FEDERAL RESERVE BANK *of* NEW YORK *Serving the Second District and the Nation*

Additional Information about the Treasury Repo Reference Rates

The New York Fed has endeavored to adopt policies and procedures consistent with best practices for financial benchmarks. The New York Fed's Audit Group has concluded that the internal control structure over the production of the Tri-Party General Collateral Rate (TGCR), the Broad General Collateral Rate (BGCR) and the Secured Overnight Financing Rate (SOFR) is effective and that the production of these rates is compliant with the applicable sections of the IOSCO Principles for Financial Benchmarks (the Principles) as detailed in the New York Fed's Statement of Compliance. The New York Fed will assess the compliance of the TGCR, the BGCR and the SOFR with the Principles on an annual basis and issue a Statement of Compliance accordingly.

Data and Calculation Methodology

The New York Fed, in cooperation with the U.S. Office of Financial Research, publishes three Treasury repo reference rates based on transaction-level data collected under the supervisory authority of the Board of Governors of the Federal Reserve System and transaction-level data obtained from DTCC Solutions LLC (DTCC Solutions), an affiliate of the Depository Trust & Clearing Corporation, under a commercial agreement. Data are provided under a license granted to the New York Fed by DTCC Solutions. DTCC Solutions, its affiliates, and third

parties from which they obtained data have no liability for the content of this material.

The Tri-Party General Collateral Rate (TGCR) is a measure of rates on overnight, specific-counterparty tri-party general collateral repo transactions secured by Treasury securities. Specific-counterparty transactions refer to those in which the counterparties involved know each other's identity at the time of the trade. General collateral transactions are those for which the specific securities provided as collateral are not identified until after other terms of the trade are agreed. The rate excludes GCF Repo transactions and transactions to which the Federal Reserve is a counterparty. It is based on transaction-level tri-party data collected from the Bank of New York Mellon (BNYM) only.

The Broad General Collateral Rate (BGCR) is a measure of rates on overnight Treasury general collateral repo transactions. The BGCR includes all trades used in the TGCR plus GCF Repo trades. It is based on the same transaction-level tri-party data collected from BNYM as well as GCF Repo data obtained from DTCC Solutions.

The Secured Overnight Financing Rate (SOFR) provides a broad measure of the general cost of financing Treasury securities overnight. The SOFR includes all trades used in the BGCR plus data on transactions cleared through the Fixed Income Clearing Corporation's Delivery-versus-Payment (DVP) repo service. In the DVP repo market, counterparties identify specific securities to settle each trade, rather than a population of acceptable collateral as in the tri-party repo market. As a result, the DVP repo market can be used to temporarily acquire specific securities. Repos for specific-issue collateral may be executed at rates below those for general collateral repos if cash providers

are willing to accept a lesser return on their cash in order to obtain a particular security. In this case, the specific securities are said to be trading "special". DVP repo transactions with rates below the 25th volume-weighted percentile rate are removed from the distribution of DVP repo data each day. This has the effect of removing some (but not all) transactions in which the specific securities are said to be trading "special".

The SOFR, the BGCR, and the TGCR are each calculated as a volume-weighted median, which is the rate associated with transactions at the 50th percentile of transaction volume. Specifically, the volume-weighted median rate is calculated by ordering the transactions from lowest to highest rate, taking the cumulative sum of volumes of these transactions, and identifying the rate associated with the trades at the 50th percentile of dollar volume. At publication, the volume-weighted median is rounded to the nearest basis point.

The 1st, 25th, 75th, and 99th percentiles for each rate are also calculated using the same volume-weighted methodology and similarly rounded to the nearest basis point. Volume is calculated as the sum of overnight transaction volume used to calculate each reference rate, rounded to the nearest $1 billion. These additional summary statistics reflect the inputs included in the rate calculation, and will only be revised if amendments to the data result in a revision to any of the three rates.

For each rate, the New York Fed excludes trades between affiliated entities, when relevant and when the data to make such exclusions are available. To the extent possible, “open” trades, for which pricing resets daily (making such transactions economically similar to overnight transactions), are included in the calculation of the rates.

For further information regarding the development of the three Treasury repo reference rates, please see the following:

Request for Information Relating to Production of Rates (Notice and Request for Public Comment)

Production of Rates Based on Data for Repurchase Agreements (Notice)

Data Exclusions

In calculating the rates each day, the New York Fed will review the data to assess whether there are any transactions that should be excluded from the rate calculations for a given day, such as those that appear not to have been conducted at arm's length, or that seem anomalous or potentially erroneous. The New York Fed may exercise expert judgment in making such determinations.

Data Contingency

On most days, the New York Fed will calculate the Treasury repo reference rates based on tri-party repo, GCF Repo, and DVP repo data provided by BNYM and DTCC Solutions from the prior business day. However, if data for a given market segment were unavailable, then the most recently available data for that segment from would be utilized, with the rates on each transaction from that day adjusted to account for any change in the level of market rates in that segment over the intervening period. The published references rates would be calculated from this adjusted prior day's data for segments where current data were unavailable, and unadjusted data for any segments where data were available.

To determine the change in the level of market rates over the intervening period for the missing market segment, the New York Fed would use information collected through a daily survey conducted by its Trading Desk of primary dealers' repo borrowing activity. Each day, the primary dealers report the volume of their borrowing activity in each of the three repo market segments included in the rates, as well as the volume-weighted average rate of this activity. To adjust the rates from the most recently available data for the missing segment, the overall change in the volume-weighted average rate across primary dealers would be added to or subtracted from each transaction, while leaving the volume of those transactions unchanged.

Below is an illustrative example of this methodology in practice:

Assume that a given market segment *s* consists of three transactions: $20 billion in transaction volume at 1 percent, $30 billion at 2 percent, and $40 billion at 3 percent on date (t-τ), the last day for which production data was available for segment s. Given a ten basis point change in the overall volume-weighted average rate of primary dealers' repo borrowing in segment *s* from (t-τ) to t, the modified set of transactions for market segment *s* on date t would be equivalent to $20 billion in volume at 1.10 percent, $30 billion at 2.10 percent, and $40 billion at 3.10 percent. The rate on date t would be calculated based on this adjusted set of transactions as well as the available production data for the other market segments.

In other words, the New York Fed would follow the following steps:

- for each market segment, *s*, is date t production data missing?

- if yes, then compute the volume-weighted mean rate from the Primary Dealer survey for segment s for dates t and (t-τ), which represents that last day with production data for the segment.[1]
- let $\delta_{s,t-\tau}$ = change in volume-weighted mean survey rate for segment s from (t-τ) to t.
- for all transactions i in the missing segment s, set the adjusted rate $R_{s,i,t}$ as: $R_{s,i,t}= r_{s,i,t-\tau}+\delta_{s,t-\tau}$, and, set the volume $V_{s,i,t}=v_{s,i,t-\tau}$.
- compute the published rate as the volume-weighted median across all transactions from the production data for the available segment(s) and the adjusted data for the missing segment(s).

Under extraordinary circumstances where the contingency data are unavailable, the New York Fed may publish the prior day's rates. If data other than those provided by BNYM or DTCC are used, the change in source will be noted when the rate is published.

Rate Revisions

If errors are discovered in the transaction data provided by either BNYM or DTCC Solutions, or in the calculation process, subsequent to the rate publication but on that same day, the affected rate or rates and accompanying summary statistics may be republished at approximately 2:30 p.m. ET. Additionally, if transaction data from BNYM or DTCC Solutions had previously not been available in time for publication, but became available later in the day, the affected rate or rates may be republished at around this time. Rate revisions will only be effected on the same day as initial publication and will only be republished if the change in the rate exceeds one basis point. Any time a rate is revised, a footnote would indicate the revision. This revision

threshold will be reviewed periodically and may be changed based on market conditions.

For each of the three rates, updated summary statistics are published on a lagged basis at the end of each quarter. These statistics may potentially differ from the originally published data if errors in the data provided by either BNYM or DTCC Solutions, or in the rate calculation process, were discovered following the initial publication date; data from BNYM or DTCC Solutions that had not been available on the initial publication date was subsequently received; or if same-day changes in the rates had not met the threshold for same day republication as described above. Additional summary statistics, such as the 5th and 95th percentile rates, will be published on a lagged basis with this release.
Quarterly Repo Summary Statistics (data updated as of 12/31/2018)

Internal Oversight

An internal Oversight Committee periodically reviews and provides challenge on the rate production process. The Committee consists of members from across the New York Fed organizational structure who are not involved in the daily production of the SOFR, the BGCR, and the TGCR. Included are the New York Fed's Chief Risk Officer and other senior staff from various control areas of the New York Fed, in addition to participation from the U.S. Office of Financial Research. Among the Committee's responsibilities are periodic reviews of the rate production process, including quarterly reports of any use of non-standard procedures in the production of the rates, an annual review of the robustness of the rate calculation

methodology, in addition to reviewing policies regarding complaints received, audit findings, and conflicts of interest.

Changes in Methodology and Public Consultation Policy

As a reference rate administrator, the New York Fed may seek to revise the composition or calculation methodology for one or more of the reference rates it administers in response to market evolution or for some other reason. An Oversight Committee, charged with periodically reviewing the composition and calculation methodology of each reference rate to ensure that it continues to properly reflect its underlying interest, will review and approve any such proposed changes. In its evaluation of proposed changes, the Oversight Committee will take into account relevant factors such as the uses of the affected reference rate(s) and the breadth and depth of those uses, the nature of the stakeholders, the resource implications of the proposed change(s), and any risks posed by potential delays in implementing the changes.

To the extent that changes being considered are deemed material[2] by the Oversight Committee, the New York Fed will seek public comment in a manner that is proportional and appropriate to the circumstances. Typically, this will involve publishing a notice on its website detailing the proposed change, posing specific questions for feedback, and inviting interested parties to provide written comments by a specified date.

In most instances, the New York Fed will issue a final notice prior to implementing any material change(s) to its reference rates. This notification will describe the final change, explain the rationale for the change and what it entails, highlight any modifications to the proposed change that were made in response to public feedback, and note when the change will take

effect. Additionally, the New York Fed anticipates that it will publish individual comments received during this public consultation as well as a summary response to those comments when it issues the final notice.

Depending on the nature of the change, however, alternative consultation mechanisms may be utilized, such as in instances where the Federal Reserve Board of Governors is required to engage in a formal notice-and-comment process for some types of changes.

Conflicts of Interest

The New York Fed has policies on ethics and conflicts of interest. In addition, staff will consider and address potential conflicts of interest and related concerns specific to administration of the rates.

Complaints

Complaints about the rate calculation process or a given day's rate should be submitted in writing to the New York Fed via the following email address: rateproduction@ny.frb.org. The New York Fed will investigate and review any such complaints and will endeavor to respond to the complainant in a timely manner. For additional resources to report complaints, please see Tips and Complaints.

[1] τ is the number of consecutive business days of missing production data for that segment. Thus, (t- τ) is the last day for which production data is available. Because this methodology is intended to be used for short-term contingency situations, we'd expect τ to equal 1. However, the methodology is able to accommodate scenarios where production data is missing for several days.

[2] In general, a change will be deemed material if it would require updating the published methodology for the affected reference rate. Changes which do not require an update to the

published methodology will generally be considered non-material and therefore would not require a public consultation.
