

METHODOLOGY

November 2021

1. The ICE Risk Free Rates (RFR) Indexes simplify and standardise the calculation of interest for financial contracts referencing the following RFRs:
 - [SOFR](#) - published by the Federal Reserve Bank of New York;
 - [€STR](#) - published by the European Central Bank;
 - [SONIA](#) - published by the Bank of England; and
 - [TONA](#) - published by Quick for the Bank of Japan.
2. The ICE Risk RFR Indexes are designed to meet operational and economic requirements of certain lenders and borrowers:
3. For consistency, all ICE RFR Indexes are published using a base value¹ of 100 and with a precision of 8 decimal places. This matches the approach taken for the official SONIA, €STR and TONA indexes. For these RFRs the ICE RFR Index with no floor or lag will match the corresponding RFR index published by the relevant central bank.
4. However, the SOFR index published by the Federal Reserve Bank of New York has a base value of 1 rather than 100. Therefore, the ICE SOFR Index with no floor or lag has a value that is 100 times greater than the Federal Reserve index and will have 2 more digits of precision. For example, on Wednesday 28 July 2021 the SOFR Index published by the Federal Reserve had a value of 1.04215733, whereas the ICE SOFR Index had a value of 104.215733**25**.
5. The ICE RFR Index methodology is described overleaf for:
 - Determining index values for business days;
 - Calculation for non-business days;
 - Calculation with a 0% floor; and
 - Calculation with a lookback.

¹ The base value is at the designated start date, which is different for each index as described on the next page.

Determining index values for business days

All ICE RFR Indexes use the same underlying calculation methodology for determining index values for business days²:

$$Compounded\ Index_i = Compounded\ Index_{i-1} \times \left(1 + \frac{RFR_{i-N-1} \times Weighting}{Day\ Count\ Convention} \right)$$

Where:

- i* = The business day for which the index is being calculated
- i-n* = The business day falling *n* business days before *i* (and, therefore, *i-1* is the business day immediately preceding *i*)
- N* = The lookback day count, for indexes including a lookback. (N=0 for indexes not including a lookback.)
- Compounded Index_{*i*} = The index for business day *i*, calculated and published on day *i*. All published ICE RFR Index values are rounded to 8 decimal places. Compound Index₁ = 100.

Day 1 for each of the ICE RFR Indexes without a lookback matches the official RFR index and is as follows:

RFR	Day 1
SOFR	Monday 2 April 2018
€STR	Tuesday 1 October 2019
SONIA	Monday 23 April 2018
TONA	Wednesday 14 June 2017

For indexes with an *N* day lookback, Day 1 is *N* business days after the date shown above.

- Compounded Index_{*i-1*} = The index value calculated on business day *i-1*. While the published value of the index is always rounded to 8 decimal places, the underlying calculation uses the previous day's index value that has been rounded to 18 decimal places.
- RFR_{*i-N-1*} = The RFR rate with an effective date of *i-N-1*, calculated and published by the relevant official body on business day *i-N*. For indexes without any lookback, *N=0*, so this will be equal to RFR_{*i-1*}, which is published on day *i*.
- Indexes using a Floor = For an index with a floor, if the RFR value on the relevant business day is below the floor value, then the floor value will be used within the index

² "Business days" are the same days for which the relevant underlying RFR is calculated.

calculation instead of the actual RFR value. For an index with a floor the rate used in a calculation is as follows.

$$\text{Maximum}(\text{Floor value}, RFR_{i-N-1})$$

Weighting	=	The weighting to apply to the RFR rate for business day $i-N-1$. The Weighting will equal the number of calendar days from business day $i-1$ to business day i , i.e. the number of calendar days between the previous business day and the current business day. For a typical week with no holidays, the weighting will be 1 where the previous business day is Monday through to Thursday and 3 where the previous business day is Friday.
Day Count Convention	=	360 for SOFR and €STR indexes 365 for SONIA and TONA indexes

ICE RFR Index - Standard

The standard ICE RFR Index replicates³ the official index calculations.

The index value for each day is calculated using the RFR rate for the previous business day, which is published on the same day as the index calculation.

Example 1: Calculating a SONIA index value for Wednesday 20 January 2021.

- ICE SONIA Index value for the previous business day, Tuesday 19 Jan 2021 = 101.325071500536 (12dp⁴)
- SONIA value effective for Tuesday 19 January 2021 = 0.0500%
This is published by the Bank of England on Wednesday 20 January 2021 at around 9:00am, after which the ICE SONIA Index can be calculated.
- There is 1 calendar day between Wednesday 20 January 2021 and the previous business day.

$$\text{Index Value} = 101.325071500536 \times \left(1 + \frac{0.0500\% \times 1}{365}\right)$$

$$\text{Index Value} = 101.325210302004 \text{ (12dp)}$$

$$\text{Published Index Value} = 101.32521030 \text{ (Rounded to 8dp)}$$

Example 2: Calculating a SONIA index value for Monday 22 March 2021.

- ICE SONIA Index value for the previous business day, Friday 19 March 2021 = 101.333121462700 (12dp)
- SONIA value effective for Friday 19 March 2021 = 0.0485%

This is published by the Bank of England on Monday 22 March 2021 at around 9:00am, after which the ICE SONIA Index can be calculated.

- There are 3 calendar days between Monday 22 March 2021 and the previous business day.

$$\text{Index Value} = 101.333121462700 \times \left(1 + \frac{0.0485 \times 3}{365}\right)$$

$$\text{Index Value} = 101.333525407061 \text{ (12dp)}$$

$$\text{Published Index Value} = 101.33352541 \text{ (Rounded to 8dp)}$$

³ Except for the different base value in the official SOFR index. (The day to day calculation method is identical but given the different initial value the daily values are x100).

⁴ Example calculations within this document are shown to 12 decimal places. This matches the precision supported by Microsoft Excel and enables these examples to be pasted into a spreadsheet for ease of replication. Actual ICE RFR Index calculations use index values that are rounded to 18 decimal places.

ICE RFR Index - Standard - Calculation for Non-Business Days

The standard ICE RFR Index provides index values for non-business days. The index value for a non-business day is calculated as follows:

$$Compounded\ Index_{nbd} = Compounded\ Index_{bd} \times \left(1 + \frac{RFR_{bd-N} \times Weighting}{Day\ Count\ Convention} \right)$$

Where:

Compounded Index_{nbd} = The index value for non-business day, nbd. For an index with no lookback, this index value will be calculated and published on the business day that follows this non-business day⁵. For a typical Saturday and Sunday, therefore, and if N=0, the index value will be calculated and published on the Monday.

Compounded Index_{bd} = The index value for the business day, bd, that preceded the non-business day, nbd. For a typical Saturday and Sunday, the preceding business day will be Friday. Index values for non-business days are always calculated based upon the preceding business day and are never calculated based upon the index value for a previous non-business day. For example, the index value for a Sunday is calculated based upon the index value on the preceding Friday, not upon the index value for Saturday.

RFR_{bd-N} = Where N is the number of business days lookback, or 0 for an index without any lookback. The RFR rate with an effective date of bd-N, calculated and published on business day bd-N+1. For example, for an index with no lookback, the calculation of an index value for a typical Saturday will reference the RFR rate with an effective date of the previous business day, Friday. This RFR value would be published on Monday. (This is why index values for non-business days can only be published on the following business day.)

Indexes using a Floor = For an index with a floor, if the RFR value on the relevant business day is below the floor value, then the floor value will be used within the calculation instead of that RFR value. For an index with a floor the rate used in a calculation is as follows.

$$Maximum(Floor\ value, RFR_{bd-N})$$

Weighting = The weighting to apply to the RFR rate for business day bd-N. The Weighting equals the number of calendar days from business day bd to non-business day nbd. For a typical weekend with no holidays, the weighting will be 1 on Saturday and 2 on Sunday.

⁵ With a lookback, publication can be N days earlier, on day bd-N+1 - see the section below on Calculation with a Lookback.

Day Count = 360 for SOFR and €STR indexes
Convention 365 for SONIA and TONA indexes

For an index with no lookbacks, the index values for non-business days are calculated and published on the first business day following the non-business day(s). For example, the index values for both a Saturday and Sunday are typically published on a Monday. ICE RFR Index values are always calculated and published on the same days relevant RFR value is published. For an index with lookbacks, publication will be N business days earlier.

Example 3: Calculating a SONIA index value for Sunday 21 March 2021.

- ICE SONIA Index value for the previous business day, Friday 19 March 2021 = 101.333121462700 (12dp)
- SONIA value effective for Friday 19 March 2021 = 0.0485%
This is published by the Bank of England on Monday 22 March 2021 at around 9:00am, after which the ICE SONIA Index can be calculated.
- There are 2 calendar days between Sunday 21 March 2021 and the previous business day.

$$\text{Index Value} = 101.333121462700 \times \left(1 + \frac{0.0485\% \times 2}{365}\right)$$

$$\text{Index Value} = 101.333390758941 \text{ (12dp)}$$

$$\text{Published Index Value} = 101.33339076 \text{ (Rounded to 8dp)}$$

ICE RFR Index - Calculation With a 0% floor

This index can be used by borrowers and lenders that do not wish to have negative accruals on RFR based loans.

The ICE RFR Index with 0% floor is calculated using a minimum interest rate of 0%. If the daily RFR value falls below 0% then this index is calculated using 0%, instead of the actual RFR value.

Negative RFR rates result in the index having the same value each day, until the RFR rate becomes positive again.

ICE RFR Index - Calculation with a Lookback

Many lenders and borrowers would like to be able to determine the total interest for a loan before the end of a loan accrual period, or the loan term. This allows the borrower and lender to agree on the interest amount before the end of the term and for the payment from the borrower to the lender to have cleared by the end of the loan accrual period.

Parties to the loan can agree to use a time-shifted view of an RFR rather than the actual RFR rate. This is referred to as a lookback. When a lookback is used, the calculation for each day's interest uses the interest rate for N business days earlier than an index with no lookback. For example, N equals 5 if referencing an RFR value published five business prior to the index date.

An index calculated using an N day lookback can be calculated and published N days in advance. IBA publishes ICE RFR Indexes using the two most frequently used lookback periods, of 2 business days and 5 business days, corresponding to typical payment clearing timescales.

More specifically, IBA provides RFR Indexes calculated using a lookback with **no observational shift**. This approach is also referred to as a lag. With a lag, the weighting applied to the RFR rate that is referred to within the calculation, is always determined by the calculation period and not the observation period. For example, if on the day of calculation there has been only one calendar day since the last business day, then the RFR rate that is referenced will always have a weighting of 1. This is the case even if the RFR rate that is referred to was for a Friday and would have had a weighting of 3 applied for an index with no lookback. This is illustrated in the following example.

Example 4: Calculating a SONIA index value for Wednesday 20 January 2021, for an index with a 2-day lag.

Note - for this index with a 2-day lag, the index value for Wednesday 20 January 2021 can be calculated and published on Monday 18 January 2021, 2 business days earlier than an index with no lookback.

- ICE SONIA Index value with 2-day lag for the previous business day, Tuesday 19 January 2021 = 101.324367295616 (12dp)

- The two-day lag calculation will reference the SONIA rate for day (i-N-1), i.e. three business days earlier, Friday 15 January 2021. The SONIA rate had a value of 0.0498% on that day and was published by the Bank of England on Monday 18 January 2021.

The weighting applied to this rate is 1 - as there is one calendar day between the day being published (Wednesday 20 January 2021) and the previous business day (Tuesday 19 January 2021)⁶.

$$\text{Index Value} = 101.324367295616 \times \left(1 + \frac{0.0498\% \times 1}{365}\right)$$

$$\text{Index Value} = 101.324505540917 \text{ (12dp)}$$

$$\text{Published Index Value} = 101.32450554 \text{ (Rounded to 8dp)}$$

- This calculation and publication, for index date Wednesday 20 January, occurs on Monday 18 January, two days earlier than the standard (no lookback) version of the index for the same date.

⁶ For an index with no lookback, the index value for Monday 18 January would have also been calculated using Friday's rate but in this case the weighting would have been 3, as there are 3 calendar days since the previous business day on Friday.