brokers[2], 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 three 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 three 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	59.7 trillion yen (Actual)
b. Percentage and estimated value of 1, 3, and 6 month items in a.	1, 3 and 6 months	Approx. 30 %, Just under 20 trillion yen (Estimate)
c. Japanese Yen OIS Transaction amounts in the data reported by the three reporting brokers (TORF Reporting subjected data including cleared by LCH)[5]	1, 3 and 6 months	11.5 trillion yen (Actual)
d. Cleared by JSCC in c.	1, 3 and 6 months	7.2 trillion yen (Actual)
e. Percentage of reporting brokers' transactions in the Japanese Yen OIS market in months 1, 3 and 6 (d/b)	1, 3 and 6 months	Just under 40% (Estimate)

Table 2: Estimated percentage of transactions through brokers by three 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.a.)	1, 3 and 6 months	Just under 20 trillion yen (Estimate)
b. Percentage of a. and estimated amount via brokers	1, 3 and 6 months	Approx. 50%, Just under 10 trillion yen (Estimate)
c. Japanese Yen OIS transaction amount of the data reported by the three reporting brokers (only cleared by JSCC) (Table 1 .d)	1, 3 and 6 months	7.2 trillion yen (Actual)
d. Percentage of transactions through brokers accounted for by the three 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 are 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.jpx.co.jp/jscc/en/interest_rate_swap.html)

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

[6] 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 are not guaranteed to be accurate. QBS assumes no responsibility for any indirect or direct damages resulting from the use of such estimates.

[7] Same as footnote[2]

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, in terms of the regulations, effective December 6, 2021, the obligation to use ETPs on interest rate swaps that reference the 6 and 3 months Japanese Yen LIBOR was switched to the Japanese Yen OIS. Although the tenors that are subject to the ETP obligation are limited to 5, 7, and 10 year tenors, QBS will continue to monitor the status of ETP transactions.

ii. Evaluation by Rate Trends

In confirming the adequacy of reporting broker's share of transactions, 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 the graph in Figure 2: Comparison between TORF Rates and JSCC Settlement Rates. The 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 rate and JSCC Settlement rate differ not only in the calculation method but also in the data used for the calculation. Specifically, TORF uses only the execution rates and quoted rates for Japanese Yen OIS transactions[9], while JSCC clearing rates are based on quotes "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 are generally consistent as shown in Figure 2: Comparison between TORF Rates and JSCC Settlement Rates.

[8] https://www.jpx.co.jp/jscc/en/cash/irs/margin.html

[9] The benchmark index, TORF, is designed to comply with the Principles on Financial Market 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)

However, the difference from the JSCC clearing rate for the 1 month contract is slightly more prominent than for the 3 month and 6 month. As shown in Table 4 below, the 1 month TORF has more days than other tenors where the "previous day rate" is used, which cannot be calculated up to the Level5 because there is no execution rate or quote rate based on trading, while JSCC uses a wider range of data for its calculations than TORF, and we believe that the discrepancy was caused by such differences in the data used.

Figure 2: Comparison between TORF Rates and JSCC Settlement Rates

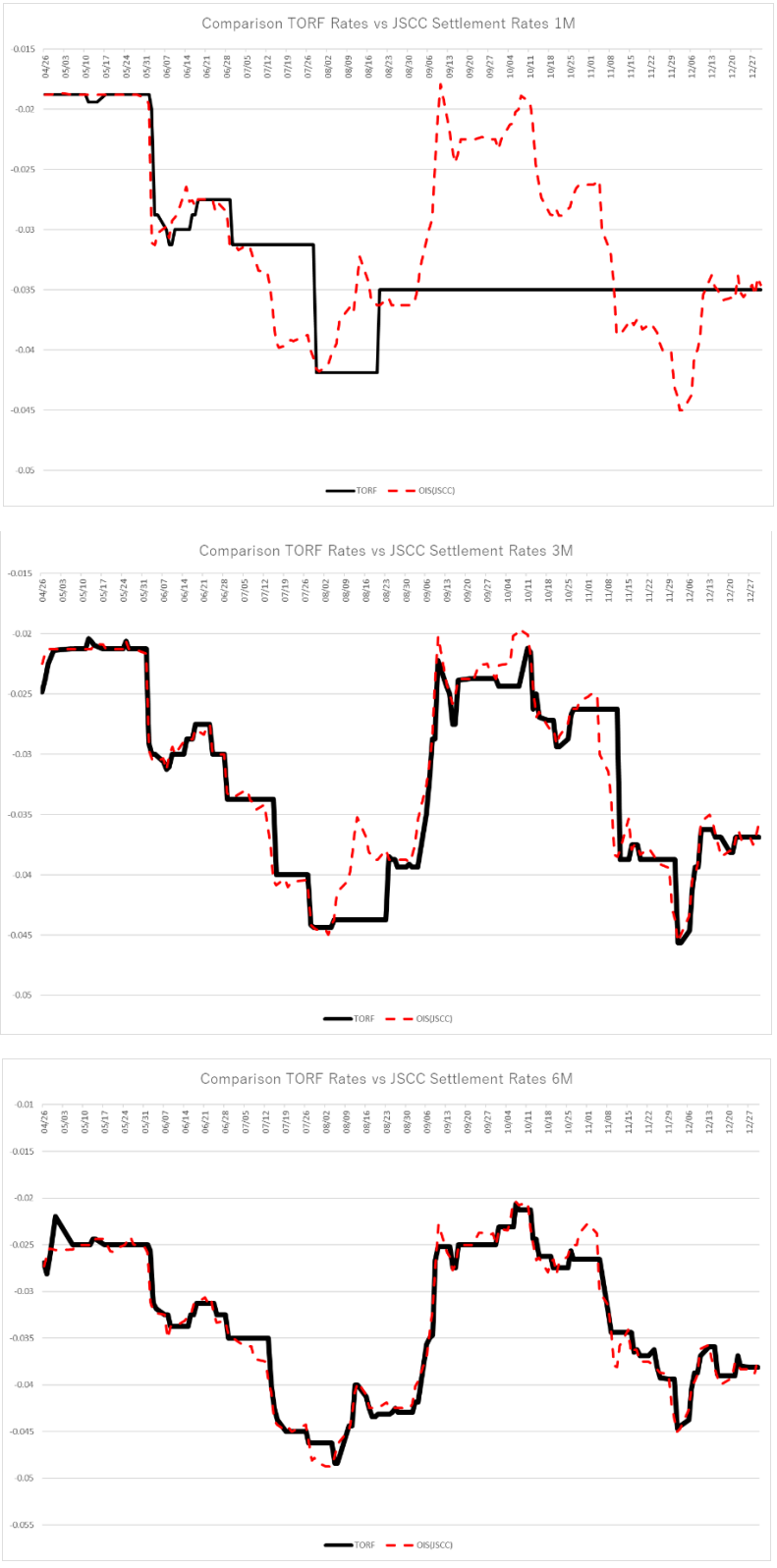


Table 3: Difference between TORF and JSCC Settlement rates

Tenor	Minimum	Maximum	Average
1 Month	0.000%	0.0171%	0.0045%
3 Month	0.000%	0.0122%	0.0014%
6 Month	0.000%	0.0055%	0.0010%

iii. TORF Calculation-Judge by Level

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 Level[10]

	1M	3M	6M
Level 1	0.0%	23.8%	19.0%
Level 2	——[11]		
Level 3	23.2%	16.1%	21.4%
Level 4	0.0%	0.0%	0.6%
Level 5	3.0%	16.1%	19.6%
Previous Day's official Rate	73.8%	44.0%	39.3%

[10] Rounded off at the two decimal places.

[11] 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. The calculation is then based on the current day's rate for a percentage of days exceeding 50% and 60% for the 3 month and 6 month, respectively. On the other hand, only about 30% of the 1 month was able to be calculated based on the same day rate.

(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, the company 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 April to July 2021[12], errors were detected in some of the reported data by some reporting brokers.

Also, in November 2021, during the confirmation process of calculations by QBS, it was found that some reporting brokers' quote reporting data contained erroneous data[13]. In addition, periodic monitoring from November 2021 to January 2022[14] revealed that some reporting brokers had failed to report execution rates from December 2021 until early February 2022.

With regard to each of these events, we ordered the reporting broker to formulate measures to prevent recurrence, confirmed the implementation of such measures, strengthened the verification of reporting data, and reinforced internal communication.

[12] https://www.torf.co.jp/en/monitoringresults4-7/

[13] Erroneous data was detected and corrected before calculating the rate.

[14] https://www.torf.co.jp/en/monitoringresults11-1/

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

3. Conclusion

QBS concludes that it is not necessary to change the TORF operational framework including TORF calculation methodology based on the result of periodic review.

The TORF is a term risk-free rate, which is characterized by the following: (1) it is calculated using only transaction rates (execution rates and order rates submitted based on the premise of a transaction,) to maintain transparency and robustness as an benchmark index, (2) it is limited to centrally-cleared transactions to eliminate credit risk of counterparties in Japanese Yen OIS transactions, and (3) to eliminate arbitrariness and credit risk in rate determination, rates used for calculation exclude those of negotiated transactions, and only rates through reporting brokers are used.

Article 48 (1) of the TORF Operational Rules sets forth the conditions under which a review of the TORF definition and calculation method needs to be considered, but we have not yet reached a situation where those conditions are met. Compared to April 2021, when the TORF began to be published, the permanent suspension of the publication of the Japanese Yen LIBOR at the end of 2021, as indicated in 2. (2), has rather increased the importance of the Japanese Yen OIS market.

In addition, Article 50 of the TORF Operational Rules stipulates the conditions under which the continuous suspension of publication must be considered, but as mentioned above, these conditions are not applicable.

However, for the 1 month TORF, more than 70% of the previous day's rates were used, which affects the calculation based on execution rate of the Japanese Yen OIS market. QBS will continue to monitor the situation closely in cooperation with market participants.

On the other hand, we will continue to strictly monitor the appropriateness of the reporting broker's reporting rate generation process through confirmation and periodic monitoring during daily calculation operations. If any problems are found in the reporting rate generation process or checking system, we will pursue the root causes and take necessary measures to strengthen the management of reporting brokers.

Appendix

TORF Calculation [15]

The main feature of the TORF is that it uses the transaction rate of the Japanese Yen OIS market, rather than an interest rate index 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 set 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.

[15] Based on TORF Calculation Guidelines

Table 5: Summary of TORF Calculation Process

(1) Separation	• Separate reporting data by tenor • Separate execution date and quote data
(2) Extract	• 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	• Level judgement by tenor
(4) Calculate	• Calculate the rate according to the calculation method of each level
(5) Publish	• 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	・ 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.

*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.