

Alternative Reference Rates Committee

SOFR Floating Rate Notes Conventions Matrix

August 2019

The Alternative Reference Rates Committee (“ARRC”) is a group of private-market participants convened by the Federal Reserve Board and the Federal Reserve Bank of New York (“FRBNY”) with a mandate to develop recommendations to help ensure a successful transition from U.S. dollar LIBOR. It is comprised of a diverse set of private-sector entities, including buy-side, sell-side, and intermediary participants in markets affected by U.S. dollar LIBOR, and a wide array of official-sector entities, including banking and financial sector regulators, as ex-officio members. After a multi-year process of market-wide consultation and deliberation to evaluate a range of potential alternatives to U.S. dollar LIBOR, the ARRC identified the Secured Overnight Financing Rate (“SOFR”) as its recommended alternative rate.¹

The ARRC is supported by eleven working groups, including a Floating Rate Notes Working Group (“FRN Working Group” or “Working Group”) tasked with specific objectives to help enable a smooth transition from U.S. dollar LIBOR. One of the objectives of the FRN Working Group is to identify the considerations relevant to using SOFR in new issuances. In furtherance of this goal, the FRN Working Group developed the matrix below that identifies those considerations for market participants interested in using SOFR in new issuances (“Matrix”). The Working Group may further refine its recommendations and revise this Matrix as the market evolves. This Matrix is intended as a resource for market participants to consider when using SOFR in new issuances and as a supplement to the ARRC’s paper titled “*A User’s Guide to SOFR*”²; it is not intended in any way to mandate, prescribe, or limit the ways in which SOFR may be used in new issuances. Market participants, including those serving on the FRN Working Group, will determine for themselves how SOFR can best be used in new issuances. Accordingly, nothing herein is intended to be binding on any market participant or give rise to any legal rights or obligations of the ARRC.

¹ SOFR is a broad measure of the cost of borrowing cash overnight collateralized by Treasury securities.
<https://apps.newyorkfed.org/markets/autorates/SOFR>.

² “A User’s Guide to SOFR” is available at <https://www.newyorkfed.org/arrc/publications>.

Issues	Explanations and Considerations
<p>Compounded vs. Simple Average</p>	<ul style="list-style-type: none"> • Explanation: An averaged SOFR referenced in floating rate notes (“FRNs”) can either be calculated by using a <i>simple</i> or a <i>compounded</i> average³ • Compounded SOFR: <ul style="list-style-type: none"> ○ Calculation of the compounded interest rate is more complex, however, this potential additional complexity may be mitigated by a published SOFR index or calculator described below ○ There will be economic equivalence between the compounded rate of interest and the interest applicable for a deposit that is held in a bank account for the same period or invested and rolled daily in overnight markets. The compounded rate of interest more accurately reflects the time value of money than a simple average ○ Use of a compounded rate aligns with the established market practice for SOFR-referencing derivatives, including the overnight index swap (OIS) market. This may be preferable for hedging purposes ○ SONIA⁴ FRNs are compounded, therefore using compounding for SOFR may reduce the risk of international liquidity fragmentation • Simple average SOFR: <ul style="list-style-type: none"> ○ As the simple averaging formula is less complex when compared to compounding, it may be easier to include in interest calculation systems, however, there have been several compounded SOFR deals in the market already, evidencing that certain firms have

³ The technical differences between the “simple average” and “compounded average” are described on pages 5-6 of “A User’s Guide to SOFR.”

⁴ The Sterling Overnight Index Average “SONIA” is the Working Group on Sterling Risk Free Reference Rates’ preferred successor for sterling LIBOR. For more information about SONIA, see <https://www.bankofengland.co.uk/markets/sonia-benchmark>.

	<p>improved system capabilities for compounding</p> <ul style="list-style-type: none"> ○ There is a certain degree of familiarity with and existing infrastructure supporting the simple average calculation <ul style="list-style-type: none"> ● FRN Working Group Recommendation: The Working Group expressed a preference for compounded SOFR
<p>Compounded SOFR calculator or SOFR index</p>	<ul style="list-style-type: none"> ● Explanation: To calculate a compounded average of SOFR over an interest period, one has to obtain each daily rate, multiply it by the day count fraction and compound based on a specific formula, taking care to apply the rate correctly in accordance with any conventions (e.g. lookback) for both business days as well as weekends and bank holidays <ul style="list-style-type: none"> ○ This calculation is more complex than existing calculations that use just one rate (e.g. 3-month LIBOR) for an entire interest period ○ The complexity of this calculation may be reduced, however, by making available an online SOFR calculator or publishing SOFR indexes⁵ ○ The way an index would work is that to calculate the compounded SOFR between any two calendar dates “x” and “y” one would only need to know the SOFR indexes for such dates and input them into a simple formula: $\text{Compounded SOFR} = \left(\frac{\text{SOFR Index}_y}{\text{SOFR Index}_x} - 1 \right) \times \left(\frac{360}{n} \right)$ <p>x = start date of SOFR observation period y = end date of SOFR observation period n = number of calendar days in SOFR observation period</p>

⁵ Additional information regarding a SOFR index is available at slide 12 of “Templates for Using SOFR” available at: https://www.newyorkfed.org/medialibrary/microsites/arrc/files/2019/Templates_for_Using_SOFR.pdf.

	<ul style="list-style-type: none"> • Benefits of a SOFR index or SOFR calculator: <ul style="list-style-type: none"> ○ Expedite interest calculation process by enabling market participants to take the applicable rate from the screen or calculator ○ Assist with interest calculations involving non-business days and national holidays ○ Provide third party validation to calculations of interest payable ○ Assist with secondary market trading and calculation of accrued interest to date ○ May reduce operational costs ○ Without a publicly available calculator or SOFR index, issuances using compounded SOFR refer to a mathematical formula that may be operationally challenging for certain market participants ○ A widely-used published SOFR index could avoid discrepancies in compounding formulas and rounding conventions ○ Encourage use of compounded averages of SOFR due to ease of use and transparency • FRN Working Group Recommendation: The Working Group notes that while market participants may calculate compounded SOFR in accordance with the standard derivatives compounding formula⁶ and do not need to wait for an index or calculator to issue FRNs based on this convention, it would be helpful for market participants if there were a definitive published compounded SOFR index or compounded SOFR calculator
Margin⁷ treatment	<ul style="list-style-type: none"> • Explanation: There are different options for applying margin to a product using compounded SOFR. The margin could be added to the daily rate that is compounded or it could be added to the compounded rate at the end of the compounding period • Benefits of adding margin at the end of the compounding period (“margin-exclusive compounding”):

⁶ The formula for compounded SOFR referenced herein is set forth in the ISDA definition of “USD-SOFR-COMPOUND” and is discussed in the Appendix of “A User’s Guide to SOFR.”

⁷ As used herein, “margin” is a reference to the spread (not collateral).

	<ul style="list-style-type: none"> ○ Daily compounding of the margin would lead to changes to the prevailing level of margin for the product based on movements in daily SOFR rates. It would be easier to benchmark and compare transactions if the SOFR rate and the additional margin are kept separate ○ Margin compounding is likely to introduce additional complexity to the interest payment calculation and might give rise to variations in interest calculation. It may also not be compatible with use of a standard calculator tool or compounded index, were one to become widely accepted ○ Compounding the margin could lead to misalignment between the underlying SOFR product (i.e. a SOFR-referencing bond) and its associated hedge, as SOFR derivatives do not compound the margin ○ All recent SONIA-referencing bonds have added the margin after the compounding calculation, which suggests that there is a degree of comfort with this approach <ul style="list-style-type: none"> ● FRN Working Group Recommendation: The Working Group recommends margin-exclusive compounding
<i>In arrears vs. in advance framework</i>	<ul style="list-style-type: none"> ● Explanation: All SOFR issuances have thus far employed an <i>in arrears</i> framework using SOFR rates over the applicable interest period⁸ rather than over a prior interest period (in advance). However, the interest accrued for the entire period can only be calculated at the end and this feature, together with the one day lag for SOFR rate publication,⁹ creates administrative difficulties that can be mitigated using a variety of conventions¹⁰ and combinations thereof including:

⁸ Interest periods in SOFR FRNs are generally defined as quarterly from, and including, an interest period end date (or, in the case of the first interest period, the interest commencement date) to, but excluding, the following interest period end date (or, in the case of the final interest period, the maturity date or, if the notes are redeemed, the redemption date).

⁹ It is important to note that the SOFR rate published on any day represents the repurchase agreement (repo) transactions entered into on the previous business day and the date associated with each rate reflects the date of the underlying repo transactions rather than the date of publication. For an example, see the image from the FRBNY's website on page 9 of "A User's Guide to SOFR."

¹⁰ Each convention used to allow for advance notice of payment within the "in arrears" framework is discussed in greater detail in "A User's Guide to SOFR" and depicted in a diagram therein, "Table 3: Models for Using SOFR in Arrears."

	<ul style="list-style-type: none"> ○ <u>Lockout</u>: One of the daily SOFR rates is a cut-off rate, meaning that it is repeated for several days, typically at the end of an interest period¹¹ ○ <u>Lookback</u>: The SOFR rate used to calculate a rate for each day in an interest period is based on the SOFR that represents repo trading on a prior day¹² ○ <u>Payment Delay</u>: Payment is made a number of days after the interest period concludes ● <i>FRN Working Group Recommendation</i>: The Working Group recommends using an average of daily SOFR <i>in arrears</i> because it reflects what actually happens to interest rates over the applicable interest period rather than a prior period; This necessitates use of a convention or a combination of the conventions described above that are intended to allow for advance notice of payment
<p><i>Comparison of select FRN structures with conventions intended to allow for advance notice of payment</i></p>	<ul style="list-style-type: none"> ● <i>Explanation</i>: There are a number of different approaches to conventions that have been used in SOFR FRNs issued in the past year and no single market structure has yet emerged; The FRN Working Group considered the following with respect to four structures: <ul style="list-style-type: none"> <i>1. <u>FRNs with Lockouts and One-Day Lookback</u></i>¹³ <ul style="list-style-type: none"> ○ The first SOFR-referencing floating rate notes adopted a simple average of SOFR rates, a two-day lockout (or longer) at the end of each interest period, and a one business day lookback (meaning the SOFR rate applicable to any date in the interest period is the rate published that day by the FRBNY for repo transactions occurring on the prior business day) ○ A benefit of this structure is that for most days during an interest period it uses the SOFR rate representing repo transactions the day before (very recent)

¹¹ The period during which a cut-off rate is used may also be referred to as a “suspension period.”

¹² Note that a convention with no “lookback” applies the daily SOFR rate representing repo transactions on such day that will be published on the following U.S. business day. This definition used by the FRN Working Group may not be consistent with how some issuers have previously described a “lookback.”

¹³ This structure #1 is represented on the ARRC’s SOFR FRN Comparison Chart by “Multiple FRNs 2018-2019.”

- This formulation is based on the conventions used for effective federal funds rate FRNs so there is a certain degree of familiarity with this structure
- However, implementation of a lockout with compounded SOFR for each interest period rather than a simple average would require additional functionality to lock the rate and then take the compound average
- In the event that compounded SOFR indexes are published, interest with a lockout period for each interest period would not match such data
- A lockout period at the end of each interest period means that a meaningful number of days in the life of the bond are being excluded from the interest calculation and this could be material to the extent that SOFR is volatile (e.g. the rate spikes on or before the days that are skipped or suspended at a prior rate)
- Secondary trading consideration: The one-day lookback in this structure allows parties to calculate accrued interest for secondary trades on the business day before settlement but is not available on the trade date¹⁴

2. FRNs with Five-Day Lookback and No Lockouts¹⁵

- Recent issuances of SONIA-referencing bonds and two SOFR issuances have adopted a five business day lookback approach
- This formulation allows additional time for clearing of bonds
- This structure may also be useful when investors and issuers are across multiple time zones
- Adopting this convention for SOFR FRNs may reduce market fragmentation across currencies
- Because there is no need for a lockout, this formulation avoids the risk of locking the rate on a date when the SOFR rate is unusually volatile

¹⁴ Generally FRNs trade in the secondary market with interest in favor of the seller that accrues to, but excluding, settlement. Settlement is typically two business days after the trade date.

¹⁵ This structure #2 is represented on the ARRC's SOFR FRN Comparison Chart by "European Investment Bank FRNs June 2019; World Bank FRNs July 2019."

- However, with this structure, the rate that applies over a weekend or holiday may differ from the repo transaction rate (and hedge rate) that applies over those days because each daily SOFR rate is applied to the compounding formula based on the applicable interest period date and not on the repo trading date
- A mismatch between the FRN and over-the-counter hedges can be minimized by using a five-business day lag because weekends would align (although holidays would not align)
- Secondary trading consideration: The use of a lookback allows parties to calculate accrued interest for secondary market trades a number of days before settlement (i.e., the day that accrued interest can be calculated depends upon the length of the lookback period); Market participants find this useful for secondary market trading

3. FRNs with Two-Day Backward-Shifted Observation Period and No Lockouts¹⁶

- One recent SOFR-linked issuance applied a lookback with a two business day backward-shifted observation period
- This “lookback” convention shifts the SOFR observation period so that each rate applies to the repo transaction period it represents (e.g., with a two-business day shift, the observation period would start and end two U.S. business days prior to interest period start and end dates)¹⁷
- Because this structure uses all SOFR resets (i.e., it is not combined with any lockouts), parties can align FRN interest accruals with hedges that have established the same SOFR observation period
- Shifting the observation period also ensures that the SOFR applied for weekends and holidays is consistent with the repo market
- In order to utilize a published compounded SOFR index with an FRN that has a lookback, the lookback must be applied with an observation period shift
- Because there are no lockouts, this formulation avoids the risks of locking the rate on a

¹⁶ This structure #3 is represented on the ARRC’s SOFR FRN Comparison Chart by “Goldman Sachs FRNs May 2019.”

¹⁷ In certain circumstances, shifting the observation period may result in a different number of calendar days in the observation period than in the interest accrual period (e.g. if the observation period begins immediately prior to a holiday).

- date when the SOFR rate is unusually volatile
- Secondary trading consideration: As with the structure above, the use of a lookback allows parties to calculate accrued interest for secondary market trades a number of days before settlement

4. FRNs with Two-Day Payment Delay, No Lookback, and Two-Day Lockout prior to Maturity¹⁸

- Several FRNs were issued in June and July of 2019 with a two business day payment delay and no lookback; This structure had a two business day lockout only applicable for the final interest period before maturity to allow for interest to be paid on the maturity date
- A benefit of this formulation is that no lookback is necessary so that bond accruals and SOFR observations are exactly aligned, i.e., the SOFR rate for each day during the interest period is based on the repo transaction rates for such day
- The payment delay convention is common in the derivatives market and can facilitate alignment with derivatives
- This formulation generally avoids the risk of locking the rate on a date when the SOFR rate is unusually volatile, except for the period immediately before the bond matures
- However, investors will be paid a few days after each interest period ends (except at maturity when they will be paid on the maturity date)
- The payment delay that occurs for two business days following the first interest period may result in opportunity costs (e.g. absence of re-investment income) for those two days¹⁹
- Secondary trading consideration: Because there is no lookback in this structure, accrued interest for secondary market trades cannot be determined prior to settlement; This

¹⁸ This structure is represented on the ARRC's SOFR FRN Comparison Chart by "Morgan Stanley FRNs June 2019; Bank of America FRNs July 2019."

¹⁹ After the first interest period has past, the subsequent periods in this structure could be compared to structure #3 (a two-day backward-shifted observation period), provided, however, that in the final period there are two additional days of accrued interest (at the cut-off rate).

	<p>could be addressed by implementing a convention (e.g., a lockout), however, this would mean that there is a different approach for accrued interest when trading compared to actual accrued interest earned by holding the notes</p> <ul style="list-style-type: none"> • FRN Working Group Recommendation: Issuers and investors should be mindful of the advantages and disadvantages of lockouts, lookbacks and/or payment delays and how economic costs and operational challenges may impact pricing and valuation of notes. The Working Group notes that: <ol style="list-style-type: none"> 1. There are economic benefits when FRN SOFR observations are aligned with the repo market (<i>i.e.</i> there are minimal or no lookbacks or lockouts) 2. If SOFR rates rise or fall during a lockout period, the impact would not be incorporated into the interest payment and this could result in losses or gains 3. Amongst the structures incorporating a lookback, the FRN Working Group expressed a preference for (i) the lookback with an observation period shift as compared to (ii) the lookback based on the day in the interest period, because the observation period shift applies the correct weighting to the SOFR rates and could utilize a published compounded SOFR index 4. FRN structures that are not aligned with hedges may lead to increased costs and risks; Characteristics such as use of an observation period shift or payment delay facilitate hedge matching 5. Structures requiring additional conventions for secondary market trading may create operational challenges
<p>Number of days for lookback or</p>	<ul style="list-style-type: none"> • Explanation: There are both advantages and disadvantages to having a longer or shorter period for any applicable lookback and lockout mechanisms

<p><i>lockout, if applicable</i></p>	<ul style="list-style-type: none"> ○ Increasing the number of days gives more time to calculate the amount of interest owed on the relevant payment date, which may be required in certain instances, for example when tax obligations need to be calculated or for certain clearing systems ○ Decreasing the number of days provides greater alignment with the level of market interest rates ○ For shorter interest periods, such as one month, longer lockout periods could be seen as having a greater impact on accruals given the lockout would represent a greater proportion of the interest period ○ A longer lookback makes secondary market trading easier because there is additional time to calculate the accrued interest ○ Fedwire Securities requires payment instructions at least two days before payment; Although DTC does not require instructions two days in advance, there may be other timing requirements or constraints depending on the paying agent used ○ Excessively long lockout periods could impact hedge effectiveness if using a standard OIS for hedging purposes ○ Significantly long lookback/lockout periods may lead to accounting challenges ○ As noted above, recent issuances of SONIA-referencing bonds have adopted a five-business day lookback approach ○ One benefit of this common SONIA lookback is that even without an observation period shift, most of the time the rate will have the appropriate weighting for weekends (although not holidays); Note, however, that market rates could change materially over five business days
<p><i>Published SOFR observation time</i></p>	<ul style="list-style-type: none"> ● <i>Explanation:</i> SOFR is published at 8 am every U.S. business day, but because the rate is subject to correction by the FRBNY until 2:30 pm New York time the same day, users may wish to reference the rate after this time ● <i>FRN Working Group Recommendation:</i> The Working Group expressed a preference for a 3 pm observation because it provides more time than a 5 pm observation to calculate payments if they are due soon afterwards

<p>Business Day Convention</p>	<ul style="list-style-type: none"> • Explanation: The OIS standard convention is to use the “Modified Following Business Day Convention,” meaning that payments will be adjusted to the next succeeding business day, unless that business day falls in the next succeeding calendar month, in which case the interest payment date will be the preceding business day • FRN Working Group Recommendation: The Working Group recommends the Modified Following Business Day convention
<p>Interest Payment Date Adjustment</p>	<ul style="list-style-type: none"> • Explanation: In contrast to fixed rate notes, it is customary for the interest payment date of floating rate notes to move (adjust) to the following business day if the payment would otherwise fall on a non-business day. With this adjustment, the relevant interest period becomes longer, since the interest now accrues to (but excluding) the following business day. The amount of interest for such period is more than it would have been if the period had ended on the non-business day. Correspondingly, the following interest period becomes shorter, because now it begins on the business day to which the payment date was moved, rather than the earlier holiday date. Note that, except in the case of FRNs that use a “payment delay” convention, the payment date is the first day of the calculation period. • Considerations regarding adjustment: <ul style="list-style-type: none"> ○ Payment periods that begin on a non-business day create challenges for a compounded SOFR formula • FRN Working Group Recommendation: The Working Group expressed a preference to “adjust” payment days to a U.S. business day when compounded SOFR is being used
<p>Day Count Convention</p>	<ul style="list-style-type: none"> • FRN Working Group Recommendation: The Working Group expressed a preference for “Accrual Period divided by 360” which is the commonly used convention for SOFR FRNs
<p>Fallbacks for SOFR</p>	<ul style="list-style-type: none"> • Explanation: Market participants should aim to ensure they have robust contractual fallbacks for SOFR products in line with the IOSCO Statement on Matters to Consider in the Use of Financial Benchmarks

	<ul style="list-style-type: none"> ○ Some issuances have implemented fallback provisions that are based on the bottom three steps of the ARRC’s recommended fallback language for LIBOR FRNs (modified ARRC-endorsed fallbacks) ○ It is important to note that these fallback provisions do not precisely match the fallbacks for SOFR currently embedded in the ISDA definitions used by standard derivatives²⁰ <ul style="list-style-type: none"> ● FRN Working Group Recommendation: The Working Group expressed a preference for the modified ARRC-endorsed fallbacks
<p>Negative Interest Rates</p>	<ul style="list-style-type: none"> ● Explanation: In the event that SOFR becomes negative, there are several options to address this in SOFR FRN coupon calculations: <ul style="list-style-type: none"> ○ Coupon (SOFR for the interest period plus the margin) is floored at zero (consistent with LIBOR) ○ SOFR for the interest period is floored at zero ○ Individual daily SOFR resets are floored at zero ○ Individual daily SOFR resets plus margin are floored at zero (this would only be considered for a simple-average SOFR FRN as in a compounded SOFR FRN, the margin is added at the end to the already calculated compounded SOFR rate) ● Considerations: <ul style="list-style-type: none"> ○ Economic differences between the approaches above can be material ○ In the SONIA market, this has not been consistently addressed in offering documentation, but FRN coupons are implicitly floored at zero because systems cannot handle a coupon payment from an investor to an issuer ○ There are certain costs associated with hedging floored rates

²⁰ ARRC members and market participants recognized that ISDA’s fallbacks may change in the future and consultation feedback indicated a preference to reference the ISDA definitions in place at the time the benchmark (in this case SOFR) is discontinued rather than name specific fallback rates.

- | | |
|--|---|
| | <ul style="list-style-type: none">• FRN Working Group Recommendation: The Working Group expressed a preference to floor the entire coupon (SOFR for the interest period plus the margin) at zero |
|--|---|