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# Fusion LIBOR Transition Calculator Web App User Guide

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Release month and year: July 2023

# Document Revision History

| Document Version | Date | Description of Revision(s) |
|---|---|---|
| 1.2 | 17 July 2023<br>(General Availability) | Updated the following sections for Fusion LIBOR Transition Calculator Web App version 1.4:<br>• **ARR Calculator App Options** section on page **10**<br>• **Release Notes** section on page **91** |
| 1.2 | 19 June 2023<br>(Release Preview) | Updated the following sections for Fusion LIBOR Transition Calculator Web App version 1.4:<br>• **ARR Calculator App Options** section on page **10**<br>• **ARR Calculator App - Overview** section starting on page **11**<br>• **Using the ARR Calculator App** section starting on page **15**<br>• **Exporting Output to PDF or CSV** section starting on page **26**<br>• **ARR Calculator App Attribute Details** section starting on page **30**<br>o Added information for new parameter - *Lookback Date*<br>• **Release Notes** section on page **91** |
| 1.1 | 12 June 2023 | Updated **Supported Holiday Calendars** section on page **86**. |
| 1.0 | 31 January 2022 | Initial version of the document - Fusion LIBOR Transition Calculator Web App version 1.3. |

# CONTENTS

# 1 Purpose

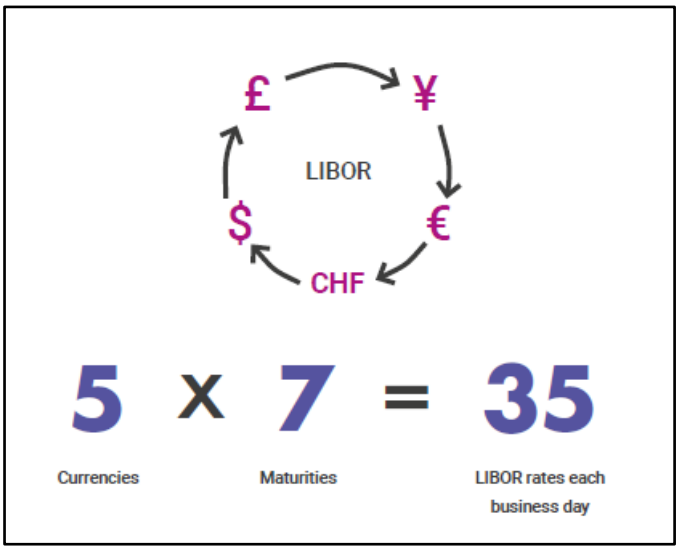
This user guide is created to help users understand **Fusion LIBOR Transition Calculator** Web App which provides an Alternative Reference Rates (ARR) or Risk-free Rates (RFRs) calculation service for applications and legacy lending systems that are unable to calculate their own ARR/RFR based rates and interest accruals.

## 1.1 Business Context

### 1.1.1 Transition from LIBOR to RFRs

The London Interbank Offered Rate or LIBOR is a globally accepted benchmark average interest rate at which major global banks lend to one another in the international interbank market for short-term loans.

LIBOR is based on five currencies (US dollar, Euro, British pound, Japanese yen, and Swiss franc) and serves seven different maturities: overnight, one week, and 1, 2, 3, 6 and 12 months. As such, there are 35 different LIBOR rates each business day. The rate is calculated and published each day by the Intercontinental Exchange (ICE).




The Financial Conduct Authority (FCA) has announced a phase-out of LIBOR by the end of June 2023; stating that the market supporting LIBOR was no longer “sufficiently active” and called for a transition to transaction-based benchmarks. The transition from LIBOR is expected to be disruptive, because of its universality in the market. The imminent transition from LIBOR to new risk-free rates (RFRs) implies pricing of loans using these new rates. Overnight rates have emerged as the Alternative Reference Rates (ARR).

Overnight rates include the US (Secured Overnight Financing Rate or **SOFR**), the UK (Sterling Overnight Index Average or **SONIA**), Europe (Euro Short Term Rate or **ESTR**), Switzerland (Swiss Average Rate Overnight or **SARON**), and Japan (Tokyo Overnight Average Rate or **TONAR**). Other prominent IBOR (Interbank Offered Rates) replacement rates include Singapore (Singapore Overnight Rate Average or **SORA**), Hong Kong (Hong Kong Dollar Overnight Index Average or **HONIA**), Australia (AUD Overnight Index Average or **AONIA**) and Canada (Canadian Overnight Repo Rate Average or **CORRA**). Each has unique characteristics in currency, posting timing, security and underlying sources of data. This will ultimately lead to complexity for banks that have various loan instruments on their books.

### 1.1.2 Business Challenges

There is no doubt the LIBOR transition is the biggest change the market has seen in lending over the last 20 to 30 years. With banks required to use a unique daily market rate for each currency, released by different authorities at different times, the need for automation is significant. This highly disruptive event in the lending market brings along complexities around interest calculations using these rates and significant operational impact.

Banks must be prepared to source and reconcile the new risk-free rates that are released by different authorities at different times and evaluate their systems' readiness to perform ARR calculations involving complex calculation methods that impact accruals.

Legacy Lending systems lack the ability to process ARR / RFR priced loans, given they weren't designed to perform these calculations in the first place, and implementing complex system changes can be costly. The need to have a flexible service that can expand over time as these ARR / RFR methodologies evolve is more important than ever.

Finastra understands the need to provide a flexible solution that can expand over time as these ARR/RFR methodologies evolve and has created a ARR calculation web application, **Fusion LIBOR Transition Calculator** Web App that enables lenders and corporates to calculate ARR/RFR based rates and interest accruals.

# 2 About ARR Calculator App

The **Fusion LIBOR Transition Calculator** Web App (hereafter referred to as ARR Calculator App) independently sources the ARR/RFRs from external market data sources and calculates ARR rates based on the recommendations of key market conventions, along with corresponding interest accrued amounts for a given set of inputs.

The ARR Calculator App is set apart from other offerings on the market by three powerful attributes.

- A trusted methodology

  The ARR Calculator is based on the key ARR loan market conventions to deliver consistent and accurate results thereby helping users significantly reduce operational risk and ensure regulatory compliance .

- Flexible integration

  Clients can access the web-app on the cloud to perform/validate ARR calculations. Or leverage the Open API based service that can integrate seamlessly with legacy systems that are not prepared for the transition.

- Future Proofing your business

  The calculator service will expand in line with the evolving market/regulatory needs, thereby future-proofing customer's business from any additional investments due to market developments related to this transition.

## 2.1 How it Works

A client can use the ARR Calculator App by passing certain loan parameters (such as Interest cycle start and end dates, spread, and so on) and ARR/RFR parameters (such as Rate Type, Lookback/Lockout Days, Spread Adjustments, and so on) and be returned the Average Compounded ARR Rates (Average Compounded in Arrears Rate or Daily Non-Cumulative Compounded Rates), or simple ARR rates, and/or interest accrued for the specified period. These calculated rate values and/or accrued interest amounts can directly be plugged into the legacy lending system to perform conventional interest accrual calculations.

The ARR Calculator App provides an intuitive graphical user interface (GUI) to the Fusion LIBOR Transition Calculator API Service. It works by connecting to the Fusion LIBOR Transition Calculator API, sends the user's inputs to the Fusion LIBOR Transition Calculator API, and then displays the calculated ARR rates/accrued interest values that are provided as an output by the ARR Calculator API Service.

## 2.2 How to Access ARR Calculator App

The **ARR Calculator App** is accessible through the **Finastra FusionStore** available on the **FusionFabric.Cloud** platform. This secure platform allows you to enter required ARR parameters on the App and send the request to the Fusion LIBOR Transition Calculator Service to receive the required calculated values in a prescribed format for your consumption.

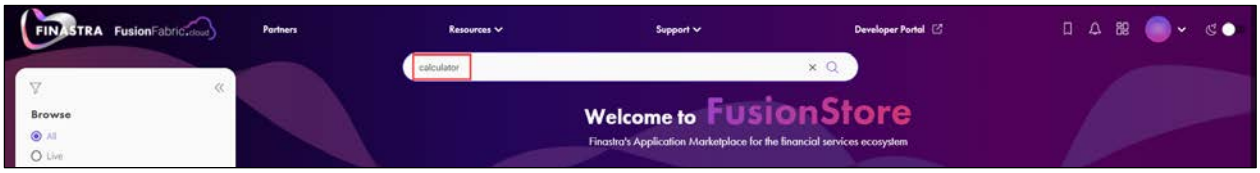
In order to use the ARR Calculator App service, the user must do the following in sequence.

1. Visit the Fusion Store on FusionFabric.Cloud.
2. Do one for the following:

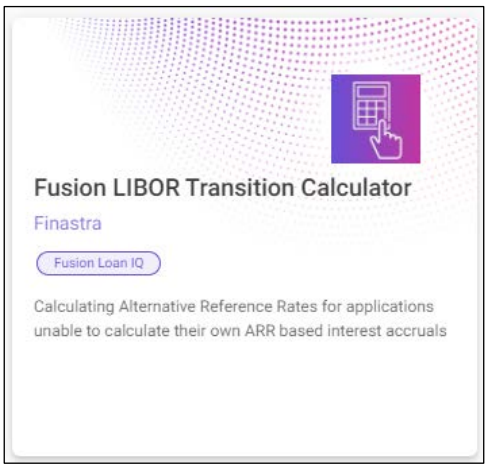
   **Note:** The user must be registered on FusionStore to have access to the Demo app/Live app.

   **Run a Search**

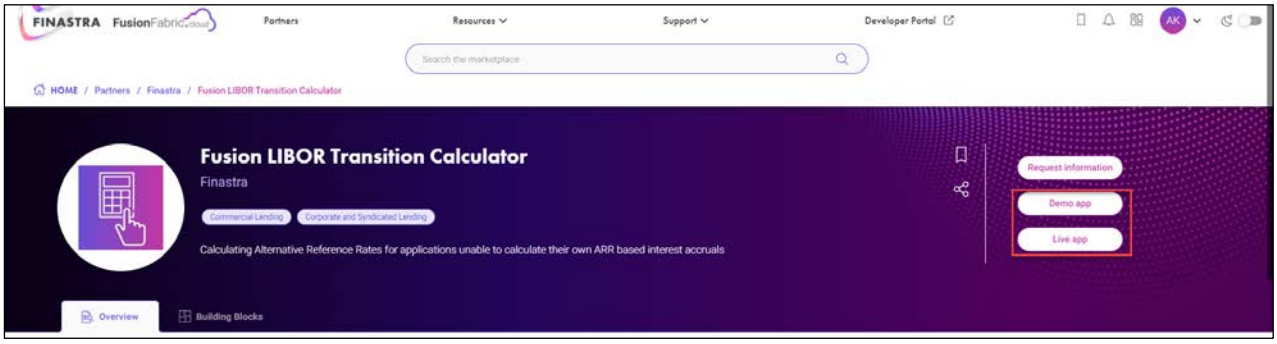
   a. In the Search text field, enter the term **calculator** (or **libor)** and press **Enter** or click the Search icon.




b. Scroll down the page and click **Fusion LIBOR Transition Calculator** Web App.




c. On the **Fusion LIBOR Transition Calculator** Web App page, click the app type (*Demo* or *Live*) based on your subscription. The *ARR Calculator App* is launched on a new tab.



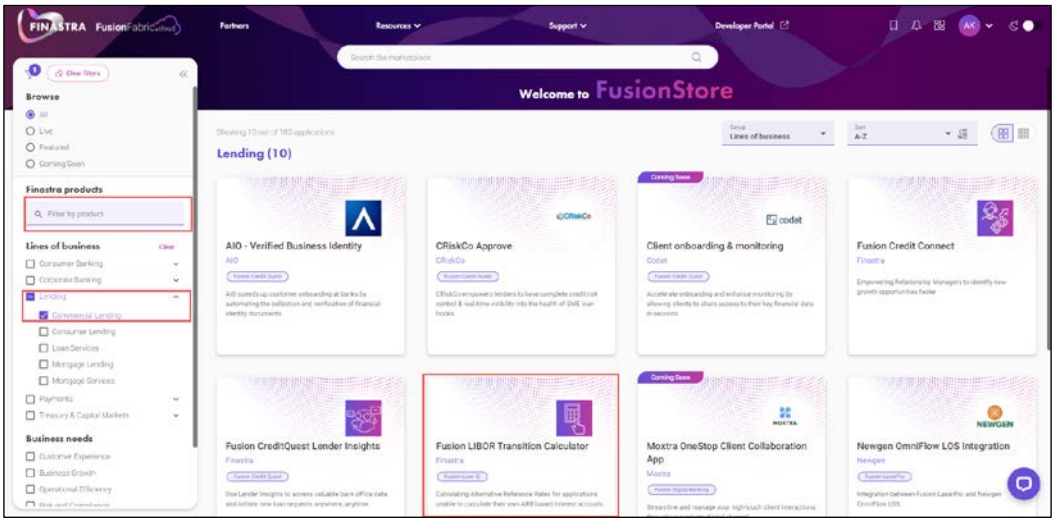

**Note:** The availability of data on the **Demo app** is different from the **Live app**. For more information, refer to the *ARR Calculator App Options* section.

d. Click **Demo app**.

**Note:** The Live app is accessible based on legal contract. For more information, refer to the *ARR Calculator App Options* section.

**Use the Filter option**

- On the left pane, select **Fusion Loan IQ** in the **Filter by product** drop-down list [OR]
- In the Lines of Business group, select **Lending** > **Commercial Lending**. Scroll down the page and click **Fusion LIBOR Transition Calculator** Web App.




## 2.2.1 ARR Calculator App Options

Finastra provides two options for accessing the ARR Calculator App.

### 2.2.1.1 Demo app

| | |
|---|---|
| **Purpose** | Development or Initial test/evaluation (Sandbox environment) |
| **Accessibility** | Available to any registered FusionStore user |
| **RFR Rate Data Availability** | Note that this environment is set up with limited published rate data. The published rate data available in the Demo app option is as follows:<br>• RFR Rates (SOFR, SONIA, TONAR, and SORA): from 2019-01-01 to 2020-12-31.<br>• RFR Rates (ESTR): from 2019-10-01 to 2020-12-31<br>• SOFR Compounded Averages and SOFR Index Data from 2020-03-02 to 2020-12-31.<br>Therefore, it is advised to provide inputs in the app within this data range to get results. |
| **Pricing** | Requests to Demo app do not carry any charge |
| **Connectivity to API Environment** | Connected to the Fusion LIBOR Transition Calculator API Sandbox Environment (finastra-dev) |
| **Current App Version Available** | 1.4 |

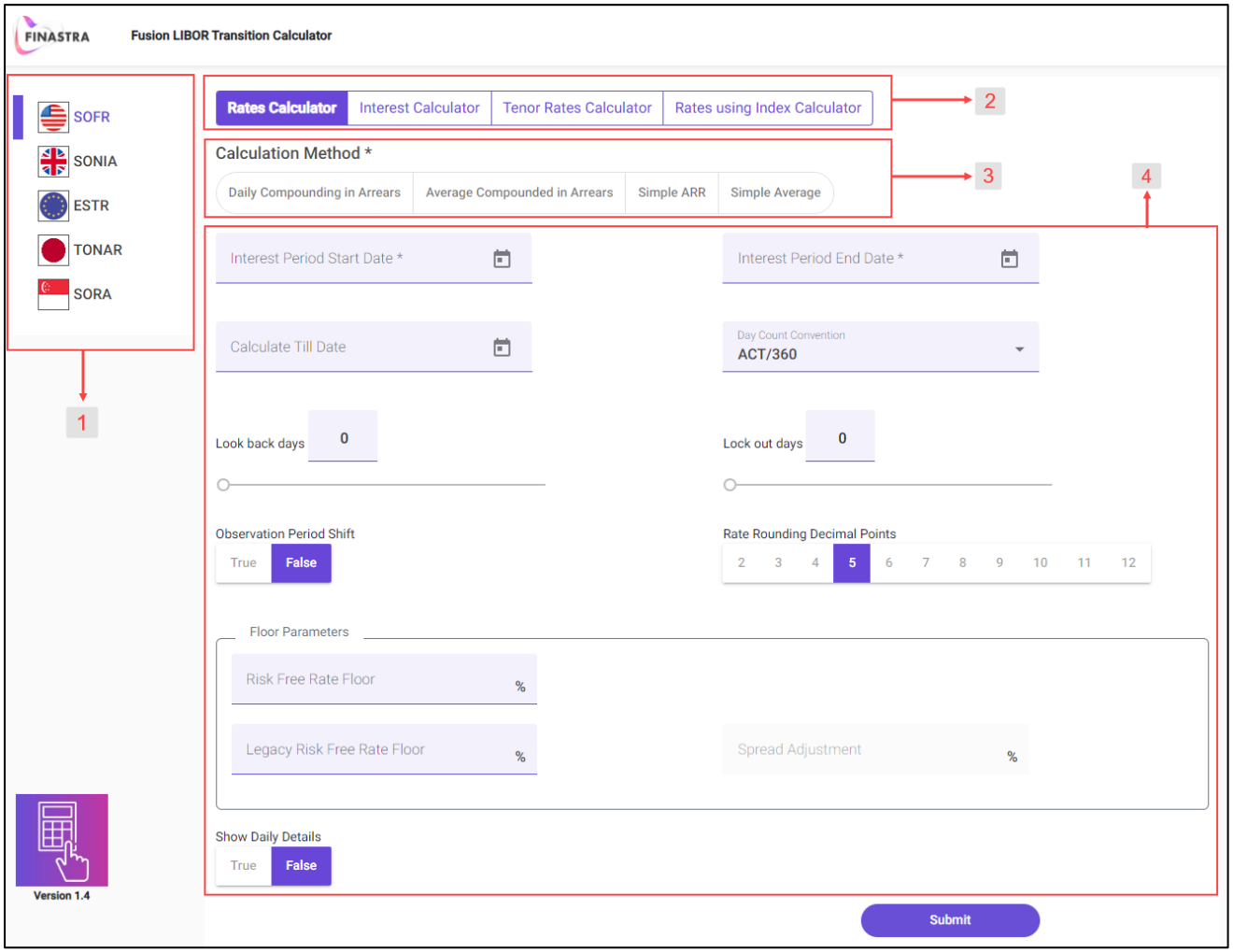
### 2.2.1.2 Live app

| | |
|---|---|
| **Purpose** | Live/Production Usage for clients. |
| **Accessibility** | Available to use only after an app subscription contract is signed with Finastra |
| **RFR Rate Data Availability** | Latest RFR rate data is available as described in the *Official Sources of Market Data* section. |
| **Pricing** | Requests get counted as part of ARR Calculator subscription |
| **Connectivity to API Environment** | Connected to the Fusion LIBOR Transition Calculator API Production Environment (finastra-prod) |
| **Current App Version Available** | 1.4 |

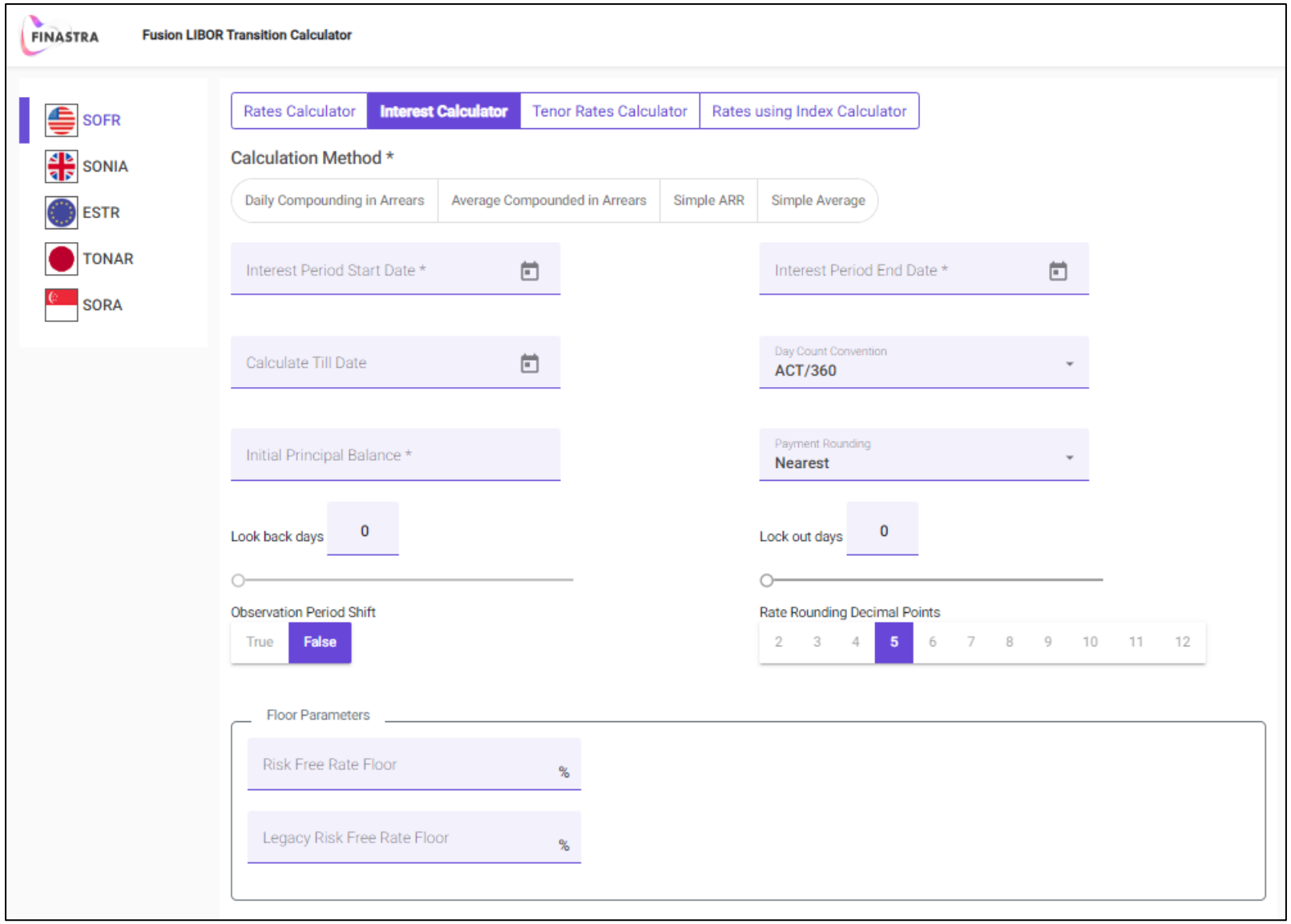
## 2.3 ARR Calculator App - Overview

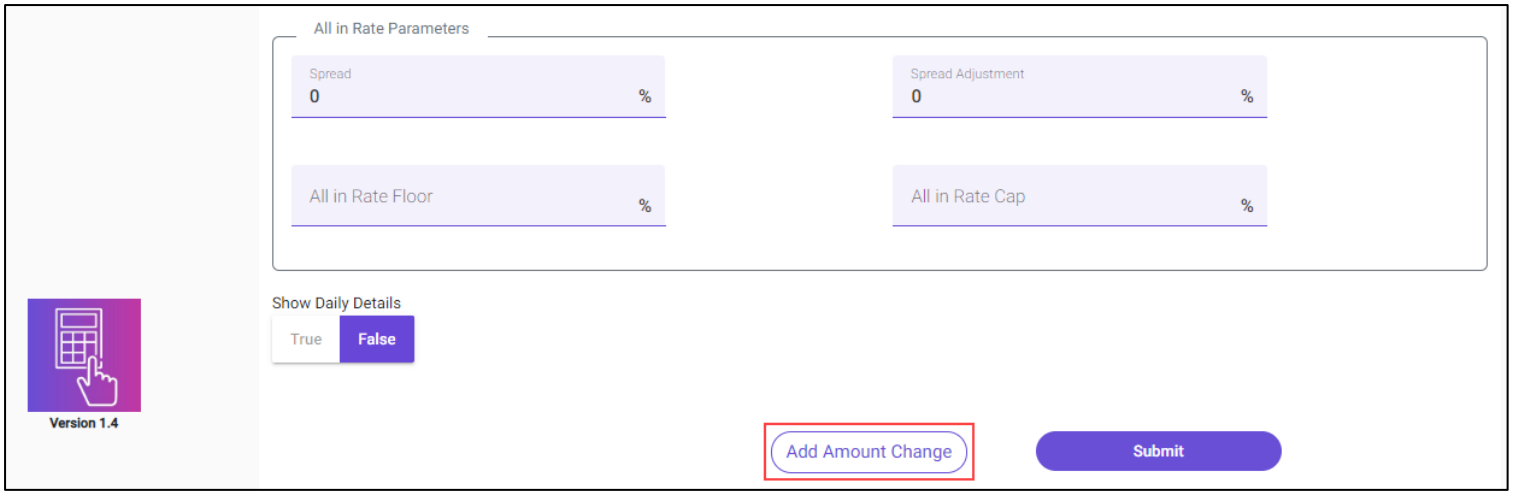
The following screenshot shows the ARR Calculator App Dashboard for SOFR (*Rates Calculator*):

**1** – Supported Rate Type; **2** – Supported End Points; **3** – Supported Calculation Methods; **4** – End Point Specific ARR Parameters



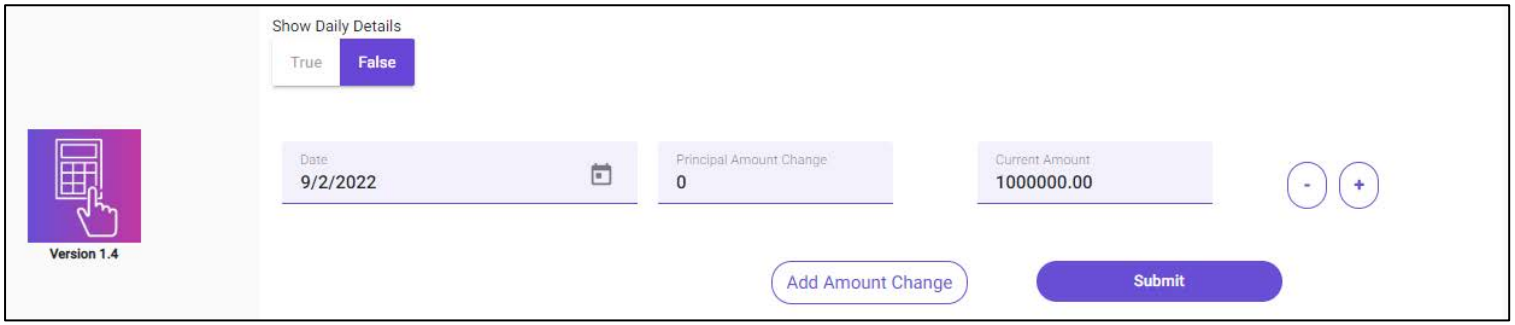
The following screenshot shows the ARR Calculator App Dashboard for SOFR (*Interest Calculator*):






**Note:** To add Principal Amount Change for the interest period, click the **Add Amount Change** button.

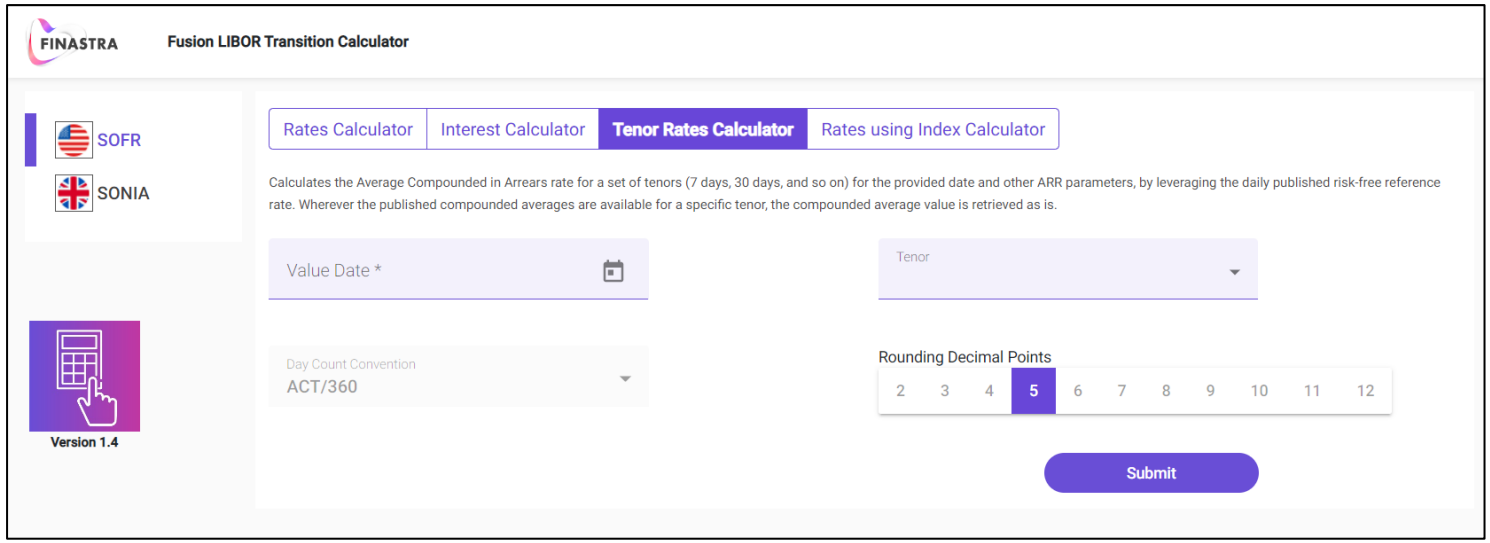
The following screenshot shows the ARR Calculator App Dashboard for SOFR (*Interest Calculator*) when principal amount change is applicable.



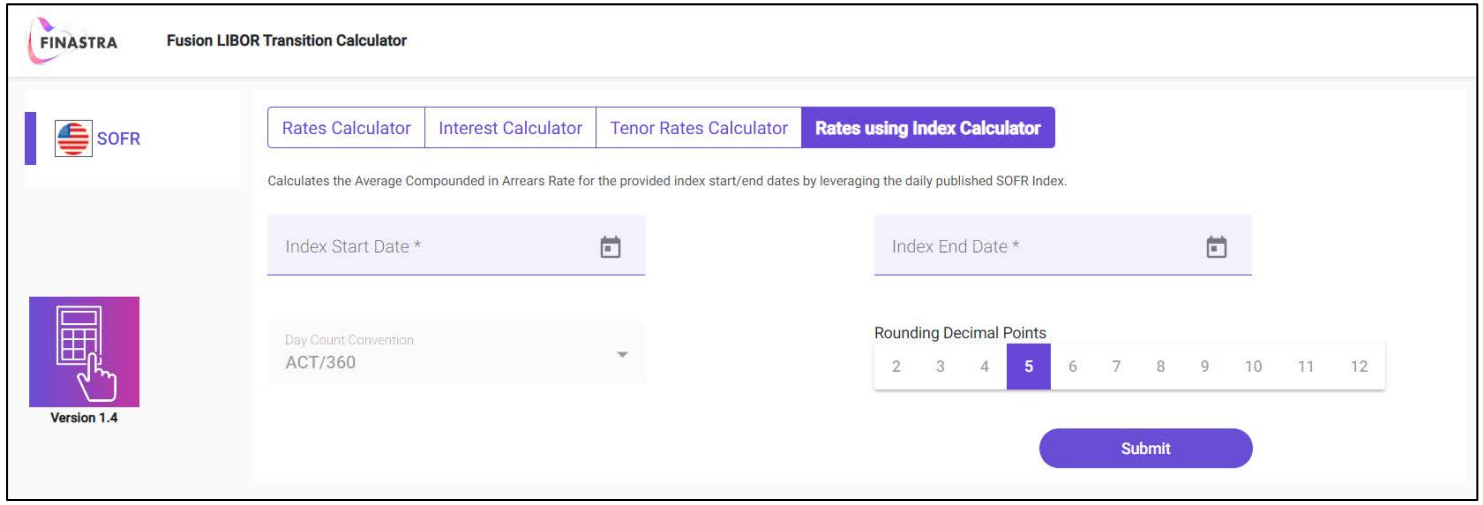

**Notes:**

- To add Principal Amount Change for an interest period, click the **Add Amount Change** button.
- To add multiple principal amount changes for an interest period, click the **–** or + options in the principal amount change section.

The following screenshot shows the ARR Calculator App Dashboard for SOFR (*Tenor Rates Calculator*):




The following screenshot shows the ARR Calculator App Dashboard for SOFR (*Rates using Index Calculator*):



## 2.4 Using the ARR Calculator App

After successfully registering on the FusionStore, the user can launch the ARR Calculator App.

After the ARR Calculator App is launched, the user can:

1. Select the applicable rate type.

   **Notes:**

   - Currently, the rate types supported by the ARR Calculator App are **SOFR** (click here for reference image), **SONIA**, **ESTR**, **TONAR**, and **SORA**.
   - Based on the rate type selected, the supported end points and ARR parameters also change.

2. Select the required end point such as **Rates Calculation**, **Interest Calculation**, and so on.
3. Select the Calculation Method.

   **Note:** Currently, the Calculation Method supported by the ARR Calculator App are **Daily Compounding in Arrears**, **Average Compounded in Arrears**, **Simple ARR** (not available for ESTR, TONAR, and SORA), and **Simple Average**. Based on the Calculation Method selected the ARR Calculator App displays the applicable ARR Parameters.

4. Provide the required ARR parameters such as **Interest Period Start Date**, **Interest Period End Date**, **Look back days**, and so on.

   **Note:** To add Principal Amount Change for the interest period, click the **Add Amount Change** button. Click here for reference images.

5. Submit the request.

The ARR Calculator App works by connecting to the Fusion LIBOR Transition Calculator Service to send inputs to the Fusion LIBOR Transition Calculator API and display the calculated ARR rates/accrued interest values that are provided as an output by the ARR Calculator Service. The results can be exported to a supported format such as CSV and PDF and includes the request (input) as well.

**Note:** The ARR Calculator App displays the version number on the UI to let users know what version of the App they are currently using.

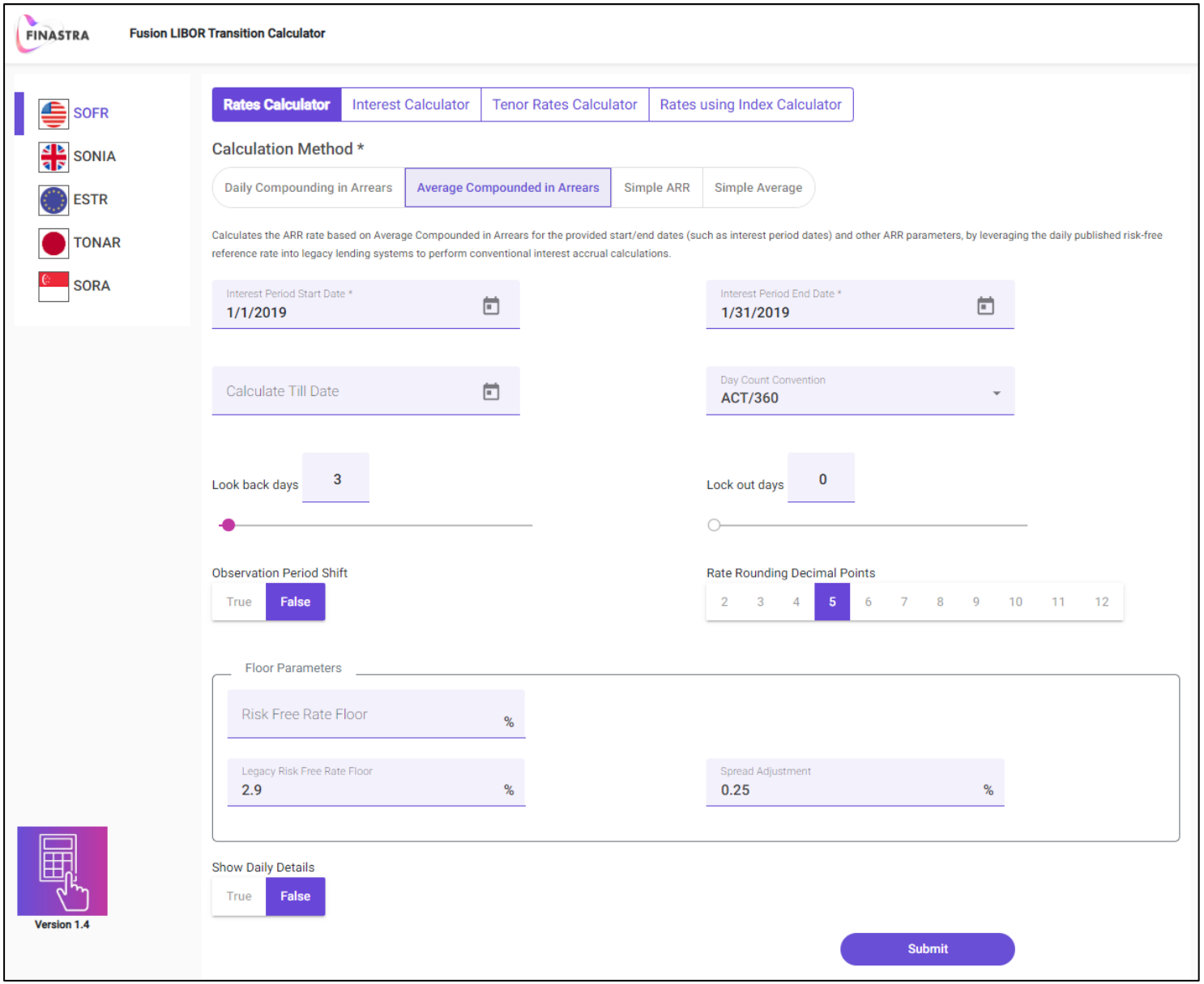
### 2.4.1 Use Case Examples

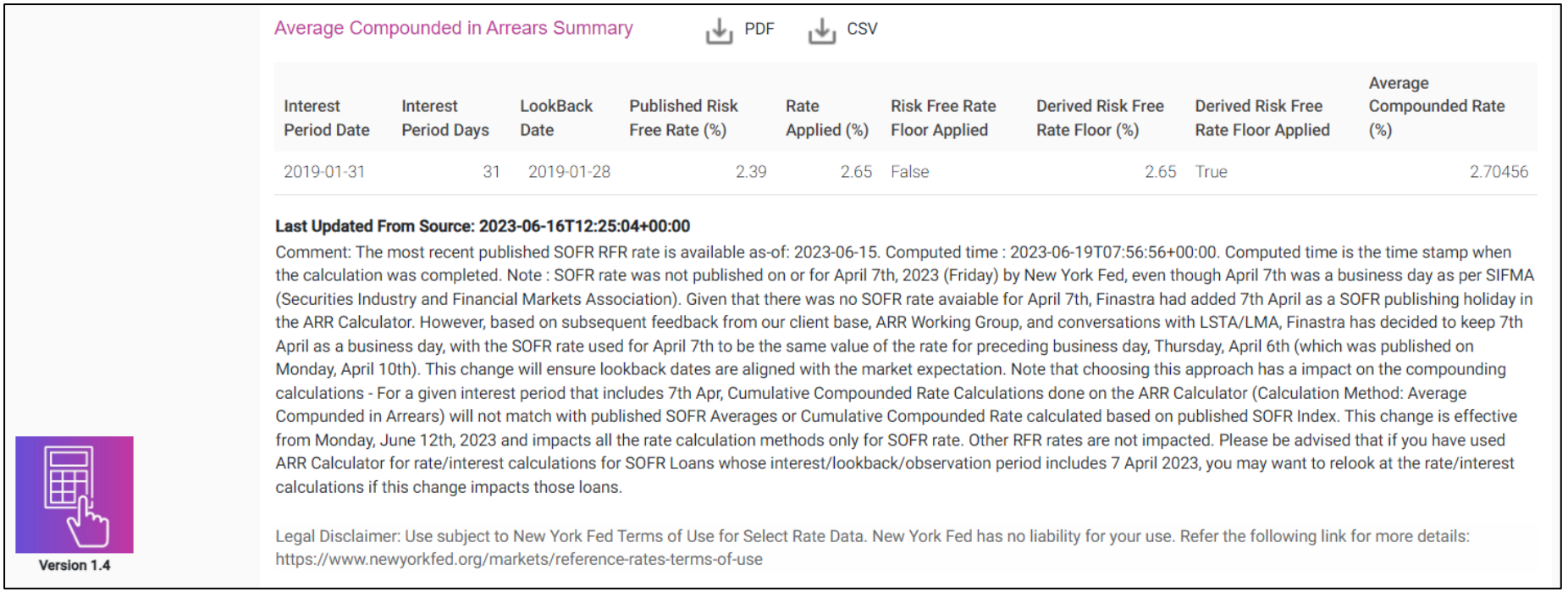
The following are examples of values entered for the input attributes and the resulting output/response from the end point.

#### 2.4.1.1 Example 1: SOFR Rates Calculator – Average Compounded in Arrears with Legacy Risk Free Rate Floor

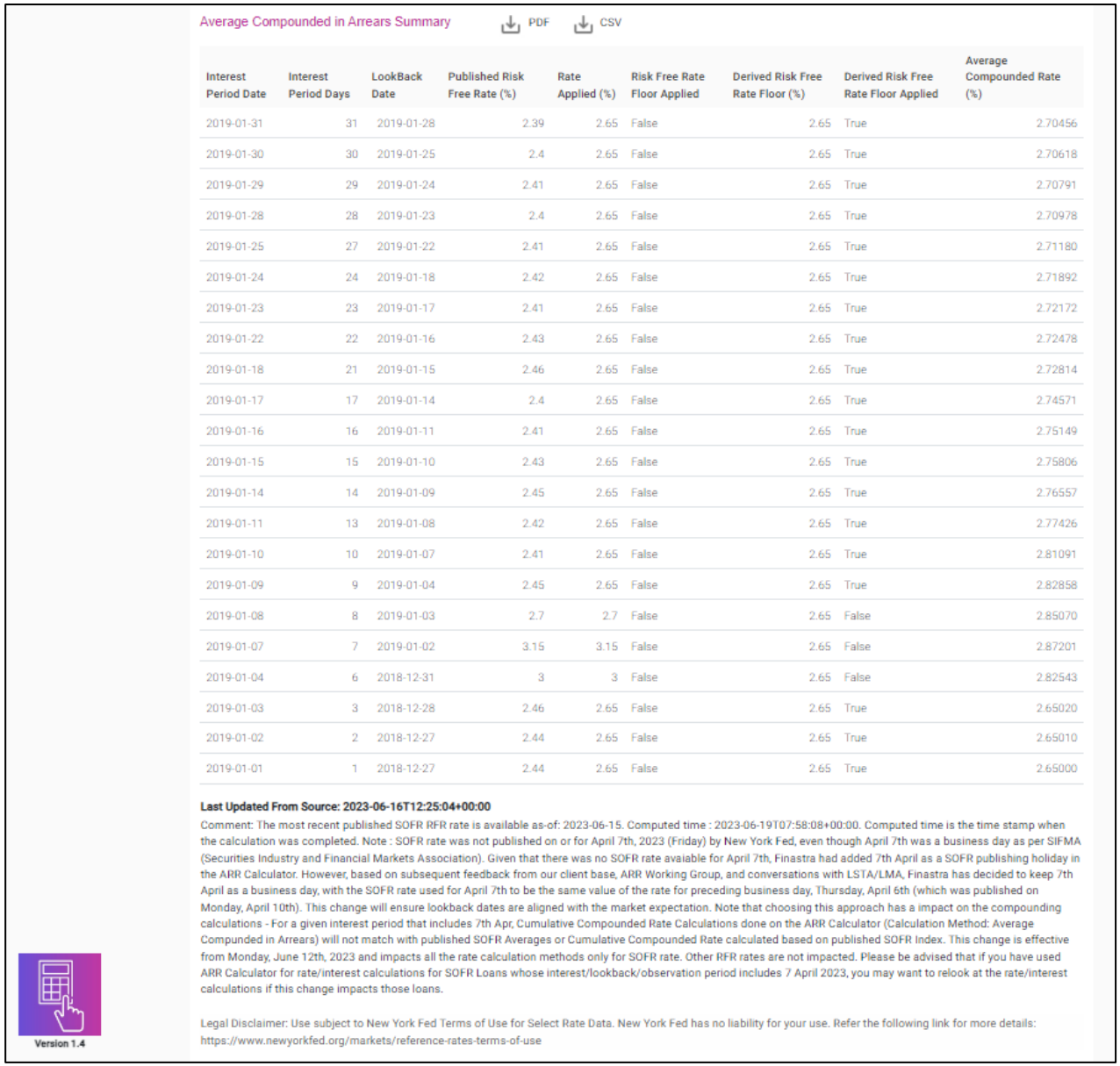
| ARR Parameter Field | Value Entered |
|---|---|
| Interest Period Start Date* | 1/1/2019 |
| Interest Period End Date* | 1/31/2019 |
| Calculate Till Date | Not entered |
| Day Count Convention | Default (ACT/360) |
| Look back days | 3 |
| Lock out days | Default (0) |
| Observation Period Shift | Default (False) |
| Rate Rounding Decimal Points | Default (5) |
| **Floor Parameters** | |
| Risk Free Rate Floor | Not entered |
| Legacy Risk Free Rate Floor | 2.9 |
| Spread Adjustment | 0.25 |
| Show Daily Details | Default (False) |

**Notes:** The *Spread Adjustment* field is enabled only when *Legacy Risk Free Rate Floor* is provided. For information on Legacy Risk Free Rate Floor, refer to the *Legacy Risk Free Rate Floor* section.


FINASTRA
Fusion LIBOR Transition Calculator
SOFR
SONIA
ESTR
TONAR
SORA
Rates Calculator
Interest Calculator
Tenor Rates Calculator
Rates using Index Calculator
Calculation Method *
Daily Compounding in Arrears
Average Compounded in Arrears
Simple ARR
Simple Average
Calculates the ARR rate based on Average Compounded in Arrears for the provided start/end dates (such as interest period dates) and other ARR parameters, by leveraging the daily published risk-free reference rate into legacy lending systems to perform conventional interest accrual calculations.
Interest Period Start Date *
1/1/2019
Interest Period End Date *
1/31/2019
Calculate Till Date
Day Count Convention
ACT/360
Look back days
3
Lock out days
0
Observation Period Shift
True
False
Rate Rounding Decimal Points
2 3 4 5 6 7 8 9 10 11 12
Floor Parameters
Risk Free Rate Floor
%
Legacy Risk Free Rate Floor
2.9
%
Spread Adjustment
0.25
%
Show Daily Details
True
False
Version 1.4
Submit




**Note:** The mage on the following page is the same result displayed on the App when **Show Daily Details** is set to **True**. The image is taken after excluding the ARR Parameters section on the App to make the result viewable.



Average Compounded in Arrears Summary PDF CSV

| Interest Period Date | Interest Period Days | LookBack Date | Published Risk Free Rate (%) | Rate Applied (%) | Risk Free Rate Floor Applied | Derived Risk Free Rate Floor (%) | Derived Risk Free Rate Floor Applied | Average Compounded Rate (%) |
|---|---|---|---|---|---|---|---|---|
| 2019-01-31 | 31 | 2019-01-28 | 2.39 | 2.65 | False | 2.65 | True | 2.70456 |
| 2019-01-30 | 30 | 2019-01-25 | 2.4 | 2.65 | False | 2.65 | True | 2.70618 |
| 2019-01-29 | 29 | 2019-01-24 | 2.41 | 2.65 | False | 2.65 | True | 2.70791 |
| 2019-01-28 | 28 | 2019-01-23 | 2.4 | 2.65 | False | 2.65 | True | 2.70978 |
| 2019-01-25 | 27 | 2019-01-22 | 2.41 | 2.65 | False | 2.65 | True | 2.71180 |
| 2019-01-24 | 24 | 2019-01-18 | 2.42 | 2.65 | False | 2.65 | True | 2.71892 |
| 2019-01-23 | 23 | 2019-01-17 | 2.41 | 2.65 | False | 2.65 | True | 2.72172 |
| 2019-01-22 | 22 | 2019-01-16 | 2.43 | 2.65 | False | 2.65 | True | 2.72478 |
| 2019-01-18 | 21 | 2019-01-15 | 2.46 | 2.65 | False | 2.65 | True | 2.72814 |
| 2019-01-17 | 17 | 2019-01-14 | 2.4 | 2.65 | False | 2.65 | True | 2.74571 |
| 2019-01-16 | 16 | 2019-01-11 | 2.41 | 2.65 | False | 2.65 | True | 2.75149 |
| 2019-01-15 | 15 | 2019-01-10 | 2.43 | 2.65 | False | 2.65 | True | 2.75806 |
| 2019-01-14 | 14 | 2019-01-09 | 2.45 | 2.65 | False | 2.65 | True | 2.76557 |
| 2019-01-11 | 13 | 2019-01-08 | 2.42 | 2.65 | False | 2.65 | True | 2.77426 |
| 2019-01-10 | 10 | 2019-01-07 | 2.41 | 2.65 | False | 2.65 | True | 2.81091 |
| 2019-01-09 | 9 | 2019-01-04 | 2.45 | 2.65 | False | 2.65 | True | 2.82858 |
| 2019-01-08 | 8 | 2019-01-03 | 2.7 | 2.7 | False | 2.65 | False | 2.85070 |
| 2019-01-07 | 7 | 2019-01-02 | 3.15 | 3.15 | False | 2.65 | False | 2.87201 |
| 2019-01-04 | 6 | 2018-12-31 | 3 | 3 | False | 2.65 | False | 2.82543 |
| 2019-01-03 | 3 | 2018-12-28 | 2.46 | 2.65 | False | 2.65 | True | 2.65020 |
| 2019-01-02 | 2 | 2018-12-27 | 2.44 | 2.65 | False | 2.65 | True | 2.65010 |
| 2019-01-01 | 1 | 2018-12-27 | 2.44 | 2.65 | False | 2.65 | True | 2.65000 |

**Last Updated From Source: 2023-06-16T12:25:04+00:00**

Comment: The most recent published SOFR RFR rate is available as-of: 2023-06-15. Computed time : 2023-06-19T07:58:08+00:00. Computed time is the time stamp when the calculation was completed. Note : SOFR rate was not published on or for April 7th, 2023 (Friday) by New York Fed, even though April 7th was a business day as per SIFMA (Securities Industry and Financial Markets Association). Given that there was no SOFR rate avaiable for April 7th, Finastra had added 7th April as a SOFR publishing holiday in the ARR Calculator. However, based on subsequent feedback from our client base, ARR Working Group, and conversations with LSTA/LMA, Finastra has decided to keep 7th April as a business day, with the SOFR rate used for April 7th to be the same value of the rate for preceding business day, Thursday, April 6th (which was published on Monday, April 10th). This change will ensure lookback dates are aligned with the market expectation. Note that choosing this approach has a impact on the compounding calculations - For a given interest period that includes 7th Apr, Cumulative Compounded Rate Calculations done on the ARR Calculator (Calculation Method: Average Compunded in Arrears) will not match with published SOFR Averages or Cumulative Compounded Rate calculated based on published SOFR Index. This change is effective from Monday, June 12th, 2023 and impacts all the rate calculation methods only for SOFR rate. Other RFR rates are not impacted. Please be advised that if you have used ARR Calculator for rate/interest calculations for SOFR Loans whose interest/lookback/observation period includes 7 April 2023, you may want to relook at the rate/interest calculations if this change impacts those loans.

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Version 1.4

#### 2.4.1.2 Example 2: SOFR Interest Calculator – Daily Compounding in Arrears with Spread, Spread Adjustment, with Principal Amount Change

| ARR Parameter Field | Value Entered |
|---|---|
| Interest Period Start Date* | 8/2/2019 |
| Interest Period End Date* | 8/15/2019 |
| Calculate Till Date | 8/15/2019 |
| Day Count Convention | Default (ACT/360) |
| Initial Principal Balance | 1,000,000 |
| Payment Rounding | Default (NEAREST) |
| Look back days | 3 |
| Lock out days | Default (0) |
| Observation Period Shift | Default (False) |
| Rate Rounding Decimal Points | Default (5) |
| CCR Rounding Applies | False |
| CCR Rounding Precision | Auto Disabled |
| **Floor Parameters** | |
| Risk Free Rate Floor | Not entered |
| Legacy Risk Free Rate Floor | Not entered |
| **All in Rate Parameters** | |
| Spread | 0.5 |
| Spread Adjustment | 0.25 |
| All in Rate Floor | Not entered |
| All in Rate Cap | Not entered |

| ARR Parameter Field | Value Entered |
|---|---|
| Show Daily Details | Default (False) |

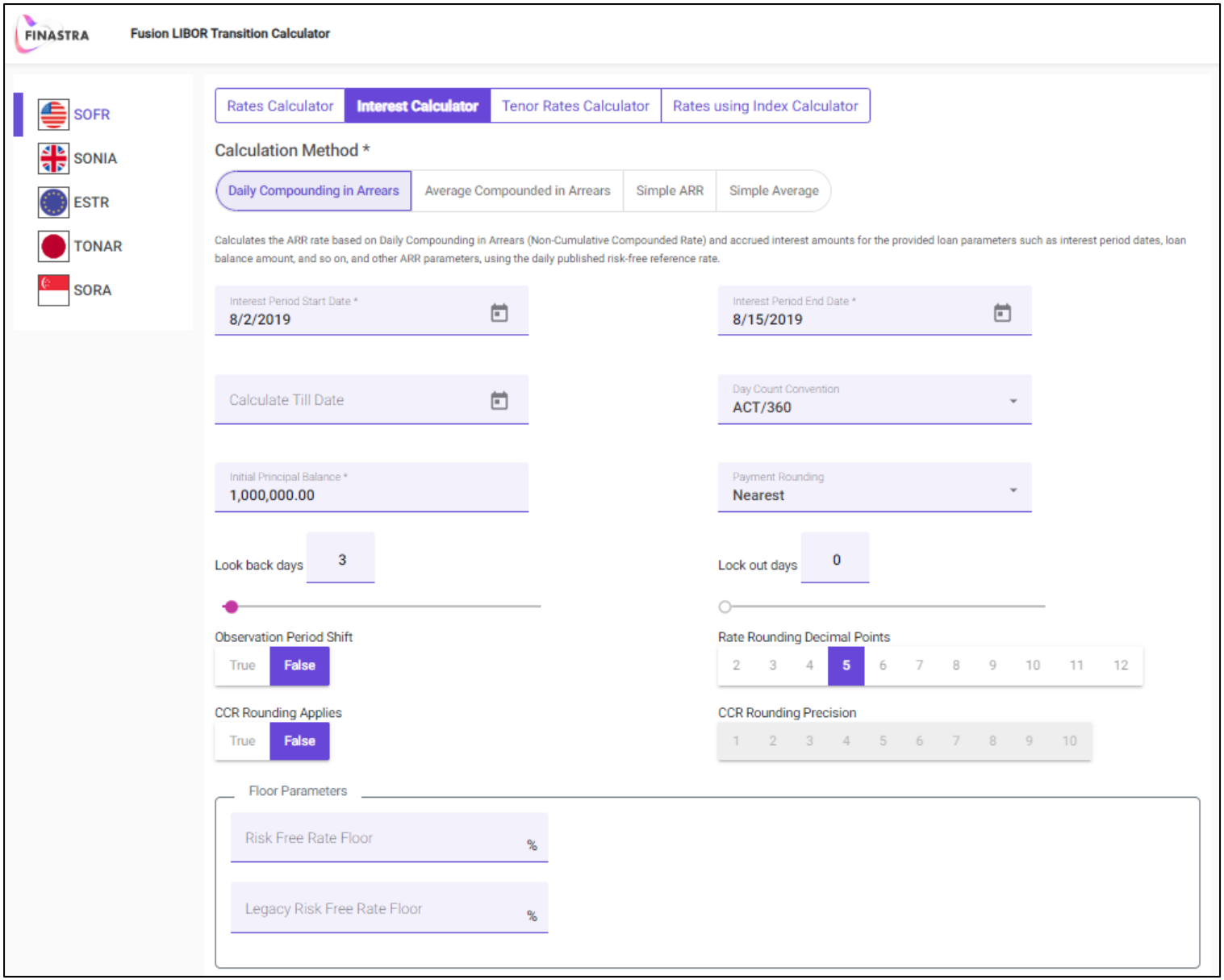
Principal Amount Change

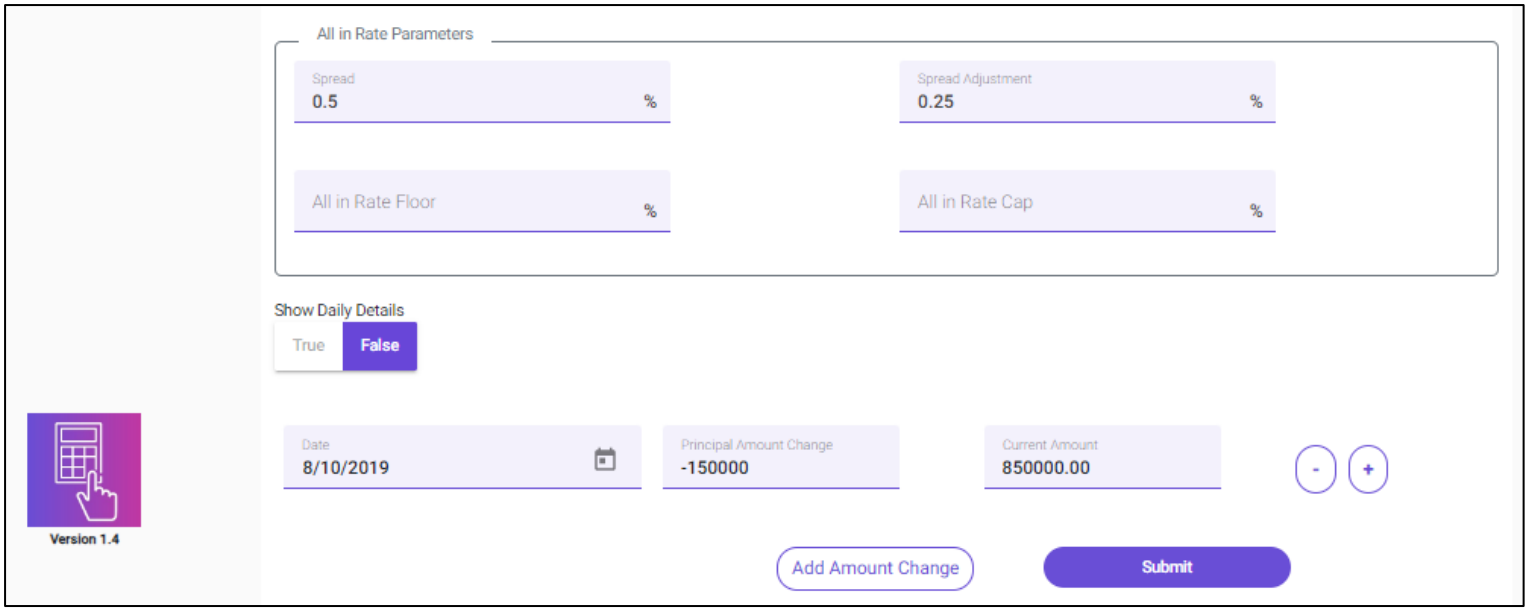
| Date | Principal Amount Change |
|---|---|
| 8/10/2019 | -150000 |

**Notes:**

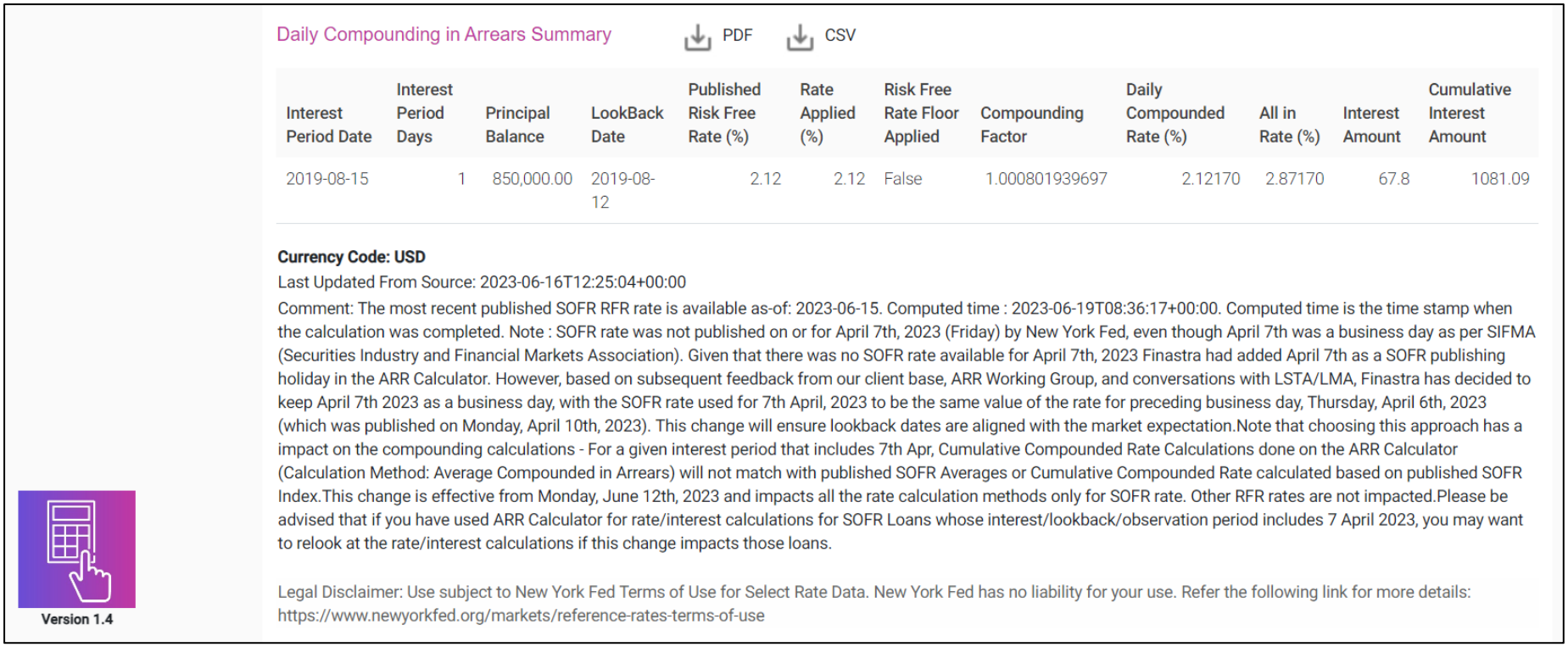
- The *Legacy Risk Free Rate Floor* is a new field available in 1.2 and later versions. For information on Legacy Risk Free Rate Floor, refer to the *Legacy Risk Free Rate Floor* section.
- The CCR Rounding Applies and CCR Rounding Precision fields are applicable only for Daily Compounding in Arrears calculation method. For information on CCR Rounding, refer to the *Daily Compounding in Arrears (Non Cumulative Compounded Rate or NCCR)* section.

The result image is provided in the following pages.


FINASTRA
Fusion LIBOR Transition Calculator
SOFR
SONIA
ESTR
TONAR
SORA
Rates Calculator
Interest Calculator
Tenor Rates Calculator
Rates using Index Calculator
Calculation Method *
Daily Compounding in Arrears
Average Compounded in Arrears
Simple ARR
Simple Average
Calculates the ARR rate based on Daily Compounding in Arrears (Non-Cumulative Compounded Rate) and accrued interest amounts for the provided loan parameters such as interest period dates, loan balance amount, and so on, and other ARR parameters, using the daily published risk-free reference rate.
Interest Period Start Date *
8/2/2019
Interest Period End Date *
8/15/2019
Calculate Till Date
Day Count Convention
ACT/360
Initial Principal Balance *
1,000,000.00
Payment Rounding
Nearest
Look back days
3
Lock out days
0
Observation Period Shift
True
False
Rate Rounding Decimal Points
2 3 4 5 6 7 8 9 10 11 12
CCR Rounding Applies
True
False
CCR Rounding Precision
1 2 3 4 5 6 7 8 9 10
Floor Parameters
Risk Free Rate Floor
%
Legacy Risk Free Rate Floor
%




**Note:** The result is displayed on the following page.




**Note:** The image on the following page is the same result displayed on the App when **Show Daily Details** is set to **True**. The image is taken after excluding the ARR Parameters section on the App to make the result viewable.

Daily Compounding in Arrears Summary PDF CSV

| Interest Period Date | Interest Period Days | Principal Balance | LookBack Date | Published Risk Free Rate (%) | Rate Applied (%) | Risk Free Rate Floor Applied | Compounding Factor | Daily Compounded Rate (%) | All in Rate (%) | Interest Amount | Cumulative Interest Amount |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2019-08-15 | 1 | 850,000.00 | 2019-08-12 | 2.12 | 2.12 | False | 1.000801939697 | 2.12170 | 2.87170 | 67.8 | 1081.09 |
| 2019-08-14 | 1 | 850,000.00 | 2019-08-09 | 2.11 | 2.11 | False | 1.000743285021 | 2.11157 | 2.86157 | 67.56 | 1013.29 |
| 2019-08-13 | 1 | 850,000.00 | 2019-08-08 | 2.09 | 2.09 | False | 1.000685189687 | 2.09143 | 2.84143 | 67.09 | 945.72 |
| 2019-08-12 | 1 | 850,000.00 | 2019-08-07 | 2.1 | 2.1 | False | 1.000626819789 | 2.10132 | 2.85132 | 67.32 | 878.63 |
| 2019-08-10 | 2 | 850,000.00 | 2019-08-06 | 2.11 | 2.11 | False | 1.000450907171 | 2.11095 | 2.86095 | 135.1 | 811.31 |
| 2019-08-09 | 1 | 1,000,000.00 | 2019-08-06 | 2.11 | 2.11 | False | 1.000450907171 | 2.11095 | 2.86095 | 79.47 | 676.21 |
| 2019-08-08 | 1 | 1,000,000.00 | 2019-08-05 | 2.13 | 2.13 | False | 1.000391717328 | 2.13083 | 2.88083 | 80.02 | 596.74 |
| 2019-08-07 | 1 | 1,000,000.00 | 2019-08-02 | 2.19 | 2.19 | False | 1.000330863867 | 2.19072 | 2.94072 | 81.69 | 516.72 |
| 2019-08-06 | 1 | 1,000,000.00 | 2019-08-01 | 2.19 | 2.19 | False | 1.000270014108 | 2.19059 | 2.94059 | 81.68 | 435.03 |
| 2019-08-05 | 1 | 1,000,000.00 | 2019-07-31 | 2.55 | 2.55 | False | 1.000199166667 | 2.55051 | 3.30051 | 91.68 | 353.35 |
| 2019-08-02 | 3 | 1,000,000.00 | 2019-07-30 | 2.39 | 2.39 | False | 1.000000000000 | 2.39000 | 3.14000 | 261.67 | 261.67 |

**Currency Code: USD**

Last Updated From Source: 2023-06-16T12:25:04+00:00

Comment: The most recent published SOFR RFR rate is available as-of: 2023-06-15. Computed time : 2023-06-19T08:36:37+00:00. Computed time is the time stamp when the calculation was completed. Note : SOFR rate was not published on or for April 7th, 2023 (Friday) by New York Fed, even though April 7th was a business day as per SIFMA (Securities Industry and Financial Markets Association). Given that there was no SOFR rate available for April 7th, 2023 Finastra had added April 7th as a SOFR publishing holiday in the ARR Calculator. However, based on subsequent feedback from our client base, ARR Working Group, and conversations with LSTA/LMA, Finastra has decided to keep April 7th 2023 as a business day, with the SOFR rate used for 7th April, 2023 to be the same value of the rate for preceding business day, Thursday, April 6th, 2023 (which was published on Monday, April 10th, 2023). This change will ensure lookback dates are aligned with the market expectation.Note that choosing this approach has a impact on the compounding calculations - For a given interest period that includes 7th Apr, Cumulative Compounded Rate Calculations done on the ARR Calculator (Calculation Method: Average Compounded in Arrears) will not match with published SOFR Averages or Cumulative Compounded Rate calculated based on published SOFR Index.This change is effective from Monday, June 12th, 2023 and impacts all the rate calculation methods only for SOFR rate. Other RFR rates are not impacted.Please be advised that if you have used ARR Calculator for rate/interest calculations for SOFR Loans whose interest/lookback/observation period includes 7 April 2023, you may want to relook at the rate/interest calculations if this change impacts those loans.

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Version 1.4

## 2.5 Exporting Output to PDF or CSV

To download the result as a PDF or CSV, after the result is generated, click the download option (  ) available at the start of the result section and save the file in the required format in the required destination.

The following is the PDF output of the *Example 1: SOFR Rates Calculator – Average Compounded in Arrears* with Show Daily Details set to False.

### Average Compounded in Arrears-Rates

| Interest Period Start Date | Interest Period End Date | Risk Free Rate | Legacy Risk Free Rate Floor | Spread Adjustment | Rate Rounding Decimal Points | Day Count Convention | Look Back Days | showDailyDetails | Observation Period Shift |
|---|---|---|---|---|---|---|---|---|---|
| 2019-01-01 | 2019-01-31 | SOFR | 2.9 | 0.25 | 5 | ACT/360 | 3 | False | False |

| Interest Period Date | Interest Period Days | LookBack Date | Published Risk Free Rate (%) | Rate Applied (%) | Risk Free Rate Floor Applied | Derived Risk Free Rate Floor (%) | Derived Risk Free Rate Floor Applied | Average Compounded Rate (%) |
|---|---|---|---|---|---|---|---|---|
| 2019-01-31 | 31 | 2019-01-28 | 2.39 | 2.65 | False | 2.65 | True | 2.70456 |

Last Updated From Source: 2023-06-16T12:25:04+00:00

Comment: The most recent published SOFR RFR rate is available as-of: 2023-06-15. Computed time : 2023-06-19T07:56:56+00:00. Computed time is the time stamp when the calculation was completed. Note : SOFR rate was not published on or for April 7th, 2023 (Friday) by New York Fed, even though April 7th was a business day as per SIFMA (Securities Industry and Financial Markets Association). Given that there was no SOFR rate avaiable for April 7th, Finastra had added 7th April as a SOFR publishing holiday in the ARR Calculator. However, based on subsequent feedback from our client base, ARR Working Group, and conversations with LSTA/LMA, Finastra has decided to keep 7th April as a business day, with the SOFR rate used for April 7th to be the same value of the rate for preceding business day, Thursday, April 6th (which was published on Monday, April 10th). This change will ensure lookback dates are aligned with the market expectation. Note that choosing this approach has a impact on the compounding calculations - For a given interest period that includes 7th Apr, Cumulative Compounded Rate Calculations done on the ARR Calculator (Calculation Method: Average Compunded in Arrears) will not match with published SOFR Averages or Cumulative Compounded Rate calculated based on published SOFR Index. This change is effective from Monday, June 12th, 2023 and impacts all the rate calculation methods only for SOFR rate. Other RFR rates are not impacted. Please be advised that if you have used ARR Calculator for rate/interest calculations for SOFR Loans whose interest/lookback/observation period includes 7 April 2023, you may want to relook at the rate/interest calculations if this change impacts those loans.

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The following is the PDF output of the *Example 1: SOFR Rates Calculator – Average Compounded in Arrears* with Show Daily Details set to True.

## Average Compounded in Arrears-Rates

| Interest Period Start Date | Interest Period End Date | Risk Free Rate | Legacy Risk Free Rate Floor | Spread Adjustment | Rate Rounding Decimal Points | Day Count Convention | Look Back Days | showDailyDetails | Observation Period Shift |
|---|---|---|---|---|---|---|---|---|---|
| 2019-01-01 | 2019-01-31 | SOFR | 2.9 | 0.25 | 5 | ACT/360 | 3 | True | False |

| Interest Period Date | Interest Period Days | LookBack Date | Published Risk Free Rate (%) | Rate Applied (%) | Risk Free Rate Floor Applied | Derived Risk Free Rate Floor (%) | Derived Risk Free Rate Floor Applied | Average Compounded Rate (%) |
|---|---|---|---|---|---|---|---|---|
| 2019-01-31 | 31 | 2019-01-28 | 2.39 | 2.65 | False | 2.65 | True | 2.70456 |
| 2019-01-30 | 30 | 2019-01-25 | 2.4 | 2.65 | False | 2.65 | True | 2.70618 |
| 2019-01-29 | 29 | 2019-01-24 | 2.41 | 2.65 | False | 2.65 | True | 2.70791 |
| 2019-01-28 | 28 | 2019-01-23 | 2.4 | 2.65 | False | 2.65 | True | 2.70978 |
| 2019-01-25 | 27 | 2019-01-22 | 2.41 | 2.65 | False | 2.65 | True | 2.71180 |
| 2019-01-24 | 24 | 2019-01-18 | 2.42 | 2.65 | False | 2.65 | True | 2.71892 |
| 2019-01-23 | 23 | 2019-01-17 | 2.41 | 2.65 | False | 2.65 | True | 2.72172 |
| 2019-01-22 | 22 | 2019-01-16 | 2.43 | 2.65 | False | 2.65 | True | 2.72478 |
| 2019-01-18 | 21 | 2019-01-15 | 2.46 | 2.65 | False | 2.65 | True | 2.72814 |
| 2019-01-17 | 17 | 2019-01-14 | 2.4 | 2.65 | False | 2.65 | True | 2.74571 |
| 2019-01-16 | 16 | 2019-01-11 | 2.41 | 2.65 | False | 2.65 | True | 2.75149 |
| 2019-01-15 | 15 | 2019-01-10 | 2.43 | 2.65 | False | 2.65 | True | 2.75806 |
| 2019-01-14 | 14 | 2019-01-09 | 2.45 | 2.65 | False | 2.65 | True | 2.76557 |
| 2019-01-11 | 13 | 2019-01-08 | 2.42 | 2.65 | False | 2.65 | True | 2.77426 |
| 2019-01-10 | 10 | 2019-01-07 | 2.41 | 2.65 | False | 2.65 | True | 2.81091 |
| 2019-01-09 | 9 | 2019-01-04 | 2.45 | 2.65 | False | 2.65 | True | 2.82858 |
| 2019-01-08 | 8 | 2019-01-03 | 2.7 | 2.7 | False | 2.65 | False | 2.85070 |
| 2019-01-07 | 7 | 2019-01-02 | 3.15 | 3.15 | False | 2.65 | False | 2.87201 |
| 2019-01-04 | 6 | 2018-12-31 | 3 | 3 | False | 2.65 | False | 2.82543 |
| 2019-01-03 | 3 | 2018-12-28 | 2.46 | 2.65 | False | 2.65 | True | 2.65020 |
| 2019-01-02 | 2 | 2018-12-27 | 2.44 | 2.65 | False | 2.65 | True | 2.65010 |
| 2019-01-01 | 1 | 2018-12-27 | 2.44 | 2.65 | False | 2.65 | True | 2.65000 |

Last Updated From Source: 2023-06-16T12:25:04+00:00

Comment: The most recent published SOFR RFR rate is available as-of: 2023-06-15. Computed time : 2023-06-19T07:58:08+00:00. Computed time is the time stamp when the calculation was completed. Note : SOFR rate was not published on or for April 7th, 2023 (Friday) by New York Fed, even though April 7th was a business day as per SIFMA (Securities Industry and Financial Markets Association). Given that there was no SOFR rate avaiable for April 7th, Finastra had added 7th April as a SOFR publishing holiday in the ARR Calculator. However, based on subsequent feedback from our client base, ARR Working Group, and conversations with LSTA/LMA, Finastra has decided to keep 7th April as a business day, with the SOFR rate used for April 7th to be the same value of the rate for preceding business day, Thursday, April 6th (which was published on Monday, April 10th). This change will ensure lookback dates are aligned with the market expectation. Note that choosing this approach has a impact on the compounding calculations - For a given interest period that includes 7th Apr, Cumulative Compounded Rate Calculations done on the ARR Calculator (Calculation Method: Average Compunded in Arrears) will not match with published SOFR Averages or Cumulative Compounded Rate calculated based on published SOFR Index. This change is effective from Monday, June 12th, 2023 and impacts all the rate calculation methods only for SOFR rate. Other RFR rates are not impacted. Please be advised that if you have used ARR Calculator for rate/interest calculations for SOFR Loans whose interest/lookback/observation period includes 7 April 2023, you may want to relook at the rate/interest calculations if this change impacts those loans.

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The following is the CSV output of the *Example 1: SOFR Rates Calculator – Average Compounded in Arrears* with Show Daily Details set to False.

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Average Compounded in Arrears-Rates | | | | | | | | | | | |
| 2 | Input | | | | | | | | | | | |
| 3 | interestPeriodStartDate | interestPeriodEndDate | riskFreeRate | lookBackDays | lockoutDays | observationPeriodShift | dayCountConvention | rateRoundingDecimalPoints | legacyRiskFreeRateFloor | spreadAdjustment | showDailyDetails | |
| 4 | 2019-01-01 | 2019-01-31 | SOFR | 3 | 0 | false | ACT/360 | 5 | 2.9 | 0.25 | false | |
| 5 | | | | | | | | | | | | |
| 6 | Output | | | | | | | | | | | |
| 7 | InterestPeriodDate | InterestPeriodDays | LookBackDate | PublishedRiskFreeRate(% | RateApplied(%) | RiskFreeRateFloorApplied | DerivedRiskFreeRateFloor(%) | DerivedRiskFreeRateFloorApplied | AverageCompoundedRate(%) | | | |
| 8 | 2019-01-31 | 31 | 2019-01-28 | 2.39 | 2.65 | False | 2.65 | True | 2.70456 | | | |
| 9 | | | | | | | | | | | | |
| 10 | Last Updated From Sour | 2023-06-16T12:25:04+00:00 | | | | | | | | | | |
| 11 | Comment | "The most recent published SOFR RFR rate is available as-of: 2023-06-15. Computed time : 2023-06-19T07:58:08+00:00. Computed time is the time stamp when the calculation was completed. Note: SOFR rate was not published on or for April 7th 2023 (Friday) by New York Fed even though April 7th was a business day as per SIFMA (Securities Industry and Financial Markets Association). Given that there was no SOFR rate avaiable for April 7th Finastra had added 7th April as a SOFR publishing holiday in the ARR Calculator. However based on subsequent feedback from our client base ARR Working Group and conversations with LSTA/LMA Finastra has decided to keep 7th April as a business day with the SOFR rate used for April 7th to be the same value of the rate for preceding business day Thursday April 6th (which was published on Monday April 10th). This change will ensure lookback dates are aligned with the market expectation. Note that choosing this approach has a impact on the compounding calculations - For a given interest period that includes 7th Apr Cumulative Compounded Rate Calculations done on the ARR Calculator (Calculation Method: Average Compunded in Arrears) will not match with published SOFR Averages or Cumulative Compounded Rate calculated based on published SOFR Index. This change is effective from Monday June 12th 2023 and impacts all the rate calculation methods only for SOFR rate. Other RFR rates are not impacted. Please be advised that if you have used ARR Calculator for rate/interest calculations for SOFR Loans whose interest/lookback/observation period includes 7 April 2023 you may want to relook at the rate/interest calculations if this change impacts those loans." | | | | | | | | | | |
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| 13 | | | | | | | | | | | | |

Average Compounded in Arrears-R

The following is the CSV output of the *Example 1: SOFR Rates Calculator – Average Compounded in Arrears* with Show Daily Details set to True.

| | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Average Compounded in Arrears-Rates | | | | | | | | | | | |
| 2 | Input | | | | | | | | | | | |
| 3 | interestPeriodStartDate | interestPeriodEndDate | riskFreeRate | lookBackDays | lockoutDays | observationPeriodShift | dayCountConvention | rateRoundingDecimalPoints | legacyRiskFreeRateFloor | spreadAdjustment | showDailyDetails | |
| 4 | 2019-01-01 | 2019-01-31 | SOFR | 3 | 0 | false | ACT/360 | 5 | 2.9 | 0.25 | true | |
| 5 | | | | | | | | | | | | |
| 6 | Output | | | | | | | | | | | |
| 7 | InterestPeriodDate | InterestPeriodDays | LookBackDate | PublishedRiskFreeRate(%) | RateApplied(%) | RiskFreeRateFloorApplied | DerivedRiskFreeRateFloor(%) | DerivedRiskFreeRateFloorApplied | AverageCompoundedRate(%) | | | |
| 8 | 2019-01-31 | 31 | 2019-01-28 | 2.39 | 2.65 | False | 2.65 | True | 2.70456 | | | |
| 9 | 1/30/2019 | 30 | 2019-01-25 | 2.4 | 2.65 | False | 2.65 | True | 2.70618 | | | |
| 10 | 1/29/2019 | 29 | 2019-01-24 | 2.41 | 2.65 | False | 2.65 | True | 2.70791 | | | |
| 11 | 1/28/2019 | 28 | 2019-01-23 | 2.4 | 2.65 | False | 2.65 | True | 2.70978 | | | |
| 12 | 1/25/2019 | 27 | 2019-01-22 | 2.41 | 2.65 | False | 2.65 | True | 2.7118 | | | |
| 13 | 1/24/2019 | 24 | 2019-01-18 | 2.42 | 2.65 | False | 2.65 | True | 2.71892 | | | |
| 14 | 1/23/2019 | 23 | 2019-01-17 | 2.41 | 2.65 | False | 2.65 | True | 2.72172 | | | |
| 15 | 1/22/2019 | 22 | 2019-01-16 | 2.43 | 2.65 | False | 2.65 | True | 2.72478 | | | |
| 16 | 1/18/2019 | 21 | 2019-01-15 | 2.46 | 2.65 | False | 2.65 | True | 2.72814 | | | |
| 17 | 1/17/2019 | 17 | 2019-01-14 | 2.4 | 2.65 | False | 2.65 | True | 2.74571 | | | |
| 18 | 1/16/2019 | 16 | 2019-01-11 | 2.41 | 2.65 | False | 2.65 | True | 2.75149 | | | |
| 19 | 1/15/2019 | 15 | 2019-01-10 | 2.43 | 2.65 | False | 2.65 | True | 2.75806 | | | |
| 20 | 1/14/2019 | 14 | 2019-01-09 | 2.45 | 2.65 | False | 2.65 | True | 2.76557 | | | |
| 21 | 1/11/2019 | 13 | 2019-01-08 | 2.42 | 2.65 | False | 2.65 | True | 2.77426 | | | |
| 22 | 1/10/2019 | 10 | 2019-01-07 | 2.41 | 2.65 | False | 2.65 | True | 2.81091 | | | |
| 23 | 1/9/2019 | 9 | 2019-01-04 | 2.45 | 2.65 | False | 2.65 | True | 2.82858 | | | |
| 24 | 1/8/2019 | 8 | 2019-01-03 | 2.7 | 2.7 | False | 2.65 | False | 2.8507 | | | |
| 25 | 1/7/2019 | 7 | 2019-01-02 | 3.15 | 3.15 | False | 2.65 | False | 2.87201 | | | |
| 26 | 1/4/2019 | 6 | 2018-12-31 | 3 | 3 | False | 2.65 | False | 2.82543 | | | |
| 27 | 1/3/2019 | 3 | 2018-12-28 | 2.46 | 2.65 | False | 2.65 | True | 2.6502 | | | |
| 28 | 1/2/2019 | 2 | 2018-12-27 | 2.44 | 2.65 | False | 2.65 | True | 2.6501 | | | |
| 29 | 1/1/2019 | 1 | 2018-12-27 | 2.44 | 2.65 | False | 2.65 | True | 2.65 | | | |
| 30 | | | | | | | | | | | | |
| 31 | Last Updated From Sourc | 2023-06-16T12:25:04+00:00 | | | | | | | | | | |
| 32 | Comment | The most recent published SOFR RFR rate is available as-of: 2023-06-15. Computed time : 2023-06-19T07:58:08+00:00. Computed time is the time stamp when the calculation was completed. Note: SOFR rate was not published on or for April 7th 2023 (Friday) by New York Fed even though April 7th was a business day as per SIFMA (Securities Industry and Financial Markets Association). Given that there was no SOFR rate avaiable for April 7th Finastra had added 7th April as a SOFR publishing holiday in the ARR Calculator. However based on subsequent feedback from our client base ARR Working Group and conversations with LSTA/LMA Finastra has decided to keep 7th April as a business day with the SOFR rate used for April 7th to be the same value of the rate for preceding business day Thursday April 6th (which was published on Monday April 10th). This change will ensure lookback dates are aligned with the market expectation. Note that choosing this approach has a impact on the compounding calculations - For a given interest period that includes 7th Apr Cumulative Compounded Rate Calculations done on the ARR Calculator (Calculation Method: Average Compunded in Arrears) will not match with published SOFR Averages or Cumulative Compounded Rate calculated based on published SOFR Index. This change is effective from Monday June 12th 2023 and impacts all the rate calculation methods only for SOFR rate. Other RFR rates are not impacted. Please be advised that if you have used ARR Calculator for rate/interest calculations for SOFR Loans whose interest/lookback/observation period includes 7 April 2023 you may want to relook at the rate/interest calculations if this change impacts those loans. | | | | | | | | | | |
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| 34 | | | | | | | | | | | | |

Average Compounded in Arrears-R

# 3 ARR Calculator App Attribute Details

## 3.1 Rates Calculator

The Alternative Reference Rates supported are SOFR, SONIA, ESTR, TONAR, and SORA.

The supported Calculation Methods are:

- **Daily Compounding in Arrears** – Calculates the ARR rates based on Daily Compounding in Arrears (Non-Cumulative Compounded Rate) for the provided start/end dates (such as interest period dates) and other ARR parameters, by leveraging the daily published risk-free reference rate.
- **Average Compounded in Arrears** – Calculates the ARR rate based on Average Compounded in Arrears for the provided start/end dates (such as interest period dates) and other ARR parameters, by leveraging the daily published risk-free reference rate.  into legacy lending systems to perform conventional interest accrual calculations.
- **Simple ARR** – Applies the Simple ARR method for the provided interest period start, end dates, or an interim date in the interest period and other ARR parameters, by leveraging the daily published risk-free reference rate.

  **Note:** Simple ARR calculation method is not available for ESTR, TONAR, and SORA.

- **Simple Average** – Calculates the ARR rate based on Simple Average for the provided start/end dates (such as interest period dates) and other ARR parameters, by leveraging the daily published risk-free reference rate into legacy lending systems to perform conventional interest accrual calculations.

**Notes:**

- For sample ARR Calculator App reference image for Rates Calculator rates, click here.
- For more information on calculation methods and related attributes, refer to the *Calculation Methods* section.
- Legacy Risk Free Rate Floor is applicable for all the calculation methods. For information on Legacy Risk Free Rate Floor, refer to the *Legacy Risk Free Rate Floor* section.
- The CCR Rounding Applies and CCR Rounding Precision fields are applicable only for Daily Compounding in Arrears calculation method. For information on CCR Rounding, refer to the *Daily Compounding in Arrears (Non Cumulative Compounded Rate or NCCR)* section.
- Lookback Date (output attribute) is not applicable for *Tenor Rates Calculator* and *Rates using Index Calculator*.
- For data restrictions on the supported RFRs, refer to the *Third-Party Data Restrictions* section.

### 3.1.1 Rates Calculator – ARR Calculator App Attributes

The following table lists the user input attributes (request) and the expected output attributes (response).

| Input Attributes | | | | |
|---|---|---|---|---|
| **ARR Calculator App** | **Description and Validation** | **Required/Optional** | **Format** | **Additional Remarks** |
| Risk Free Rate | The name of the Risk Free Rate/Alternative Reference Rate<br>Supported RFRs: SOFR, SONIA, SORA, ESTR, TONAR. | Required | -- | -- |
| Interest Period Start Date | The start date of the interest period from (and including) which the ARR Compounding Calculation must be performed.<br>The date can be selected from the drop-down calendar or entered in mm/dd/yyyy format. | Required | Date | -- |
| Interest Period End Date | The end date of the interest period to (and including) which the ARR compounding calculation should be performed.<br>The date can be selected from the drop-down calendar or entered in mm/dd/yyyy format. | Required | Date | • It is also used by the Calculator to identify if the interest period is in the rates known window or not.<br>• If Calculate Till Date is not provided, the interest period end date can be an intermediate date in the interest period up to (and including) which the compounded rates are calculated. |
| Calculate Till Date | The Date up to (and including) which the calculated compounded rates are expected in the output.<br>The date can be selected from the drop-down calendar or entered in mm/dd/yyyy format. | Optional | Date | -- |
| Day Count Convention | The Day Count Conventions supported. Valid Value are - ACT/360, ACT/365, and ACT/ACT.<br>Default value: for SOFR = ACT/360, for SONIA = ACT/365, ESTR = ACT/360, TONAR = ACT/365, SORA = ACT/365. | Optional | Drop-down List | -- |

| Input Attributes | | | | |
|---|---|---|---|---|
| **ARR Calculator App** | **Description and Validation** | **Required/Optional** | **Format** | **Additional Remarks** |
| Look back Days | Lookback days refers to the fixed date (business days prior to) from which the calculator is expected to use the published Risk Free Rate/Alternative Reference Rate<br>Minimum Value = 0 (Default), Maximum Value = 99<br>For more information, see *Lookback Days* section. | Optional | Number | -- |
| Lock out Days | Lockout days refers to the period (business days) in which the applicable ARR is derived using Lookback days and applied to all the days defined as Lockout days<br>Minimum Value = 0 (Default), Maximum Value = 99<br>For more information, see *Lockout Days* section. | Optional | Number | -- |
| Rate Rounding Decimal Points | Rounds the calculated ARR Compounded Rate to the specified decimal precision.<br>Minimum Value = 2, Maximum Value = 12<br>Default value: SOFR = 5, SONIA = 4, ESTR = 4, TONAR = 5, SORA = 4. | Optional | Numerical Scale | Rate rounding is done on the percentage value of the calculated ARR Compounded Rate. Rate Rounding Decimal Points is not considered when CCR Rounding Applies is set to True. |
| Risk Free Rate Floor | The Floor value (as a percentage) for the published risk-free reference rate.<br>Accepts up to 6 decimal points.<br>Accepted range: -100 to 100<br>**Note: Beginning with version 1.4 and later**, this field is displayed in a common sub-section named **Floor Parameters**. | Optional | Number | -- |

| Input Attributes | | | | |
|---|---|---|---|---|
| **ARR Calculator App** | **Description and Validation** | **Required/Optional** | **Format** | **Additional Remarks** |
| CCR Rounding Applies | Indicates whether rounded Cumulative Compounded Rate is used to calculate the Daily Compounded Rate (Value = True) or not (Value = False). This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations.<br>Default value is False.<br>**Note:** The CCR Rounding Applies field is applicable only for Daily Compounding in Arrears calculation method. For information on CCR Rounding, refer to the Daily Compounding in Arrears (Non Cumulative Compounded Rate or NCCR) section. | Optional | True/False | -- |
| CCR Rounding Precision | If CCR Rounding Applies is true, rounds the Cumulative Compounded Rate to the specified decimal precision. If CCR Rounding Applies is false, this attribute is ignored. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations.<br>Minimum Value = 1, Maximum Value = 10<br>Default value is 4.<br>For more information, see *CCR Rounding Approach* section.<br>**Note:** The CCR Rounding Precision field is applicable only for Daily Compounding in Arrears calculation method. For information on CCR Rounding, refer to the Daily Compounding in Arrears (Non Cumulative Compounded Rate or NCCR) section. | Optional | Numerical Scale | Rounding is done on the percentage value. |

| Input Attributes | | | | |
|---|---|---|---|---|
| **ARR Calculator App** | **Description and Validation** | **Required/Optional** | **Format** | **Additional Remarks** |
| Legacy Risk Free Rate Floor | Risk Free Rate Floor (percentage) for legacy LIBOR contracts. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. Up to 6 decimals points are supported.<br>Accepted range: -100 to 100<br>For more information, see *Legacy Risk Free Rate Floor* section.<br>**Note: Beginning with version 1.4 and later**, this field is displayed in a common sub-section named **Floor Parameters**. | Optional | Number | -- |
| Spread Adjustment | Spread Adjustment (percentage) during the interest period. Up to 6 decimals points are supported.<br>Accepted range: -100 to 100<br>Default value is 0.<br>**Note: Beginning with version 1.4 and later**, this field is displayed in a common sub-section named **Floor Parameters**. | Optional | Number | Only applicable if Legacy Risk Free Rate Floor is provided. |
| Show Daily Details | Indicates whether the Calculated Compounded Rates in the output appear for all business days (Value = True) OR only for the Calculate Till Date or last business day for the interest period (Value = False), based on whether Calculate Till Date is outside the rates-known window or not, respectively<br>Default value: False. | Optional | True/False | -- |
| Observation Period Shift | Indicates whether Observation Period Shift is applicable or not. Not supported if lockout days is non-zero.<br>Default value is False.<br>For more information, see *Observation Period Shift* section. | Optional | True/False | -- |

### Daily Compounding in Arrears

| Output Attributes – Daily Compounding in Arrears | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| Daily Compounding in Arrears Summary | • If Show Daily Details = True, Daily Compounding in Arrears Summary displays the Average Compounded Rate up to (and including) Calculate Till Date, if it is outside the Rate Known Window, or up to (and including) the interest Period End Date otherwise.<br>• If Show Daily Details = False, displays the Average Compounded Rate only for Calculate Till Date, if it is outside the Rate Known Window, or only for the last business day for the interest period otherwise. | if Calculate Till Date is not provided and rates are known for the interest period, then the output appears for all business days in the interest period else error message will be displayed.<br>The following attributes are supported for multi-record:<br>• Interest Period Date<br>• Interest Period Days<br>• Observation Period Date<br>• Observation Period Days<br>• Published Risk Free Rate<br>• Rate Applied<br>• Risk Free Rate Floor Applied<br>• Compounding Factor<br>• Daily Compounded Rate |
| Interest Period Date | The date in the interest period for which calculated ARR Compounded Rate is displayed in the output.<br>The date is in ISO 8601 Date Format yyyy-mm-dd. | • If Interest Period Start Date is a non-business day, then Interest Period Date for the first Calculated Compounded In Arrears Rates record is same as the Interest Period Start Date<br>• If Calculate Till Date is a non- business day, then the previous business date is shown as Interest Period Date for that Calculated Compounded In Arrears Rates record. |
| Interest Period Days | Number of days in the interest period (from and including the Interest Period Start Date) for which the calculated Compounded Rate is applicable. | When Observation Period shift does not apply, this is same as the rate weightage (ni) in the calculation formula for NCCR. |
| Observation Period Date | The date in the observation period for which the published ARR rate (Rate Applied) and the corresponding weightage of that rate is used for ARR Compounding calculation. Populated only if the Observation Period Shift is True<br>Observation Period is defined as commencing ‘x’ number of "business" days (lookback days) prior to the start (first day) of the interest period.<br>The date is in ISO 8601 Date Format yyyy-mm-dd. | -- |

| Output Attributes – Daily Compounding in Arrears | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| Observation Period Days | Number of days in the observation period (from and including the start of Observation Period).<br>Populated only if the *Observation Period Shift* is true. | When Observation Period shift applies, this is same as the rate weightage (ni) in the calculation formula for NCCR. |
| Lookback Date | **Available in version 1.4 and later.**<br>Lookback Date displays the corresponding date for which the publishedRiskFreeRate is displayed. This date is derived based on the lookBackDays and the interestPeriodDate. Not displayed when:<br>1. lookBackDays is not provided OR<br>2. observationPeriodShift=TRUE | -- |
| Published Risk Free Rate (%) | The published ARR rate applied (percentage) for the Interest Period Date (if Observation Period Shift = false) or Observation Period Date (if Observation Period Shift = true). | -- |
| Rate Applied (%) | The ARR Rate applied (percentage)<br>This field's value is the higher of publishedRiskFreeRate and the riskFreeRateFloor/derivedRiskFreeRateFloor (as applicable). | -- |
| Risk Free Rate Floor Applied | Indicates whether the riskFreeRateFloor value has been factored in for the interestPeriodDate (Value = TRUE) or not (Value = FALSE).<br>The riskFreeRateFloor value is applied on the publishedRiskFreeRate. | This indicator is shown post publishedRiskFreeRate (immediately after rateApplied). |
| Derived Risk Free Rate Floor (%) | The Derived Risk Free Rate Floor Value (percentage) calculated as a difference between legacyRiskFreeRateFloor and spreadAdjustment. Will be displayed only if legacyRiskFreeRateFloor is provided and riskFreeRateFloor is not provided.<br>This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations.<br>The derivedRiskFreeRateFloor value is applied on the publishedRiskFreeRate. | This indicator is shown post publishedRiskFreeRate (immediately after riskFreeRateFloorApplied). |
| Derived Risk Free Rate Floor Applied | Indicates whether the derivedRiskFreeRateFloor value has been factored in for the interestPeriodDate (Value = TRUE) or not (Value = FALSE).<br>This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. | This indicator is shown post publishedRiskFreeRate (immediately after derivedRiskFreeRateFloor). |

| Output Attributes – Daily Compounding in Arrears | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| | The derivedRiskFreeRateFloor value is applied on the publishedRiskFreeRate. | |
| Compounding Factor | Ratio of Daily Compounded Rate and the Rate Applied. | If Rate Applied = 0 for the first interest period date, then the compounding factor is set as 1 else the previous days compounding factor is applied.<br>The Compounding Factor is not rounded as per rate Rounding Decimal Points and is displayed up to 12 decimal points. |
| Daily Compounded Rate | The calculated Daily Compounded Rate (Non Cumulative Compounded Rate) as a percentage, applicable for the interestPeriodDays, rounded to rateRoundingDecimalPoints, if ccrRoundingApplies =false. (dot) is the only character supported for decimal place separator. This field's value provides the calculated Daily Compounded Rate (Non Cumulative Compounded Rate). | If CCR Rounding Applies is set to true, then the unrounded daily Compounded Rate is displayed up to 12 decimals.<br>If CCR Rounding Applies is set to false, then the Daily Compounded Rate rounded as per rate Rounding Decimals is displayed. |
| Last Updated From Source | The most recent timestamp when the published ARR rate data was consumed by the Calculator from Refinitiv.<br>Format in ISO 8601 is “yyyy-MM-dd'T'HH:mm:ssXXX”. | -- |
| Comment | It displays the time stamp when the calculation was completed. Format "Computed time : yyyy-MM-dd 'T' HH:mm:ss z Z." Additionally, it shows the date of the most recent published RFR rate available in the Calculator. It may display additional narration for the calculations performed, as required. | -- |
| Legal Disclaimer | The End User Terms for using the Risk Free Rates as laid out by the respective benchmark provider. | -- |

### Average Compounded in Arrears

| Output Attributes – Average Compounded in Arrears | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| Average Compounded in Arrears Summary | • If Show Daily Details = True, Average Compounded in Arrears Summary displays the Average Compounded Rate up to (and including) Calculate Till Date, if it is outside the Rate Known Window, or up to (and including) the interest Period End Date otherwise. | if Calculate Till Date is not provided and rates are known for the interest period, then the output appears for all business days in the interest period else error message is displayed.<br>The following attributes are supported for multi-record:<br>• Interest Period Date |

| Output Attributes – Average Compounded in Arrears | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| | • If Show Daily Details = False, displays the Average Compounded Rate only for Calculate Till Date, if it is outside the Rate Known Window, or only for the last business day for the interest period otherwise | • Interest Period Days<br>• Observation Period Date<br>• Observation Period Days<br>• Published Risk Free Rate<br>• Rate Applied<br>• Risk Free Rate Floor Applied<br>• Average Compounded Rate |
| Interest Period Date | The date in the interest period for which calculated ARR Compounded Rate is displayed in the output.<br>The date is in ISO 8601 Date Format yyyy-mm-dd. | • If Interest Period Start Date is a non-business day, then Interest Period Date for the first Calculated Compounded In Arrears Rates record is same as the Interest Period Start Date<br>• If Calculate Till Date is a non- business day, then the previous business date is shown as Interest Period Date for that Calculated Compounded In Arrears Rates record. |
| Interest Period Days | Number of days in the interest period (from and including the Interest Period Start Date) for which the calculated Compounded Rate is applicable. | When Observation Period shift does not apply, this is same as the rate weightage (ni) in the calculation formula for NCCR. |
| Observation Period Date | The date in the observation period for which the published ARR rate (Rate Applied) and the corresponding weightage of that rate is used for ARR Compounding calculation. Populated only if the Observation Period Shift is True<br>Observation Period is defined as commencing 'x' number of "business" days (lookback days) prior to the start (first day) of the interest period.<br>The date is in ISO 8601 Date Format yyyy-mm-dd. | -- |
| Observation Period Days | Number of days in the observation period (from and including the start of Observation Period).<br>Populated only if the *Observation Period Shift* is true.<br>The date is in ISO 8601 Date Format yyyy-mm-dd. | When Observation Period shift applies, this is same as the rate weightage (ni) in the calculation formula for NCCR. |

| Output Attributes – Average Compounded in Arrears | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| Lookback Date | **Available in version 1.4 and later.**<br>Lookback Date displays the corresponding date for which the publishedRiskFreeRate is displayed. This date is derived based on the lookBackDays and the interestPeriodDate. Not displayed when:<br>1. lookBackDays is not provided OR<br>2. observationPeriodShift=TRUE | -- |
| Published Risk Free Rate (%) | The published ARR rate applied (percentage) for the Interest Period Date (if Observation Period Shift = false) or Observation Period Date (if Observation Period Shift = true). | -- |
| Rate Applied (%) | The ARR Rate applied (percentage)<br>This field's value is the higher of publishedRiskFreeRate and the riskFreeRateFloor/derivedRiskFreeRateFloor(as applicable). | -- |
| Risk Free Rate Floor Applied | Indicates whether the riskFreeRateFloor value has been factored in for the interestPeriodDate (Value = TRUE) or not (Value = FALSE).<br>The riskFreeRateFloor value is applied on the publishedRiskFreeRate. | This indicator is shown post publishedRiskFreeRate (immediately after rateApplied). |
| Derived Risk Free Rate Floor (%) | The Derived Risk Free Rate Floor Value (percentage) calculated as a difference between legacyRiskFreeRateFloor and spreadAdjustment. Will be displayed only if legacyRiskFreeRateFloor is provided and riskFreeRateFloor is not provided.<br>This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations.<br>The derivedRiskFreeRateFloor value is applied on the publishedRiskFreeRate. | This indicator is shown post publishedRiskFreeRate (immediately after rateApplied). |
| Derived Risk Free Rate Floor Applied | Indicates whether the derivedRiskFreeRateFloor value has been factored in for the interestPeriodDate (Value = TRUE) or not (Value = FALSE).<br>This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations.<br>The derivedRiskFreeRateFloor value is applied on the publishedRiskFreeRate. | This indicator is shown post publishedRiskFreeRate (immediately after rateApplied). |

| Output Attributes – Average Compounded in Arrears | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| Average Compounded in Arrears Rate | The calculated Average Compounded in Arrears Rate (percentage), applicable for the interestPeriodDays, rounded to rateRoundingDecimalPoints. (dot) is the only character supported for decimal place separator.<br>This field's value provides the calculated Average Compounded in Arrears Rate. | -- |
| Last Updated From Source | The most recent timestamp when the published ARR rate data was consumed by the Calculator from Refinitiv.<br>Format in ISO 8601 is “yyyy-MM-dd'T'HH:mm:ssXXX”. | -- |
| Comment | It displays the time stamp when the calculation was completed. Format "Computed time : yyyy-MM-dd 'T' HH:mm:ss z Z." Additionally, it shows the date of the most recent published RFR rate available in the Calculator. It may display additional narration for the calculations performed, as required. | -- |
| Legal Disclaimer | The End User Terms for using the Risk Free Rates as laid out by the respective benchmark provider. | -- |

### Simple ARR

| Output Attributes – Simple ARR | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| Simple ARR Summary | • If Show Daily Details = True, Simple ARR Summary displays the daily ARR Rates up to (and including) Calculate Till Date, if it is outside the Rate Known Window, or up to (and including) the Interest Period End Date otherwise.<br>• If Show Daily Details = False, displays the Simple ARR Summary only for Calculate Till Date, if it is outside the Rate Known Window, or only for the last business day for the interest period otherwise. | • If Interest Period Start Date is not provided but Interest Period End Date is provided, the output appears for all business days from Calculate Till Date to interest Period End Date (Show Daily Details = True) OR only for the Calculate Till Date or last business day for the interest period (Show Daily Details = False), based on whether Calculate Till Date is outside the rates-known window or not, respectively .<br>• If Interest Period End Date is not provided but Interest Period Start Date is provided, the output appear for all business days from Interest Period Start Date to calculate Till Date (Show Daily Details = True) OR only for the Calculate Till Date (Show Daily Details = False) |

| Output Attributes – Simple ARR | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| | | • If both Interest Period Start Date and Interest Period End Date are not provided, the output appears for the Calculate Till Date.<br>The following attributes are supported for multi-record:<br>• Interest Period Date<br>• Interest Period Days<br>• Published Risk Free Rate<br>• Rate Applied<br>• Risk Free Rate Floor Applied |
| Interest Period Date | The date in the interest period for which calculated ARR Compounded Rate is displayed in the output.<br>The date is in ISO 8601 Date Format yyyy-mm-dd. | • If Interest Period Start Date is a non-business day, then Interest Period Date for the first Calculated Compounded In Arrears Rates record is same as the Interest Period Start Date<br>• If Calculate Till Date is a non- business day, then the previous business date is shown as Interest Period Date for that Calculated Compounded In Arrears Rates record." |
| Interest Period Days | Number of days in the interest period (from and including the Interest Period Start Date) for which the calculated Compounded Rate is applicable. | When Observation Period shift does not apply, this is same as the rate weightage (ni) in the calculation formula for NCCR. |
| Lookback Date | **Available in version 1.4 and later.**<br>Lookback Date displays the corresponding date for which the publishedRiskFreeRate is displayed. This date is derived based on the lookBackDays and the interestPeriodDate. Not displayed when:<br>1. lookBackDays is not provided OR<br>2. observationPeriodShift=TRUE | **--** |
| Observation Period Date | The date in the observation period for which the published ARR rate (Rate Applied) and the corresponding weightage of that rate is used for ARR Compounding calculation. Populated only if the Observation Period Shift is True<br>Observation Period is defined as commencing 'x' number of "business" days (lookback days) prior to the start (first day) of the interest period.<br>The date is in ISO 8601 Date Format yyyy-mm-dd. | -- |

| Output Attributes – Simple ARR | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| Observation Period Days | Number of days in the observation period (from and including the start of Observation Period).<br>Populated only if the *Observation Period Shift* is true.<br>The date is in ISO 8601 Date Format yyyy-mm-dd. | When Observation Period shift applies, this is same as the rate weightage (ni) in the calculation formula for NCCR. |
| Published Risk Free Rate (%) | The published ARR rate applied (percentage) for the Interest Period Date (if Observation Period Shift = false) or Observation Period Date (if Observation Period Shift = true). | -- |
| Rate Applied (%) | The ARR Rate applied (percentage), after factoring in the Risk Free Rate Floor value, for the Interest Period Date.<br>If the published risk-free rate is lower than the floor value, Rate Applied = Risk Free Rate Floor. Otherwise, Rate Applied = Published Risk Free Rate. | -- |
| Risk Free Rate Floor Applied | Indicates whether the Rate Applied has factored the Risk Free Rate Floor value, for the Interest Period Date (Value = true) or not (Value = false). | -- |
| Derived Risk Free Rate Floor (%) | The Derived Risk Free Rate Floor Value (percentage) calculated as a difference between Legacy Risk Free Rate Floor and Spread Adjustment. Is displayed only if Legacy Risk Free Rate Floor is provided and Risk Free Rate Floor is not provided.<br>This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. | -- |
| Derived Risk Free Rate Floor Applied | Indicates whether the Rate Applied has factored in the Derived Risk Free Rate Floor value, for the Interest Period Date (Value = true) or not (Value = false). Is displayed only if Legacy Risk Free Rate Floor is provided and Risk Free Rate Floor is not provided.<br>This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. | -- |
| Last Updated From Source | The most recent timestamp when the published ARR rate data was consumed by the Calculator from Refinitiv.<br>Format in ISO 8601 is “yyyy-MM-dd'T'HH:mm:ssXXX”. | -- |
| Comment | It displays the time stamp when the calculation was completed. Format "Computed time : yyyy-MM-dd 'T' HH:mm:ss z Z." Additionally, it shows the date | -- |

| Output Attributes – Simple ARR | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| | of the most recent published RFR rate available in the Calculator. It may display additional narration for the calculations performed, as required. | |
| Legal Disclaimer | The End User Terms for using the Risk Free Rates as laid out by the respective benchmark provider. | -- |

### Simple Average

| Output Attributes – Simple Average | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| Simple Average Summary | • If Show Daily Details = True, Simple Average Summary displays the Simple Average Rate up to (and including) Calculate Till Date, if it is outside the Rate Known Window, or up to (and including) the Interest Period End Date otherwise.<br>• If Show Daily Details = False, Simple Average Summary displays the Simple Average Rate only for Calculate Till Date, if it is outside the Rate Known Window, or only for the last business day for the interest period otherwise. | • if Calculate Till Date is not provided and rates are known for the interest period, then the output appears for all business days in the interest period else error message is displayed |
| Interest Period Date | The date in the interest period for which calculated ARR Compounded Rate is displayed in the output.<br>The date is in ISO 8601 Date Format yyyy-mm-dd. | • If Interest Period Start Date is a non-business day, then Interest Period Date for the first Calculated Compounded In Arrears Rates record is same as the Interest Period Start Date<br>• If Calculate Till Date is a non- business day, then the previous business date is shown as Interest Period Date for that Calculated Compounded In Arrears Rates record. |
| Interest Period Days | Number of days in the interest period (from and including the Interest Period Start Date) for which the calculated Compounded Rate is applicable. | When Observation Period shift does not apply, this is same as the rate weightage (ni) in the calculation formula for NCCR. |

| Output Attributes – Simple Average | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| Lookback Date | **Available in version 1.4 and later.**<br>Lookback Date displays the corresponding date for which the publishedRiskFreeRate is displayed. This date is derived based on the lookBackDays and the interestPeriodDate. Not displayed when:<br>1. lookBackDays is not provided OR<br>2. observationPeriodShift=TRUE | -- |
| Observation Period Date | The date in the observation period for which the published ARR rate (Rate Applied) and the corresponding weightage of that rate is used for ARR Compounding calculation. Populated only if the Observation Period Shift is True<br>Observation Period is defined as commencing 'x' number of "business" days (lookback days) prior to the start (first day) of the interest period.<br>The date is in ISO 8601 Date Format yyyy-mm-dd. | -- |
| Observation Period Days | Number of days in the observation period (from and including the start of Observation Period).<br>Populated only if the *Observation Period Shift* is true. | When Observation Period shift applies, this is same as the rate weightage (ni) in the calculation formula for NCCR. |
| Published Risk Free Rate (%) | The published ARR rate applied (percentage) for the Interest Period Date (if Observation Period Shift = false) or Observation Period Date (if Observation Period Shift = true). | -- |
| Rate Applied (%) | The ARR Rate applied (percentage), after factoring in the Risk Free Rate Floor value, for the Interest Period Date.<br>If the published risk-free rate is lower than the floor value, Rate Applied = Risk Free Rate Floor. Otherwise, Rate Applied = Published Risk Free Rate. | -- |
| Risk Free Rate Floor Applied | Indicates whether the Rate Applied has factored the Risk Free Rate Floor value, for the Interest Period Date (Value = true) or not (Value = false). | -- |
| Derived Risk Free Rate Floor (%) | The Derived Risk Free Rate Floor Value (percentage) calculated as a difference between Legacy Risk Free Rate Floor and Spread Adjustment. Is displayed only if Legacy Risk Free Rate Floor is provided and Risk Free Rate Floor is not provided.<br>This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. | -- |

| Output Attributes – Simple Average | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| Derived Risk Free Rate Floor Applied | Indicates whether the Rate Applied has factored in the Derived Risk Free Rate Floor value, for the Interest Period Date (Value = true) or not (Value = false). Is displayed only if Legacy Risk Free Rate Floor is provided and Risk Free Rate Floor is not provided.<br>This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. | -- |
| Simple Average Rate | The calculated Simple Average Rate, applicable for the Interest Period Days, rounded to Rate Rounding Decimal Points. | |
| Last Updated From Source | The most recent timestamp when the published ARR rate data was consumed by the Calculator from Refinitiv.<br>Format in ISO 8601 is “yyyy-MM-dd'T'HH:mm:ssXXX”. | -- |
| Comment | It displays the time stamp when the calculation was completed. Format "Computed time : yyyy-MM-dd 'T' HH:mm:ss z Z." Additionally, it shows the date of the most recent published RFR rate available in the Calculator. It may display additional narration for the calculations performed, as required. | -- |
| Legal Disclaimer | The End User Terms for using the Risk Free Rates as laid out by the respective benchmark provider. | -- |

## 3.2 Interest Calculator

The Alternative Reference Rates supported are SOFR, SONIA, ESTR, TONAR, and SORA.

The supported Calculation Methods are:

- **Daily Compounding in Arrears** – Calculates the ARR rate based on Daily Compounding in Arrears (Non-Cumulative Compounded Rate) and accrued interest amounts for the provided loan parameters such as interest period dates, loan balance amount, and so on, and other ARR parameters, using the daily published risk-free reference rate.
- **Average Compounded in Arrears** – Calculates the ARR rate based on Average Compounded in Arrears and accrued interest amounts for the provided loan parameters such as interest period dates, loan balance amount, and so on, and other ARR parameters, using the daily published risk-free reference rate.

- **Simple ARR** – Applies the Simple ARR method and calculates the accrued interest amounts for the provided loan parameters such as interest period dates, loan balance amount, and so on, and other ARR parameters, using the daily published risk-free reference rate.

  **Note:** Simple ARR calculation method is not available for ESTR, TONAR, and SORA.

- **Simple Average** – Calculates the ARR rate based on Simple Average and accrued interest amounts for the provided loan parameters such as interest period dates, loan balance amount, and so on, and other ARR parameters, using the daily published risk-free reference rate.

**Notes:**

- For sample ARR Calculator App reference image for Interest Calculator calculation, click here.
- For sample ARR Calculator App reference image for principal amount change, click here.
- For more information on calculation methods and related attributes, refer to the *Calculation Methods* section.
- Legacy Risk Free Rate Floor is applicable for all the calculation methods. For information on Legacy Risk Free Rate Floor, refer to the *Legacy Risk Free Rate Floor* section.
- The CCR Rounding Applies and CCR Rounding Precision fields are applicable only for Daily Compounding in Arrears calculation method. For information on CCR Rounding, refer to the *Daily Compounding in Arrears (Non Cumulative Compounded Rate or NCCR)* section.
- Lookback Date (output attribute) is not applicable for *Tenor Rates Calculator* and *Rates using Index Calculator*.
- For data restrictions on the supported RFRs, refer to the *Third-Party Data Restrictions* section.

### 3.2.1 Interest Calculator – ARR Calculator App Attributes

The following section lists the user input attributes (request) and the expected output attributes (response).

| Input Attributes | | | | |
|---|---|---|---|---|
| **ARR Calculator App** | **Description and Validation** | **Required/Optional** | **Format** | **Additional Remarks** |
| Risk Free Rate | The name of the Risk Free Rate /Alternative Reference Rate<br>Supported RFRs: SOFR, SONIA, SORA, ESTR, TONAR. | Required | -- | -- |
| Interest Period Start Date | The start date of the interest period from (and including) which the ARR Compounding Calculation must be performed.<br>The date can be selected from the drop-down calendar or entered in mm/dd/yyyy format. | Required | Date | -- |

| Input Attributes | | | | |
|---|---|---|---|---|
| **ARR Calculator App** | **Description and Validation** | **Required/Optional** | **Format** | **Additional Remarks** |
| Interest Period End Date | The end date of the interest period to (and including) which the ARR compounding calculation should be performed.<br>The date can be selected from the drop-down calendar or entered in mm/dd/yyyy format. | Required | Date | • It is also used by the Calculator to identify if the interest period is in the rates known window or not.<br>• If Calculate Till Date is not provided, the interest period end date can be an intermediate date in the interest period up to (and including) which the compounded rates are calculated. |
| Initial Principal Balance | Principal Balance as on the Interest Period Start Date. Currency assumed is USD if Risk Free Rate = SOFR, GBP if Risk Free Rate = SONIA, EUR if Risk Free Rate = ESTR, JPY if Risk Free Rate = TONAR, SGD if Risk Free Rate = SORA. | Required | Number | -- |
| Risk Free Rate Floor | The Floor value (as a percentage) for the published risk-free reference rate.<br>Accepts up to 6 decimal points.<br>Accepted range: -100 to 100<br>**Note: Beginning with version 1.4 and later**, this field is displayed in a common sub-section named **Floor Parameters**. | Optional | Number | -- |
| Legacy Risk Free Rate Floor | Risk Free Rate Floor (percentage) for legacy LIBOR contracts. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. Up to 6 decimals points are supported.<br>For more information, see *Legacy Risk Free Rate Floor* section.<br>**Note: Beginning with version 1.4 and later**, this field is displayed in a common sub-section named **Floor Parameters**. | Optional | Number | -- |

| Input Attributes | | | | |
|---|---|---|---|---|
| **ARR Calculator App** | **Description and Validation** | **Required/Optional** | **Format** | **Additional Remarks** |
| All in Rate Floor | The Floor value (as a percentage) for the all in rate.<br>Accepts up to 6 decimal points.<br>Accepted range: -100 to 100<br>**Note: Beginning with version 1.4 and later**, this field is displayed in a common sub-section named **All in Rate Parameters**. | Optional | Number | -- |
| All in Rate Cap | The Cap value (as a percentage) for the all in rate.<br>Accepts up to 6 decimal points.<br>Accepted range: -100 to 100<br>**Note: Beginning with version 1.4 and later**, this field is displayed in a common sub-section named **All in Rate Parameters**. | Optional | Number | -- |
| Look back Days | Lookback days refers to the fixed date (business days prior to) from which the calculator is expected to use the published Risk Free Rate/Alternative Reference Rate<br>Minimum Value = 0 (Default), Maximum Value = 99<br>For more information, see *Lookback Days* section. | Optional | Number | -- |
| Lock out Days | Lockout days refers to the period (business days) in which the applicable ARR is derived using Lookback days and applied to all the days defined as Lockout days<br>Minimum Value = 0 (Default), Maximum Value = 99, and Default Value = 0<br>For more information, see *Lockout Days* section. | Optional | Number | -- |
| Observation Period Shift | Indicates whether Observation Period Shift is applicable or not. Not supported if lockout days is non-zero<br>Default value is False.<br>For more information, see *Observation Period Shift* section. | Optional | True/False | -- |

| Input Attributes | | | | |
|---|---|---|---|---|
| **ARR Calculator App** | **Description and Validation** | **Required/Optional** | **Format** | **Additional Remarks** |
| Spread | Spread (percentage) applicable during the interest period.<br>Default Value: 0.00%. Up to 6 decimals points are supported.<br>Accepted range: -100 to 100<br>Default value is 0.<br>**Note: Beginning with version 1.4 and later**, this field is displayed in a common sub-section named **All in Rate Parameters**. | Optional | Number | -- |
| Spread Adjustment | Spread Adjustment (percentage) during the interest period.<br>Default Value: 0.00%.<br>Accepted range: -100 to 100<br>Default value is 0.<br>**Note: Beginning with version 1.4 and later**, this field is displayed in a common sub-section named **All in Rate Parameters**. | Optional | Number | -- |
| Day Count Convention | The Day Count Conventions supported. Valid Value are - ACT/360, ACT/365, and ACT/ACT.<br>Default value: for SOFR = ACT/360, for SONIA = ACT/365, ESTR = ACT/360, TONAR = ACT/365, SORA = ACT/365. | Optional | Drop-down List | -- |
| CCR Rounding Applies | Indicates whether rounded Cumulative Compounded Rate is used to calculate the Daily Compounded Rate (Value = True) or not (Value = False). This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations.<br>Default value is false. | Optional | True/False | -- |
| CCR Rounding Precision | If CCR Rounding Applies is true, rounds the Cumulative Compounded Rate to the specified decimal precision. If CCR Rounding Applies is false, this attribute is ignored. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations.<br>Minimum Value = 1, Maximum Value = 10<br>Default value is 4.<br>For more information, see *CCR Rounding Approach* section. | Optional | Numerical Scale | Rounding is done on the percentage value. |

| Input Attributes | | | | |
|---|---|---|---|---|
| **ARR Calculator App** | **Description and Validation** | **Required/Optional** | **Format** | **Additional Remarks** |
| Rate Rounding Decimal Points | Rounds the calculated ARR Compounded Rate to the specified decimal precision.<br>Minimum Value = 2, Maximum Value = 12<br>Default value: SOFR = 5, SONIA = 4, ESTR = 4, TONAR = 5, SORA = 4. | Optional | Numerical Scale | Rate rounding is done on the percentage value of the calculated ARR Compounded Rate. Rate Rounding Decimal Points is not considered when CCR Rounding Applies is set to true. |
| Payment Rounding | Rule to round the calculated interest accrued amounts.<br>Default Value: Nearest<br>Enum: [ ACTUAL, UP, DOWN, NEAREST ] | Optional | Drop-down List | -- |
| Principal Amount Change | The amount of the Principal Change. Principal Decreases are negative.<br>Principal Change Currency is assumed as USD if Risk Free Rate = SOFR, GBP if Risk Free Rate = SONIA, EUR if Risk Free Rate = ESTR, JPY if Risk Free Rate = TONAR, SGD if Risk Free Rate = SORA.<br>**Note:** This field is displayed when the **Add Amount Change** button is clicked. | Optional | Numerical Scale | The App displays an error if Principal changes beyond *Calculate Till Date* are provided in the input. |
| Date | Date from which the Principal change is effective from.<br>The date can be selected from the drop-down calendar or entered in mm/dd/yyyy format.<br>**Note:** This field is displayed when the **Add Amount Change** button is clicked. | Optional | Date | -- |
| Current Amount | Displays the amount entered in the Initial Principal Balance field. | Automatically Populated | Number | - |
| Show Daily Details | Indicates whether the Calculated Compounded Rates in the output appear for all business days (Value = True) OR only for the Calculate Till Date or last business day for the interest period (Value = False), based on whether Calculate Till Date is outside the rates-known window or not, respectively<br>Default value: False | Optional | True/False | -- |

| Input Attributes | | | | |
|---|---|---|---|---|
| **ARR Calculator App** | **Description and Validation** | **Required/Optional** | **Format** | **Additional Remarks** |
| Calculate Till Date | The Date up to (and including) which the calculated compounded rates are expected in the output.<br>The date can be selected from the drop-down calendar or entered in mm/dd/yyyy format.<br>**Note:** If the rates are known on Calculate Till Date, then the output appears for the entire business cycle, else the output appears only until the Calculate Till Date (if rates are available). | Optional | Date | -- |

### Daily Compounding in Arrears

| Output Attributes – Daily Compounding in Arrears | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| Daily Compounding in Arrears Summary | • If Show Daily Details = True, Daily Compounding in Arrears Summary displays the Average Compounded Rate up to (and including) Calculate Till Date, if it is outside the Rate Known Window, or up to (and including) the interest Period End Date otherwise.<br>• If Show Daily Details = False, displays the Average Compounded Rate only for Calculate Till Date, if it is outside the Rate Known Window, or only for the last business day for the interest period otherwise. | If Calculate Till Date is not provided and rates are known for the interest period, then the output appears for all business days in the interest period else error message is displayed.<br>The following attributes are supported for multi-record:<br>• Interest Period Date<br>• Interest Period Days<br>• Observation Period Date<br>• Observation Period Days<br>• Principal Balance<br>• Published Risk Free Rate<br>• Rate Applied<br>• Risk Free Rate Floor Applied<br>• Daily Compounded Rate<br>• All In Rate<br>• Interest Amount |

| Output Attributes – Daily Compounding in Arrears | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| | | • Cumulative Interest Amount |
| Principal Balance | Principal balance as on Interest Period Date | -- |
| Lookback Date | **Available in version 1.4 and later.**<br>Lookback Date displays the corresponding date for which the publishedRiskFreeRate is displayed. This date is derived based on the lookBackDays and the interestPeriodDate. Not displayed when:<br>1. lookBackDays is not provided OR<br>2. observationPeriodShift=TRUE | **--** |
| Interest Period Date | The date in the interest period for which calculated ARR Compounded Rate is displayed in the output.<br>The date is in ISO 8601 Date Format yyyy-mm-dd. | • If interest Period StartDate is a non-business day, then Interest Period Date for the first Calculated Daily Compounding Interest record is same as the interest Period Start Date<br>• If Calculate Till Date is a non- business day, then the previous business date is shown as Interest Period Date for that Calculated Daily Compounding Interest record. |
| Interest Period Days | Number of days in the interest period (from and including the Interest Period Start Date) for which the calculated Compounded Rate is applicable | -- |
| Observation Period Date | The date in the observation period for which the published ARR rate (Rate Applied) and the corresponding weightage of that rate is used for ARR Compounding calculation. Populated only if the Observation Period Shift is True<br>Observation Period is defined as commencing 'x' number of "business" days (lookback days) prior to the start (first day) of the interest period.<br>The date is in ISO 8601 Date Format yyyy-mm-dd | -- |
| Observation Period Days | Number of days in the observation period (from and including the start of Observation Period).<br>Populated only if the *Observation Period Shift* is True | -- |
| Published Risk Free Rate (%) | The published ARR rate applied for the interest Period Date (if Observation Period Shift = false) or Observation Period Date (if Observation Period Shift = true) | -- |

| Output Attributes – Daily Compounding in Arrears | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| Rate Applied (%) | The ARR Rate applied (percentage)<br>This field's value is the higher of publishedRiskFreeRate and the riskFreeRateFloor/derivedRiskFreeRateFloor(as applicable). | -- |
| Risk Free Rate Floor Applied | Indicates whether the riskFreeRateFloor value has been factored in for the interestPeriodDate (Value = TRUE) or not (Value = FALSE).<br>The riskFreeRateFloor value is applied on the publishedRiskFreeRate. | This indicator is shown post publishedRiskFreeRate (immediately after rateApplied). |
| Compounding Factor | Ratio of Daily Compounded Rate and the Rate Applied | If Rate Applied = 0 for the first interest period date, then the compounding factor is set as 1 else the previous days compounding factor is applied.<br>The Compounding Factor is not rounded as per Rate Rounding Decimal Points and is displayed up to 12 decimal points. |
| Daily Compounded Rate (%) | The calculated Daily Compounded Rate (Non Cumulative Compounded Rate) as a percentage, applicable for the interestPeriodDays, rounded to rateRoundingDecimalPoints, if ccrRoundingApplies =false. (dot) is the only character supported for decimal place separator.This field's value provides the calculated Daily Compounded Rate (Non Cumulative Compounded Rate). | If CCR Rounding Applies is set to true, then the unrounded Daily Compounded Rate is displayed up to 12 decimals. If CCR Rounding Applies is set to false, then the Daily Compounded Rate rounded as per Rate Rounding Decimals is displayed. |
| All in Rate Floor Applied | Indicates whether the All In Rate has factored the All In Rate Floor value, for the Interest Period Date (Value = true) or not (Value = false). Appears only if All In Rate Floor is provided | -- |
| All in Rate Cap Applied | Indicates whether the All In Rate has factored the risk Free Cap Floor value, for the Interest Period Date (Value = True) or not (Value = False). Appears only if All In Rate Cap is provided. | -- |
| Calculated All in Rate | The calculated All-in Rate before applying the All in Rate Cap or Floor. Equals sum of Average Compounded Rate, spread, and Spread Adjustment, rounded to Rounding Decimal Points. Appears only if all In Rate Floor or All In Rate Cap is provided. | If CCR Rounding Applies is set to true, then the Calculated All In Rate as sum of unrounded Daily Compounded Rate, Spread and Spread Adjustment and is displayed up to 12 decimals, else (CCR Rounding Applies is set to false) Calculated All In Rate as sum of rounded daily Compounded Rate, spread and Spread Adjustment rounded as per Rate Rounding Decimal Points. |

| Output Attributes – Daily Compounding in Arrears | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| All in Rate | The All-in Rate applied, after factoring in the All In Rate Floor or All In Rate Cap value, to the Calculated All In Rate Value, based on the following criteria, rounded to Rate Rounding Decimal Points. This field is used for accrued interest computation.<br>• If the Calculated All In Rate is lower than the All In Rate Floor value, Rate Applied = All In Rate Floor.<br>• If the Calculated All In Rate is greater than the All In Rate Cap value, Rate Applied = All In Rate Cap.<br>Otherwise, All In Rate = Calculated All In Rate. | If CCR Rounding Applies is set to true, then the All-in Rate applied displays unrounded value up to 12 decimals, else (CCR Rounding Applies is set to false) All-in Rate applied is rounded as per Rate Rounding Decimal Points. |
| Derived Risk Free Rate Floor (%) | The Derived Risk Free Rate Floor Value (percentage) calculated as a difference between legacyRiskFreeRateFloor and spreadAdjustment. Will be displayed only if legacyRiskFreeRateFloor is provided and riskFreeRateFloor is not provided.<br>This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations.<br>The derivedRiskFreeRateFloor value is applied on the publishedRiskFreeRate. | This indicator is shown post publishedRiskFreeRate (immediately after rateApplied). |
| Derived Risk Free Rate Floor Applied | Indicates whether the derivedRiskFreeRateFloor value has been factored in for the interestPeriodDate (Value = TRUE) or not (Value = FALSE).<br>This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations.<br>The derivedRiskFreeRateFloor value is applied on the publishedRiskFreeRate. | This indicator is shown post publishedRiskFreeRate (immediately after rateApplied). |
| Interest Amount | Calculated interest accrued amount from (and including) the Interest Period Date to (but excluding) the next business day.<br>Rate Basis used for interest computation is as per Day Count Convention. | Interest amount calculated for each interest period date is rounded as per Payment Rounding. |
| Cumulative Interest Amount | Calculated cumulative interest accrued amount for all the Interest Period Days from (and including) the Interest Period Start Date.<br>Rate Basis used for interest computation is as per Day Count Convention. | Unrounded interest amount for each Interest Period Date is consider for calculating the cumulative Interest Amount and the final value is rounded as per Payment Rounding. |
| Currency Code | Currency code for the Principal Balance and Cumulative Interest Amount | |
| Last Updated From Source | The most recent timestamp when the published ARR rate data was consumed by the Calculator from Refinitiv.<br>Format in ISO 8601 is “yyyy-MM-dd'T'HH:mm:ssXXX” | -- |

| Output Attributes – Daily Compounding in Arrears | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| Comment | It displays the time stamp when the calculation was completed. Format "Computed time : yyyy-MM-dd 'T' HH:mm:ss z Z." Additionally, it shows the date of the most recent published RFR rate available in the Calculator. It may display additional narration for the calculations performed, as required. | -- |
| Legal Disclaimer | The End User Terms for using the Risk Free Rates as laid out by the respective benchmark provider. | -- |

### Average Compounded in Arrears

| Output Attributes – Average Compounded in Arrears | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| Average Compounded in Arrears Summary | • If Show Daily Details = True, Average Compounded in Arrears Summary displays the Average Compounded Rate up to (and including) Calculate Till Date, if it is outside the Rate Known Window, or up to (and including) the interest Period End Date otherwise.<br>• If Show Daily Details = False, displays the Average Compounded Rate only for Calculate Till Date, if it is outside the Rate Known Window, or only for the last business day for the interest period otherwise. | if Calculate Till Date is not provided and rates are known for the interest period, then the output appears for all business days in the interest period else error message is displayed.<br>The following attributes are supported for multi-record:<br>• Interest Period Date<br>• Interest Period Days<br>• Observation Period Date<br>• Observation Period Days<br>• Principal Balance<br>• Published Risk Free Rate<br>• Rate Applied<br>• Risk Free Rate Floor Applied<br>• Average Compounded Rate<br>• All In Rate<br>• Cumulative Interest Amount |

| Output Attributes – Average Compounded in Arrears | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| Principal Balance | Principal balance as on Interest Period Date | -- |
| Lookback Date | **Available in version 1.4 and later.**<br>Lookback Date displays the corresponding date for which the publishedRiskFreeRate is displayed. This date is derived based on the lookBackDays and the interestPeriodDate. Not displayed when:<br>1. lookBackDays is not provided OR<br>2. observationPeriodShift=TRUE | -- |
| Interest Period Date | The date in the interest period for which calculated ARR Compounded Rate is displayed in the output.<br>The date is in ISO 8601 Date Format yyyy-mm-dd. | • If interest Period StartDate is a non-business day, then Interest Period Date for the first Calculated Daily Compounding Interest record is same as the interest Period Start Date<br>• If Calculate Till Date is a non- business day, then the previous business date is shown as Interest Period Date for that Calculated Daily Compounding Interest record. |
| Interest Period Days | Number of days in the interest period (from and including the Interest Period Start Date) for which the calculated Compounded Rate is applicable | -- |
| Observation Period Date | The date in the observation period for which the published ARR rate (Rate Applied) and the corresponding weightage of that rate is used for ARR Compounding calculation. Populated only if the Observation Period Shift is True<br>Observation Period is defined as commencing 'x' number of "business" days (lookback days) prior to the start (first day) of the interest period.<br>The date is in ISO 8601 Date Format yyyy-mm-dd | -- |
| Observation Period Days | Number of days in the observation period (from and including the start of Observation Period).<br>Populated only if the *Observation Period Shift* is True | -- |
| Published Risk Free Rate (%) | The published ARR rate applied for the interest Period Date (if Observation Period Shift = false) or Observation Period Date (if Observation Period Shift = true) | -- |
| Rate Applied (%) | The ARR Rate applied (percentage) | -- |

| Output Attributes – Average Compounded in Arrears | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| | This field's value is the higher of publishedRiskFreeRate and the riskFreeRateFloor/derivedRiskFreeRateFloor(as applicable). | |
| Risk Free Rate Floor Applied | Indicates whether the riskFreeRateFloor value has been factored in for the interestPeriodDate (Value = TRUE) or not (Value = FALSE).<br>The riskFreeRateFloor value is applied on the publishedRiskFreeRate. | This indicator is shown post publishedRiskFreeRate (immediately after derivedRiskFreeRateFloor). |
| Average Compounded Rate (%) | The calculated Average Compounded in Arrears Rate (percentage), applicable for the interestPeriodDays, rounded to rateRoundingDecimalPoints. (dot) is the only character supported for decimal place separator.<br>This field's value provides the calculated Average Compounded in Arrears Rate. | -- |
| All in Rate Floor Applied | Indicates whether the All In Rate has factored the All In Rate Floor value, for the Interest Period Date (Value = true) or not (Value = false). Appears only if All In Rate Floor is provided | -- |
| All in Rate Cap Applied | Indicates whether the All In Rate has factored the risk Free Cap Floor value, for the Interest Period Date (Value = True) or not (Value = False). Appears only if All In Rate Cap is provided. | -- |
| Calculated All in Rate | The calculated All-in Rate before applying the All in Rate Cap or Floor. Equals sum of Average Compounded Rate, spread, and Spread Adjustment, rounded to Rounding Decimal Points. Appears only if all In Rate Floor or All In Rate Cap is provided. | If CCR Rounding Applies is set to true, then the Calculated All In Rate as sum of unrounded Daily Compounded Rate, Spread and Spread Adjustment and is displayed up to 12 decimals, else (CCR Rounding Applies is set to false) Calculated All In Rate as sum of rounded daily Compounded Rate, spread and Spread Adjustment rounded as per Rate Rounding Decimal Points. |
| All in Rate | The All-in Rate applied, after factoring in the All In Rate Floor or All In Rate Cap value, to the Calculated All In Rate Value, based on the following criteria, rounded to Rate Rounding Decimal Points. This field is used for accrued interest computation.<br>• If the Calculated All In Rate is lower than the All In Rate Floor value, Rate Applied = All In Rate Floor.<br>• If the Calculated All In Rate is greater than the All In Rate Cap value, Rate Applied = All In Rate Cap.<br>Otherwise, All In Rate = Calculated All In Rate. | If CCR Rounding Applies is set to true, then the All-in Rate applied displays unrounded value up to 12 decimals, else (CCR Rounding Applies is set to false) All-in Rate applied is rounded as per Rate Rounding Decimal Points. |

| Output Attributes – Average Compounded in Arrears | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| Derived Risk Free Rate Floor (%) | The Derived Risk Free Rate Floor Value (percentage) calculated as a difference between legacyRiskFreeRateFloor and spreadAdjustment. Will be displayed only if legacyRiskFreeRateFloor is provided and riskFreeRateFloor is not provided.<br>This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations.<br>The derivedRiskFreeRateFloor value is applied on the publishedRiskFreeRate. | This indicator is shown post publishedRiskFreeRate (immediately after derivedRiskFreeRateFloor). |
| Derived Risk Free Rate Floor Applied | Indicates whether the derivedRiskFreeRateFloor value has been factored in for the interestPeriodDate (Value = TRUE) or not (Value = FALSE).<br>This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations.<br>The derivedRiskFreeRateFloor value is applied on the publishedRiskFreeRate. | This indicator is shown post publishedRiskFreeRate (immediately after derivedRiskFreeRateFloor). |
| Cumulative Interest Amount | Calculated cumulative interest accrued amount for all the Interest Period Days from (and including) the Interest Period Start Date.<br>Rate Basis used for interest computation is as per Day Count Convention. | Unrounded interest amount for each Interest Period Date is consider for calculating the cumulative Interest Amount and the final value is rounded as per Payment Rounding. |
| Currency Code | Currency code for the Principal Balance and Cumulative Interest Amount | |
| Last Updated From Source | The most recent timestamp when the published ARR rate data was consumed by the Calculator from Refinitiv.<br>Format in ISO 8601 is “yyyy-MM-dd'T'HH:mm:ssXXX” | -- |
| Comment | It displays the time stamp when the calculation was completed. Format "Computed time : yyyy-MM-dd 'T' HH:mm:ss z Z." Additionally, it shows the date of the most recent published RFR rate available in the Calculator. It may display additional narration for the calculations performed, as required. | -- |
| Legal Disclaimer | The End User Terms for using the Risk Free Rates as laid out by the respective benchmark provider. | -- |

### Simple ARR

| Output Attributes – Simple ARR | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| Simple ARR Summary | • If Show Daily Details = True, Simple ARR Summary displays the daily ARR Rates up to (and including) Calculate Till Date, if it is outside the Rate Known Window, or up to (and including) the Interest Period End Date otherwise.<br>• If Show Daily Details = False, displays the Simple ARR Summary only for Calculate Till Date, if it is outside the Rate Known Window, or only for the last business day for the interest period otherwise. | If Calculate Till Date is not provided and rates are known for the interest period, then the output appears for all business days in the interest period else error message is displayed.<br>The following attributes are supported for multi-record:<br>• Interest Period Date<br>• Interest Period Days<br>• Published Risk Free Rate<br>• Rate Applied<br>• Risk Free Rate Floor Applied<br>• Interest Amount<br>• All In Rate<br>• Cumulative Interest Amount |
| Principal Balance | Principal balance as on Interest Period Date | -- |
| Lookback Date | **Available in version 1.4 and later.**<br>Lookback Date displays the corresponding date for which the publishedRiskFreeRate is displayed. This date is derived based on the lookBackDays and the interestPeriodDate. Not displayed when:<br>1. lookBackDays is not provided OR<br>2. observationPeriodShift=TRUE | • -- |
| Interest Period Date | The date in the interest period for which calculated ARR Compounded Rate is displayed in the output.<br>The date is in ISO 8601 Date Format yyyy-mm-dd. | • If interest Period StartDate is a non-business day, then Interest Period Date for the first Calculated Daily Compounding Interest record is same as the interest Period Start Date<br>• If Calculate Till Date is a non- business day, then the previous business date is shown as Interest |

| Output Attributes – Simple ARR | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| | | Period Date for that Calculated Daily Compounding Interest record. |
| Interest Period Days | Number of days in the interest period (from and including the Interest Period Start Date) for which the calculated Compounded Rate is applicable | -- |
| Observation Period Date | The date in the observation period for which the published ARR rate (Rate Applied) and the corresponding weightage of that rate is used for ARR Compounding calculation. Populated only if the Observation Period Shift is True<br>Observation Period is defined as commencing 'x' number of "business" days (lookback days) prior to the start (first day) of the interest period.<br>The date is in ISO 8601 Date Format yyyy-mm-dd | -- |
| Observation Period Days | Number of days in the observation period (from and including the start of Observation Period).<br>Populated only if the *Observation Period Shift* is True | -- |
| Published Risk Free Rate (%) | The published ARR rate applied for the interest Period Date (if Observation Period Shift = false) or Observation Period Date (if Observation Period Shift = true) | -- |
| Rate Applied (%) | The ARR Rate applied, after factoring in the Risk Free Rate Floor value, for the interest Period Date.<br>If the published risk-free rate is lower than the floor value, Rate Applied = Risk Free Rate Floor. Otherwise, rate Applied = Published Risk Free Rate | -- |
| Risk Free Rate Floor Applied | Indicates whether the Rate Applied has factored the Risk Free Rate Floor value, for the Interest Period Date (Value = True) or not (Value = False). | -- |
| All in Rate Floor Applied | Indicates whether the All In Rate has factored the All In Rate Floor value, for the Interest Period Date (Value = true) or not (Value = false). Appears only if All In Rate Floor is provided | -- |
| All in Rate Cap Applied | Indicates whether the All In Rate has factored the risk Free Cap Floor value, for the Interest Period Date (Value = True) or not (Value = False). Appears only if All In Rate Cap is provided. | -- |
| Calculated All in Rate | The calculated All-in Rate before applying the All in Rate Cap or Floor. Equals sum of Average Compounded Rate, spread, and Spread Adjustment, rounded to Rounding Decimal Points. Appears only if all In Rate Floor or All In Rate Cap is provided. | If CCR Rounding Applies is set to true, then the Calculated All In Rate as sum of unrounded Daily Compounded Rate, Spread and Spread Adjustment |

| Output Attributes – Simple ARR | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| | | and is displayed up to 12 decimals, else (CCR Rounding Applies is set to false) Calculated All In Rate as sum of rounded daily Compounded Rate, spread and Spread Adjustment rounded as per Rate Rounding Decimal Points. |
| All in Rate | The All-in Rate applied, after factoring in the All In Rate Floor or All In Rate Cap value, to the Calculated All In Rate Value, based on the following criteria, rounded to Rate Rounding Decimal Points. This field is used for accrued interest computation.<br>• If the Calculated All In Rate is lower than the All In Rate Floor value, Rate Applied = All In Rate Floor.<br>• If the Calculated All In Rate is greater than the All In Rate Cap value, Rate Applied = All In Rate Cap.<br>Otherwise, All In Rate = Calculated All In Rate. | If CCR Rounding Applies is set to true, then the All-in Rate applied displays unrounded value up to 12 decimals, else (CCR Rounding Applies is set to false) All-in Rate applied is rounded as per Rate Rounding Decimal Points. |
| Derived Risk Free Rate Floor (%) | The Derived Risk Free Rate Floor Value (percentage) calculated as a difference between Legacy Risk Free Rate Floor and Spread Adjustment. Is displayed only if Legacy Risk Free Rate Floor is provided and Risk Free Rate Floor is not provided.<br>This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. | -- |
| Derived Risk Free Rate Floor Applied | Indicates whether the Rate Applied has factored in the Derived Risk Free Rate Floor value, for the Interest Period Date (Value = True) or not (Value = False). Is displayed only if Legacy Risk Free Rate Floor is provided and Risk Free Rate Floor is not provided.<br>This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. | -- |
| Interest Amount | Calculated interest accrued amount from (and including) the Interest Period Date to (but excluding) the next business day.<br>Rate Basis used for interest computation is as per Day Count Convention. | Interest amount calculated for each interest period date is rounded as per Payment Rounding. |
| Cumulative Interest Amount | Calculated cumulative interest accrued amount for all the Interest Period Days from (and including) the Interest Period Start Date.<br>Rate Basis used for interest computation is as per Day Count Convention. | Unrounded interest amount for each Interest Period Date is consider for calculating the cumulative Interest Amount and the final value is rounded as per Payment Rounding. |
| Currency Code | Currency code for the Principal Balance and Cumulative Interest Amount | |

| Output Attributes – Simple ARR | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| Last Updated From Source | The most recent timestamp when the published ARR rate data was consumed by the Calculator from Refinitiv.<br>Format in ISO 8601 is “yyyy-MM-dd'T'HH:mm:ssXXX” | -- |
| Comment | It displays the time stamp when the calculation was completed. Format "Computed time : yyyy-MM-dd 'T' HH:mm:ss z Z." Additionally, it shows the date of the most recent published RFR rate available in the Calculator. It may display additional narration for the calculations performed, as required. | -- |
| Legal Disclaimer | The End User Terms for using the Risk Free Rates as laid out by the respective benchmark provider. | -- |

### Simple Average

| Output Attributes – Simple Average | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| Simple Average Summary | • If show Daily Details = True, Simple Average Summary displays the Simple Average Rate up to (and including) Calculate Till Date, if it is outside the Rate Known Window, or up to (and including) the Interest Period End Date otherwise.<br>• If Show Daily Details = False, Simple Average Summary displays the Simple Average Summary only for Calculate Till Date, if it is outside the Rate Known Window, or only for the last business day for the interest period otherwise. | if Calculate Till Date is not provided and rates are known for the interest period, then the output appears for all business days in the interest period else error message is displayed |
| Principal Balance | Principal balance as on Interest Period Date | -- |
| Interest Period Date | The date in the interest period for which calculated ARR Compounded Rate is displayed in the output.<br>The date is in ISO 8601 Date Format yyyy-mm-dd. | • If interest Period StartDate is a non-business day, then Interest Period Date for the first Calculated Daily Compounding Interest record is same as the interest Period Start Date<br>• If Calculate Till Date is a non- business day, then the previous business date is shown as Interest Period Date for that Calculated Daily Compounding Interest record. |

| Output Attributes – Simple Average | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| Interest Period Days | Number of days in the interest period (from and including the Interest Period Start Date) for which the calculated Compounded Rate is applicable | -- |
| Lookback Date | **Available in version 1.4 and later.**<br>Lookback Date displays the corresponding date for which the publishedRiskFreeRate is displayed. This date is derived based on the lookBackDays and the interestPeriodDate. Not displayed when:<br>1. lookBackDays is not provided OR<br>2. observationPeriodShift=TRUE | -- |
| Observation Period Date | The date in the observation period for which the published ARR rate (Rate Applied) and the corresponding weightage of that rate is used for ARR Compounding calculation. Populated only if the Observation Period Shift is True<br>Observation Period is defined as commencing 'x' number of "business" days (lookback days) prior to the start (first day) of the interest period.<br>The date is in ISO 8601 Date Format yyyy-mm-dd | -- |
| Observation Period Days | Number of days in the observation period (from and including the start of Observation Period).<br>Populated only if the *Observation Period Shift* is True | -- |
| Published Risk Free Rate (%) | The published ARR rate applied for the interest Period Date (if Observation Period Shift = false) or Observation Period Date (if Observation Period Shift = true) | -- |
| Rate Applied (%) | The ARR Rate applied, after factoring in the Risk Free Rate Floor value, for the interest Period Date.<br>If the published risk-free rate is lower than the floor value, Rate Applied = Risk Free Rate Floor. Otherwise, rate Applied = Published Risk Free Rate | -- |
| Risk Free Rate Floor Applied | Indicates whether the Rate Applied has factored the Risk Free Rate Floor value, for the Interest Period Date (Value = True) or not (Value = False). | -- |
| Simple Average Rate (%) | The calculated Simple Average Rate (percentage), applicable for the Interest Period Days, rounded to Rate Rounding Decimal Points | -- |

| Output Attributes – Simple Average | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| All in Rate Floor Applied | Indicates whether the All In Rate has factored the All In Rate Floor value, for the Interest Period Date (Value = true) or not (Value = false). Appears only if All In Rate Floor is provided | -- |
| All in Rate Cap Applied | Indicates whether the All In Rate has factored the risk Free Cap Floor value, for the Interest Period Date (Value = True) or not (Value = False). Appears only if All In Rate Cap is provided. | -- |
| Calculated All in Rate | The calculated All-in Rate before applying the All in Rate Cap or Floor. Equals sum of Average Compounded Rate, spread, and Spread Adjustment, rounded to Rounding Decimal Points. Appears only if all In Rate Floor or All In Rate Cap is provided. | If CCR Rounding Applies is set to true, then the Calculated All In Rate as sum of unrounded Daily Compounded Rate, Spread and Spread Adjustment and is displayed up to 12 decimals, else (CCR Rounding Applies is set to false) Calculated All In Rate as sum of rounded daily Compounded Rate, spread and Spread Adjustment rounded as per Rate Rounding Decimal Points. |
| All in Rate | The All-in Rate applied, after factoring in the All In Rate Floor or All In Rate Cap value, to the Calculated All In Rate Value, based on the following criteria, rounded to Rate Rounding Decimal Points. This field is used for accrued interest computation.<br>• If the Calculated All In Rate is lower than the All In Rate Floor value, Rate Applied = All In Rate Floor.<br>• If the Calculated All In Rate is greater than the All In Rate Cap value, Rate Applied = All In Rate Cap.<br>Otherwise, All In Rate = Calculated All In Rate. | If CCR Rounding Applies is set to true, then the All-in Rate applied displays unrounded value up to 12 decimals, else (CCR Rounding Applies is set to false) All-in Rate applied is rounded as per Rate Rounding Decimal Points. |
| Derived Risk Free Rate Floor (%) | The Derived Risk Free Rate Floor Value (percentage) calculated as a difference between Legacy Risk Free Rate Floor and Spread Adjustment. Is displayed only if Legacy Risk Free Rate Floor is provided and Risk Free Rate Floor is not provided.<br>This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. | -- |
| Derived Risk Free Rate Floor Applied | Indicates whether the Rate Applied has factored in the Derived Risk Free Rate Floor value, for the Interest Period Date (Value = True) or not (Value = False). Is displayed only if Legacy Risk Free Rate Floor is provided and Risk Free Rate Floor is not provided.<br>This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. | -- |

| Output Attributes – Simple Average | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| Cumulative Interest Amount | Calculated cumulative interest accrued amount for all the Interest Period Days from (and including) the Interest Period Start Date.<br>Rate Basis used for interest computation is as per Day Count Convention. | Unrounded interest amount for each Interest Period Date is consider for calculating the cumulative Interest Amount and the final value is rounded as per Payment Rounding. |
| Currency Code | Currency code for the Principal Balance and Cumulative Interest Amount | |
| Last Updated From Source | The most recent timestamp when the published ARR rate data was consumed by the Calculator from Refinitiv.<br>Format in ISO 8601 is “yyyy-MM-dd'T'HH:mm:ssXXX” | -- |
| Comment | It displays the time stamp when the calculation was completed. Format "Computed time : yyyy-MM-dd 'T' HH:mm:ss z Z." Additionally, it shows the date of the most recent published RFR rate available in the Calculator. It may display additional narration for the calculations performed, as required. | -- |
| Legal Disclaimer | The End User Terms for using the Risk Free Rates as laid out by the respective benchmark provider. | -- |

## 3.3 Tenor Rates Calculator

Calculates the Average Compounded in Arrears rate for a set of tenors (7 days, 30 days, and so on) for the provided date and other ARR parameters, by leveraging the daily published risk-free reference rate. Wherever the published compounded averages are available for a specific tenor, the compounded average value is retrieved as is. The Alternative Reference Rates supported are SOFR and SONIA.

- For sample ARR Calculator App reference image for Tenor Rates, click here.

### 3.3.1 Tenors Rates Calculator – ARR Calculator App Attributes

**Note:** Applies to Average Compounded in Arrears methodology only.

The following section lists the user input attributes (request) and the expected output attributes (response).

| Input Attributes | | | | |
|---|---|---|---|---|
| **ARR Calculator App** | **Description and Validation** | **Required/Optional** | **Format** | **Additional Remarks** |
| Risk Free Rate | The name of the Risk Free Rate/Alternative Reference Rate.<br>Supported RFRs: SOFR, SONIA | Required | -- | -- |
| Value Date | The date corresponding to one calendar day following the interest period end date. For Compounding in Advance use cases, this date corresponds to the start of the interest period.<br>Interest period end date corresponds to the date to (and including) which the ARR compounding calculation is performed.<br>Aligns with the definition of publication date of SOFR compounded averages by New York Federal Reserve.<br>The date can be selected from the drop-down calendar or entered in mm/dd/yyyy format | Required | Date | -- |

| Input Attributes | | | | |
|---|---|---|---|---|
| **ARR Calculator App** | **Description and Validation** | **Required/Optional** | **Format** | **Additional Remarks** |
| Tenor | Tenor(s) for which the ARR Compounded Rates are needed. Each Tenor corresponds to an interest period starting (and including) exact number of calendar days in the Tenor before the Value Date, to (but excluding) the Value Date.<br>Available values: 7D, 30D, 60D, 90D, 180D, 360D<br>'D' denotes the number of calendar days<br>If no value is provided, then Compounded in Arrears Rates are displayed for all the 6 tenors in the output. | Optional | Drop-down List | -- |
| Day Count Convention | The Day Count Conventions supported. Valid Value are - ACT/360, ACT/365, and ACT/ACT.<br>Default value: for SOFR = ACT/360, for SONIA = ACT/365, ESTR = ACT/360, TONAR = ACT/365, SORA = ACT/365 | Optional | Drop-down List | -- |
| Rounding Decimal Points | Rounds the calculated Average Compounded in arrears Rate to the specified decimal precision.<br>Not applicable to SOFR compounded averages for standard tenors (30D, 90D and 180D) published by New York Federal Reserve that are displayed as is in the output.<br>Minimum Value = 2, Maximum Value = 12<br>**Note:** Default value for SOFR is 5 decimal points, for SONIA is 4 decimal points. | Optional | Numerical Scale | -- |

| Output Attributes | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| Tenor Rates Summary | -- | The following attributes are supported for multi-record:<br>• Interest Period Date<br>• Interest Period Days<br>• Average Compounded Rate<br>• Published Rate |

| Output Attributes | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| Tenor | Tenor(s) for which the ARR Compounded in Arrears Rates are displayed. | -- |
| Interest Period Start Date | The start date of the interest period from (and including) which the ARR Compounding Calculation should be performed.<br>The date is in ISO 8601 Date Format yyyy-mm-dd. | -- |
| Interest Period End Date | The end date to (and including) which the ARR compounding calculation should be performed. This can correspond either to the interest accrual end date or in certain cases, any intermediate date in the interest period up to (and including) which the ARR Compounding Calculation is needed.<br>The date is in ISO 8601 Date Format yyyy-mm-dd. | -- |
| Average Compounded Rate | If published Rate is false, the calculated Average Compounded in Arrears Rate for the tenor, rounded to rate Rounding Decimal Points.<br>If Published Rate is true, SOFR compounded averages for standard tenors (30D, 90D and 180D) published by New York Federal Reserve are displayed.<br>. (dot) is the only character supported for decimal place separator. | -- |
| Published Rate | Indicates if Average Compounded Rate (percentage) is a calculated rate (Value = false) or a published rate (Value = true). | -- |
| Comment | It displays the time stamp when the calculation was completed. Format "Computed time : yyyy-MM-dd 'T' HH:mm:ss z Z." Additionally, it shows the date of the most recent published RFR rate available in the Calculator. It may display additional narration for the calculations performed, as required. | -- |
| Last Updated From Source | The most recent timestamp when the published ARR rate data was consumed by the Calculator from Refinitiv.<br>Format in ISO 8601 is "yyyy-MM-dd'T'HH:mm:ssXXX” | -- |
| Legal Disclaimer | The End User Terms for using the Risk Free Rates as laid out by the respective benchmark provider. | -- |

## 3.4 Rates using Index Calculator

Calculates the Average Compounded in Arrears Rate for the provided index start/end dates by leveraging the daily published SOFR Index. The Alternative Reference Rates supported are SOFR.

- For reference image for SOFR Index, click here.

### 3.4.1 Rates using Index Calculator – ARR Calculator App Attributes

**Note:** Applies to Average Compounded in Arrears methodology only. This functionality is only applicable for SOFR.

The following section lists the user input attributes (request) and the expected output attributes (response).

| Input Attributes | | | | |
|---|---|---|---|---|
| **ARR Calculator App** | **Description and Validation** | **Required/Optional** | **Format** | **Additional Remarks** |
| Risk Free Rate | The name of the Risk Free Rate /Alternative Reference Rate Supported RFR: SOFR | Required | -- | -- |
| Index Start Date | The Value/Publication Date of the ARR Index corresponding to the start of the interest period. Index Start Date and Index End Date cannot be the same.<br>The date can be selected from the drop-down calendar or entered in mm/dd/yyyy format | Required | Date | -- |
| Index End Date | The Value/Publication Date of the ARR Index corresponding to one calendar day following the interest period end date. Index Start Date and Index End Date cannot be the same.<br>The date can be selected from the drop-down calendar or entered in mm/dd/yyyy format | Required | Date | -- |
| Day Count Convention | The Day Count Conventions supported. Valid Value are - ACT/360, ACT/365, and ACT/ACT.<br>Default value: for SOFR = ACT/360, for SONIA = ACT/365, ESTR = ACT/360, TONAR = ACT/365, SORA = ACT/365 | Required | Drop-down List | -- |

| Input Attributes | | | | |
|---|---|---|---|---|
| **ARR Calculator App** | **Description and Validation** | **Required/Optional** | **Format** | **Additional Remarks** |
| Rounding Decimal Points | Rounds the calculated Average Compounded in arrears Rate to the specified decimal precision.<br>Minimum Value = 2, Maximum Value = 12<br>Default value for SOFR = 5. | Required | Number | -- |

| Output Attributes | | |
|---|---|---|
| **ARR Calculator App** | **Description** | **Additional Remarks** |
| Effective Start Date | Corresponds to *Index Start Date*. | This attribute is supported for multi-record. |
| Effective End Date | Corresponds To *index End Date*. | This attribute is supported for multi-record. |
| Average Compounded Rate | The calculated Average Compounded in Arrears Rate (percentage) using the index value, rounded to *Rounding Decimal Points*.<br>This rate corresponds to the interest period starting from (and including) the Index Start Date to (and excluding) the Index End Date. | This attribute is supported for multi-record. |
| Index At Effective Start Date | ARR index value for value date equal to *Index Start Date* | This attribute is supported for multi-record. |
| Index At Effective End Date | ARR index value for value date equal to *Index End Date* | This attribute is supported for multi-record. |
| Comment | It displays the time stamp when the calculation was completed. Format "Computed time : yyyy-MM-dd 'T' HH:mm:ss z Z." Additionally, it shows the date of the most recent published RFR rate available in the Calculator. It may display additional narration for the calculations performed, as required. | -- |
| Last Updated From Source | The most recent timestamp when the published ARR rate data was consumed by the Calculator from Refinitiv.<br>Format in ISO 8601 is "yyyy-MM-dd'T'HH:mm:ssXXX". | -- |
| Legal Disclaimer | The End User Terms for using the Risk Free Rates as laid out by the respective benchmark provider. | -- |

# 4 Official Sources of Market Data

The latest SOFR rate data (SOFR rate, SOFR Compounded Averages, and SOFR Index), SONIA*, ESTR, TONAR and SORA are retrieved and made available in the Calculator from Refinitiv. This includes any republication of the rates, wherever applicable.

***Note:** SONIA rate for all the calculation methods is retrieved from Refinitiv, except for Simple ARR calculation method. For Simple ARR method **only**, the SONIA rate is pulled in from the Bank of England Website and is available two (2) working days after the date to which it relates to. See Rate Availability section below for more details.

**Rate Availability**

Latest rates are pulled in from Refinitiv within a short period of time of them being made available to Refinitiv by the respective benchmark administrators.

For Simple ARR method **only**, the SONIA rate is pulled in from the Bank of England Website and is available two (2) working days after the date to which it relates to, within a short period of time of it being published on the Bank of England website.

> For example, on a given business day, say 2020-05-13 (Wednesday), the Calculator has SONIA rate related to 2020-05-11 (Monday) as the most recent SONIA rate **for Simple ARR method only**
>
> As another example, post a long weekend in the UK, 2020-05-23 (Saturday) to 2020-05-25 (Monday), on 2020-05-26 (Tuesday), the Calculator has SONIA rate related to 2020-05-21 (Thursday) as the most recent SONIA rate **for Simple ARR method only**

The following attributes in the output provide information on the RFR rates availability in the Calculator:

- "*Last Updated From Source*" provides the most recent timestamp when the rate data was retrieved from Refinitiv (or the Bank of England website, in case of SONIA for Simple ARR method, as elaborated in the note mentioned above).

  In a scenario where a particular RFR rate is republished by its benchmark administrator, a "*Last Updated From Source*" timestamp value that is after the republication cut-off time indicates that the republished rate has been retrieved by the Calculator.

- "*Comments*" now additionally provide the date of the most recent published rate available in the ARR calculator.

## 4.1 Third-Party Data Restrictions

Following are the third-party data restrictions for accessing the market data from the Fusion LIBOR Transition Calculator Web App.

- SOFR:

  Use subject to New York Fed Terms of Use for Select Rate Data. New York Fed has no liability for your use. Refer the following link for more details:
  https://www.newyorkfed.org/markets/reference-rates-terms-of-use

- SONIA

  SONIA and SONIA Compounded Index are copyright the Bank of England. The trademarks "Bank of England" and "SONIA" are registered trademarks of the Bank of England. All Rights Reserved. The SONIA benchmark and SONIA Compounded Index include the proprietary information of the Bank of England and the data comprising the SONIA benchmark and SONIA Compounded Index may not be copied or distributed except as specifically authorized. The SONIA benchmark and SONIA Compounded Index are not intended to be relied upon as authoritative or taken in substitution for the exercise of judgement and do not constitute

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- ESTR

  Use of euro short-term rate (€STR) is subject to the ECB's €STR disclaimer under https://www.ecb.europa.eu/stats/financial_markets_and_interest_rates/euro_short-term_rate/html/index.en.html#disclaimer.

- SORA

  SORA-related statistics, the 1-month, 3-month and 6-month Compounded SORA rates, and the SORA Index, are provided on an "as is" basis, without warranties of any kind. MAS shall not be liable for any damage or loss, which may arise from reliance on such data obtained from the MAS website. Please refer to the Terms of Use (https://www.mas.gov.sg/terms-of-use) on accessing and using any part of the MAS website.

- TONAR

  Use of TONAR is subject to the Bank of Japan's Terms of Use ; see https://www.boj.or.jp/en/statistics/outline/exp/data/exmutan2.pdf.

- **The Refinitiv Data**

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# 5 Supported Alternative Reference Rates Conventions

**Fusion LIBOR Transition Calculator** (hereafter referred to as ARR Calculator App) supports the following Alternative Reference Rates (ARR) conventions. These conventions are also supported in **Fusion Loan IQ** in the exact same way.

- Calculation Methods
  - Average Compounded In Arrears (Cumulative Compounded Rate or CCR)
  - Daily Compounding in Arrears (Non-Cumulative Compounded Rate or NCCR)
  - Simple ARR
  - Simple Average
- Rate Basis
- Lookback Days
- Lockout Days
- Spread Adjustment
- Observation Period Shift
- Rates Known Window
- Legacy Risk Free Rate Floor
- Compounded ARR Period Averages
- ARR Index

## 5.1 Calculation Methods

The supported calculation methods in Fusion LIBOR Transition Calculator solution are Average Compounded In Arrears and Daily Compounding in Arrears (Non Cumulative Compounded Rate).

### 5.1.1 Average Compounded In Arrears (Cumulative Compounded Rate or CCR)

In this method, the solution uses the reference rates published, calculates the Compounded in Arrears Rate for the Interest Period based on the loan parameters provided, then applies the Compounded Rate from the Cycle Start Date (for each business day in the interest period).

The following is the formula for calculation of Interest Rate:

R *Compounded Average Rate* =

$$\left[ \prod_{i=1}^{d_b} \left(1 + \frac{n_i \times r_i}{N}\right) - 1 \right] \times \frac{N}{d_c}$$

Where,

| | |
|---|---|
| $d_b$ | the number of business days for the Alternative Reference Rate (ARR). The alternative reference rate is published for each business day (value date). |
| $d_c$ | the number of calendar days in the interest period |
| $r_i$ | the interest rate applicable on ARR business day *i* |
| $n_i$ | the number of calendar days for which the rate $r_i$ applies. On most days, $n_i$ will be 1, but on a Friday, it will generally be 3, and it will also be larger than 1 on the business day before a holiday. This can also be stated as the number of calendar days from and including business days *I* to but excluding the following business day. |

| | |
|---|---|
| N | the market convention for quoting the number of days in the year (in the United States, the convention for money markets is N = 360, while in the UK it is N=365). |

$R_m$ *Compounded to date Average Rate for day m* =

$$\left[ \prod_{i=1}^{d_{bm}} (1 + \frac{n_i \times r_i}{N}) \quad - 1 \right] \times \frac{N}{d_{cm}}$$

**Sample Calculation:**

| Compounded in Arrears | | | | | | |
|---|---|---|---|---|---|---|
| Interest Period 19-Aug to 26 Aug | | | | Rate Basis | 360 N | |
| Days | Date | Rate (%) | Principal | Interest Factor | Compounded to Date Rate | Cumulative Accrual |
| $n_i$ | | $r_i$ | | | $R_m$ | |
| 3 | 23-Aug-19 | 2.10 | 10000000 | 1.000175000 | 2.10460% | 4092.28 |
| 1 | 22-Aug-19 | 2.09 | 10000000 | 1.000058056 | 2.10769% | 2341.87 |
| 1 | 21-Aug-19 | 2.10 | 10000000 | 1.000058333 | 2.11346% | 1761.21 |
| 1 | 20-Aug-19 | 2.13 | 10000000 | 1.000059167 | 2.12006% | 1177.81 |
| 1 | 19-Aug-19 | 2.11 | 10000000 | 1.000058611 | 2.11000% | 586.11 |
| Compounded Average Rate (%) | | 2.10460 R | | | | |
| Interest for the Period | | 4092.28 | | | | |

## 5.1.2 Daily Compounding in Arrears (Non-Cumulative Compounded Rate or NCCR)

### 5.1.2.1 With CCR Rounding Approach

The Cumulative Compounded Rate (CCR) Rounding approach is introduced as recommended by Sterling RFR Working Group to calculate Non-Cumulative Compounded Rate. This approach ensures that that for a given interest period, the interest amounts for Non-Cumulative Compounded Rate (NCCR) with CCR Rounding (without Observation Period Shift) and Compounded in Arrears with the same rounding precision when principal is constant must match. (For details on CCR Rounding Approach with Observation Period Shift, refer to section 5.6.1.3)

**Note:** The cumulative interest amount for the interest period matches between CCR and NCCR methods for the same interest period with constant principal.

In this method, the solution uses the rounded annualized cumulative compounded rate basis which the unannualized cumulative compounded rate is arrived. The unannualized cumulative compounded rate is used to arrive at the unrounded non-cumulative compounded rate

The following is the formula for calculation of Interest Rate:

Step 1: Annualised Cumulative Compounded Rate ($ACR_i$)

$$\left[ \prod_{i=1}^{d_b} (1 + \frac{n_i \times r_i}{N}) \quad - 1 \right] \times \frac{N}{d_c}$$

**Note:** $ACRi$ must be rounded daily to CCR rounding precision.

Step 2: Unannualised Cumulative Compounded RFR ($UCR_i$)

$$ACR_i \text{ x } \frac{tn_i}{N}$$

**Note:** $UCRi$ must not be rounded.

Step 3: Non-Cumulative Compounded RFR ($NCR_i$)

$$= \left(UCR_i - UCR_{i\,-\,1BD}\right) \mathrm{x} \frac{N}{n_i}$$

**Note:** $NCRi$ must not be rounded

Where,

| | |
|---|---|
| $d_b$ | the number of business days for the Alternative Reference Rate (ARR). The alternative reference rate is published for each business day (value date). |
| $d_c$ | the number of calendar days in the interest period |
| $r_i$ | the interest rate applicable on ARR business day *i* |
| $n_i$ | the number of calendar days for which the rate $r_i$ applies. On most days, $n_i$ will be 1, but on a Friday, it will generally be 3, and it will also be larger than 1 on the business day before a holiday. This can also be stated as the number of calendar days from and including business days *I* to but excluding the following business day. |
| tni | total number of *ni* as of the relevant Business Day within the Interest Period. |
| N | the market convention for quoting the number of days in the year |
| BD | Business Day for the specific RFR |

**Sample NCCR Calculations using CCR Rounding Approach**

Interest period: 19-Aug-19 to 26-Aug-19

| Date | Principal Amount | Days | Rate Applied | Annualised Cumulative Compounded RFR (Step 1) | Unannualised Cumulative Compounded RFR (Step 2) | Non Cumulative Compounded RFR (Step 3) | Interest Amount | Cumulative Interest Amount |
|---|---|---|---|---|---|---|---|---|
| 26 Aug 2019 | 1000000000 | 1 | 2.1 | 2.104100000000% | 0.00046757778 | 2.100600000000% | 58,350.00 | 467,577.78 |
| 23 Aug 2019 | 1000000000 | 3 | 2.1 | 2.104600000000% | 0.00040922778 | 2.100466666667% | 175,038.89 | 409,227.78 |
| 22 Aug 2019 | 1000000000 | 1 | 2.09 | 2.107700000000% | 0.00023418889 | 2.090300000000% | 58,063.89 | 234,188.89 |
| 21 Aug 2019 | 1000000000 | 1 | 2.1 | 2.113500000000% | 0.00017612500 | 2.100300000000% | 58,341.67 | 176,125.00 |
| 20 Aug 2019 | 1000000000 | 1 | 2.13 | 2.120100000000% | 0.00011778333 | 2.130200000000% | 59,172.22 | 117,783.33 |
| 19 Aug 2019 | 1000000000 | 1 | 2.11 | 2.110000000000% | 0.00005861111 | 2.110000000000% | 58,611.11 | 58,611.11 |

**Note:** Calculation of Cumulative Interest amount using CCR method for the same interest period is **467,577.78**. This value matches with the Cumulative Interest amount calculated using NCCR as shown in the table above.

### 5.1.2.2 Without CCR Rounding Approach

In this method, the solution uses the reference rates published, calculates Compounded Rate Daily based on the loan parameters provided, then applies Daily Compounded Rate for that Day.

The following is the formula for calculation of Interest Rate:

$R_m$ *Compounded Rate for the day m in the interest Cycle* =

$$[P_m - P_{m-1}] \times \frac{N}{n_i}$$

$P_m$ *Compounded interest factor for day m in the interest cycle ( P0= 0)* =

$$\left[ \prod_{i=1}^{d_m} (1 + \frac{n_i \times r_i}{N}) \right] - 1$$

Where,

| | |
|---|---|
| $d_m$ | the number of business days for the Alternative Reference Rate (ARR) till day m (inclusive). The alternative reference rate is published for each ARR business day (value date). |
| $r_i$ | the interest rate applicable on ARR business day *i* |
| $n_i$ | the number of calendar days for which the rate ri applies. On most days, ni will be 1, but on a Friday, it will generally be 3, and it will also be larger than 1 on the business day before a holiday. This can also be stated as the number of calendar days from and including business days I to but excluding the following business day. |
| N | the market convention for quoting the number of days in the year (in the United States, the convention for money markets is N = 360, while in the UK it is N=365). |
| *i* | represents a series of ordinal numbers representing each business day in the interest period. |

**Sample Calculation:**

| Daily Compounded Rate | | | | | | |
|---|---|---|---|---|---|---|
| Interest Period 19-Aug to 26 Aug | | | | Rate Basis | 360 N | |
| Days | Date | Rate (%) | Principal | Comp. Interest Factor | Compounded Daily Rate | Cumulative Accrual |
| $n_i$ | | $r_i$ | | $P_m$ | $R_m$ | |
| 3 | 23-Aug-19 | 2.10 | 10000000 | 0.000409228 | 2.10049% | 4092.28 |
| 1 | 22-Aug-19 | 2.09 | 10000000 | 0.000234187 | 2.09037% | 2341.87 |
| 1 | 21-Aug-19 | 2.10 | 10000000 | 0.000176121 | 2.10025% | 1761.21 |
| 1 | 20-Aug-19 | 2.13 | 10000000 | 0.000117781 | 2.13012% | 1177.81 |
| 1 | 19-Aug-19 | 2.11 | 10000000 | 0.000058611 | 2.11000% | 586.11 |
| Interest for the Period | | 4092.28 | | | | |

### 5.1.3 Simple ARR

In this calculation method, the Calculator directly references the daily published reference rate, based on lookback and lockout days, and directly uses it as the applied rate for interest accrual calculations. To clarify, this calculation method does **not** perform any compounding average calculations on the published reference rates.

### 5.1.4 Simple Average

In this method, the solution uses the Simple average rates for the Interest Period based on the loan parameters provided, then applies the Simple Average Rate from the Cycle Start Date (for each business day in the interest period).

The following is the formula for calculation of Interest Rate:

$$Simple\ Interest\ Formula = \left[ \sum_{i=1}^{d_b} \left( \frac{r_i \times n_i}{N} \right) \right] \times \frac{N}{d_c}$$

Where,

| | |
|---|---|
| $d_b$ | the number of business days in the interest period |
| $d_c$ | the number of calendar days in the interest period |

| | |
|---|---|
| $r_i$ | the interest rate applicable on ARR business day *i* |
| $n_i$ | the number of calendar days for which the rate $r_i$ applies. On most days, $n_i$ will be 1, but on a Friday, it will generally be 3, and it will also be larger than 1 on the business day before a holiday. This will be as per the ARR business calendar. |
| N | the market convention for quoting the number of days in the year (in the United States, the convention for money markets is N = 360, while in the UK it is N=365). |
| *i* | represents a series of ordinal numbers representing each business day in the period. |

## 5.2 Rate Basis

For the purpose of Compounded Base Rate calculation, Fusion LIBOR Transition Calculator currently supports the following Rate Basis:

- Actual/360
- Actual/365, and
- Actual/Actual

## 5.3 Lookback Days

Lookback days refers to the fixed date (business days prior to) from which the system is expected to derive and use ARR to calculate interest. This functionality is designed to provide timely notice of payment at the end of an interest period. Flexibility of defining the Lookback days is introduced in Fusion LIBOR Transition Calculator.

For example,

| | |
|---|---|
| **Start Date** | 01-Jul-2019 |
| **Repricing Frequency** | 1 Months |
| **End Date** | 31-Jul-2019 |
| **Current Business Day** | 25-Jul-2019<br>If the user performs accruals on this day, owing to the pricing delay/lag for SOFR (T+1), the system may not contain rates to compute interest for the accrual period.<br>To avoid such situations, the user can define Lookback days (usually 3 to 5 business days prior to the end of interest period. For example, *3*), so that on 25-Jul-2019 the interest calculated, for the cycle will be based on the ARR applicable on *22-Jul-2019*. |

**Note:** If the start day of the interest period is a non-business day as per the ARR calendar, the start day of the Lookback will be **k** business days preceding the first business day of the Interest Period. This means that the same rate will be used for the non-business days and the first business day under the daily compounded rate calculation method. In case of Compounded In Arrears calculation method, determination of start date of the Lookback will be as if the interest period has commenced on the first working day of the interest period.

## 5.4 Lockout Days

Lockout days refers to the period (business days) in which the applicable ARR is derived using Lookback days and applied to all the days defined as Lockout days (usually 2 to 5 days). Flexibility of defining the Lockout days is introduced in Fusion LIBOR Transition Calculator.

For example,

| | |
|---|---|
| **Start Date** | 01-Jul-2019 |
| **Repricing Frequency** | 1 Months |
| **End Date** | 31-Jul-2019 |
| **Current Business Day** | 31-Jul-2019<br>If the user performs accruals on this day, owing to the pricing delay/lag for SOFR (T+1), the system may not contain rates to compute interest for the accrual period on the end of the cycle.<br>To avoid such circumstances, the user can define Lockout days (usually 2 to 5 business days prior to the end of the cycle period. For example, 3), so that on 31-Jul-2019 the interest calculated for 29-Jul-2019 to 31-Jul-2019 is based on the Lookback Days (26-Jul-2019).<br>Rates published for 29-Jul-2019, 30-Jul-2019, and 31-Jul-2019 with T+1 delay will not be taken into consideration to compute interest as these days are locked out for rate changes. |

## 5.5 Spread Adjustment

As ARR is a risk-free-rate, similar to spread applied on LIBOR loans, an additional spread is required for risk-free rate loans, and this is captured in the Spread Adjustment parameter. Therefore, the All-in rate for an ARR loan will include the Spread Adjustment as well.

**Note:** Spread Adjustment is not a part of compounding.

For example,

| | |
|---|---|
| **Calculated Compounded Rate** | 2.420000000000% |
| **Spread** | 1.000000000000% |
| **Spread Adjustment** | 1.000000000000% |
| **All-in Rate** | 4.420000000000% |

## 5.6 Observation Period Shift

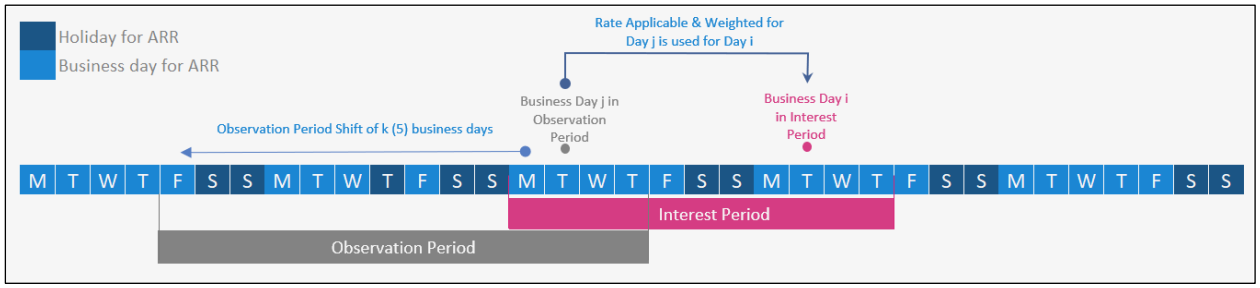
Observation Period Shift is a newly introduced functionality for ARR loans, where the calculation/computation for interest is performed within the observation period (backward-shifted period), which is an equal period commencing ‘x’ number of business days (lookback) prior to the start (first day) of the interest period. As the period over which the reference rate is observed is backward-shifted, this backward-shift includes both the rate and the weighting of that rate. The weighting is intended to account for calendar days on which the ARR rates is not published. On most days, the weighting of a rate will be equal to “1”, but on a Friday, it will generally be 3, (assuming the following Monday is a business day). It will also be larger than 1 on the business day before a holiday. The rate and weighting are determined based on the day of the observation period rather than the day of the interest period.

For example,

| | |
|---|---|
| **Start Date** | 1-Jan |
| **Adjusted Due Date:** | 31-Jan |
| **Lookback Days** | 5<br>If Observation Period Shift is selected, then the start date for the observation period will be 1-Jan minus 5 days = 27-Dec. So, the interest period calculation is from 27-Dec to 27-Jan. |
| **Lockout Days** | 0 |

### 5.6.1 Calculations under Observation Period Shift

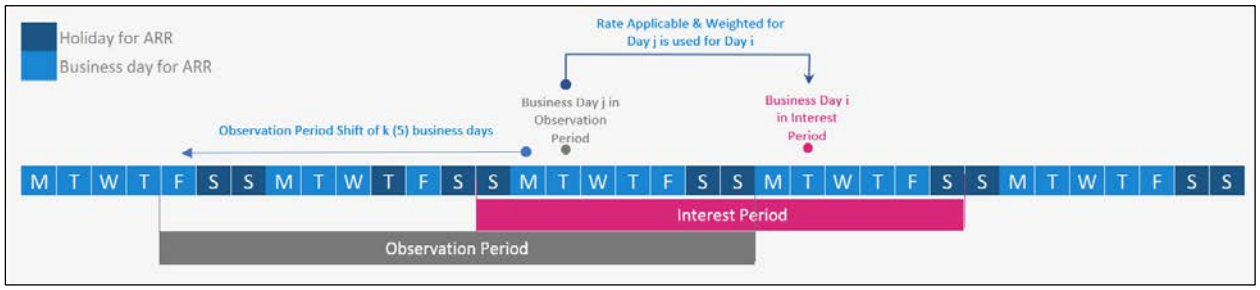
Based on feedback from clients, an approach that is based on business day mapping between the Interest Period and the Observation Period is implemented. In this approach, the interest rate computation is performed over the Observation Period which is a period commencing **k** business days preceding the first day of the interest period and ending (**k-1**) business days preceding the last day of the interest period.




***Reference 1 – Base Case Example***

**Key Highlights**

- Interest Period and Observation Period have the same number of business days for the Alternative Reference Rate (ARR).
- While the interest rate calculation is as per the Observation Period, the calculation of the interest amount is as per the interest period.




***Reference 2: Interest Cycle Start & End Dates on non-business days***

### 5.6.1.1 Compounded In Arrears Calculation for Observation Period Shift

**Calculation of the Rate**

Formula for Calculation of Interest Rate is as follows:

$R_{ca}$ Compounded Average Rate =

$$\left[ \prod_{j=1}^{d_{ob}} \left(1 + \frac{n_j \times r_j}{N}\right) - 1 \right] \times \frac{N}{d_{oc}}$$

Where,

| | |
|---|---|
| $d_{ob}$ | the number of business days in the Observation Period |
| $d_{oc}$ | the number of calendar days in the Observation Period |
| $r_j$ | the interest rate applicable on business day j in the Observation Period<br>Business day j in the Observation Period is a day which is k business days preceding the business day i in the Interest Period as per the specified ARR calendar. |
| $n_j$ | the number of calendar days in the Observation Period for which rate $r_j$ applies (on most days, $n_j$ will be 1, but on a Friday, it will generally be 3, and it will also be larger than 1 on the business day before a holiday). This can also be stated as the number of calendar days from and including business day j to but excluding the following business day. |
| *N* | the market convention for quoting the number of days in the year (in the United States, the convention for money markets is N = 360, while in the UK it is N=365). |
| *j* | represents a series of ordinal numbers representing each business day in the observation period for the Alternative Reference Rate (ARR). |

For any interim day in the interest period, dob and doc will represent business days and calendar days respectively from the start date in the Observation Period to the corresponding interim date (inclusive).

**Interest Accrual**

Interest Calculation will be as per the interest period.

Interest Amount = $\sum_{i=1}^{d_{ib}} (P_i \times n_i \times R_{ca}) / N$

Where,

| | |
|---|---|
| $P_i$ | principal outstanding on business day i in the Interest Period |
| $n_i$ | the number of calendar days in the Interest Period for which interest is to be processed (the number of calendar days from and including business day i to but excluding the following business day) |
| $d_{ib}$ | the market convention for quoting the number of days in the year (in the United States, the convention for money markets is N = 360, while in the UK it is N=365). |
| *i* | represents a series of ordinal numbers representing each business day in the Interest Period for the Alternative Reference Rate (ARR). |

### 5.6.1.2 Daily Compounding in Arrears (Non-Cumulative Compounded Rate) for Observation Period Shift – Without CCR Rounding

Based on the key ARR conventions that were published by Sterling RFR Working Group, the formula to compute Non Cumulative Compounded Rate (NCCR) with Observation Period Shift is modified to ensure that for a given interest period, the interest accrued amount for a constant principal match the corresponding interest amount computed for Cumulative Compounded Rate (CCR) with Observation Period Shift.

**Calculation of the Rate**

Formula for Calculation of Interest Rate is as follows:

$R_i$ Compounded Daily Rate for the day i in the interest Cycle =

$$\left[(P_j - 1) * X_j - (P_{j-1)} - 1)) * X_{j-1}\right] \times \frac{N}{n_i}$$

$X_j$ = $$\left[\sum_{i=1}^{d_{ib}} n_i\right] \Big/ \left[\sum_{j=1}^{d_{ob}} n_j\right]$$

Where,

| | |
|---|---|
| $d_{ib}$ | the number of calendar days in the Interest Period for which interest is to be processed (the number of calendar days from and including business day i to but excluding the following business day) |
| $d_{ob}$ | the number of business days in the Observation Period till the day j in the observation period that corresponds to day i in the interest period (inclusive). |
| $n_i$ | the number of calendar days in the Interest Period for which interest is to be processed (the number of calendar days from and including business day i to but excluding the following business day) |
| $n_j$ | the number of calendar days in the Observation Period for which rate $r_j$ applies (on most days, $n_j$ will be 1, but on a Friday, it will generally be 3, and it will also be larger than 1 on the business day before a holiday). This can also be stated as the number of calendar days from and including business day j to but excluding the following business day. |
| *i* | represents a series of ordinal numbers representing each business day in the Interest Period for the Alternative Reference Rate (ARR). |
| *N* | the market convention for quoting the number of days in the year (in the United States, the convention for money markets is N = 360, while in the UK it is N=365). |
| *j* | represents a series of ordinal numbers representing each business day in the Observation Period for the Alternative Reference Rate (ARR). |
| $X_j$ | On the business day j in the Observation period corresponding to business day i in the interest period, Ratio of number of calendars days in the interest period till and including day i and the number of calendars days in the observation period till and including day j |

**Interest Accrual**

Interest Calculation will be as per the interest period.

Interest Accrual Amount for day i in the Interest Period for calendar days

$$n_i = \frac{P_i \text{ x } n_i \text{ x } R_i}{N}$$

Where,

| | |
|---|---|
| $P_i$ | principal outstanding on business day i in the Interest Period |
| $n_i$ | the number of calendar days in the Interest Period for which interest is to be processed (the number of calendar days from and including business day i to but excluding the following business day) |
| *N* | the market convention for quoting the number of days in the year (in the United States, the convention for money markets is N = 360, while in the UK it is N=365). |

**Calculation of the Rate**

Formula for Calculation of Interest Rate is as follows:

$R_i$ Compounded Daily Rate for the day i in the interest Cycle =

$$\left[A_j - A_{j-1}\right] \times \frac{N}{n_j}$$

$A_j$ Compounded interest accumulation factor for **the j day in the Observation Period that corresponds to day i in the Interest Period** ($A_0$= 1) =

$$\left[ \prod_{j=1}^{d_{ob}} (1 + \frac{n_j \times r_j}{N}) \right]$$

Where,

| | |
|---|---|
| $d_{ob}$ | the number of business days in the Observation Period till the day j in the observation period that corresponds to day i in the interest period (inclusive). |
| $r_j$ | the interest rate applicable on business day j in the Observation Period that corresponds to day i of the Interest Period<br>Business day j in the Observation Period is a day which is k business days preceding the business day i in the Interest Period as per the specified ARR calendar. |
| $n_j$ | the number of calendar days in the Observation Period for which rate $r_j$ applies (on most days, $n_j$ will be 1, but on a Friday, it will generally be 3, and it will also be larger than 1 on the business day before a holiday). This can also be stated as the number of calendar days from and including business day j to but excluding the following business day. |
| *N* | the market convention for quoting the number of days in the year (in the United States, the convention for money markets is N = 360, while in the UK it is N=365). |
| *j* | represents a series of ordinal numbers representing each business day in the Observation Period for the Alternative Reference Rate (ARR). |

**Interest Accrual**

Interest Calculation will be as per the interest period.

Interest Accrual Amount for day i in the Interest Period for calendar days

$$n_i = \frac{P_i \text{ x } n_i \text{ x } R_i}{N}$$

Where,

| | |
|---|---|
| $P_i$ | principal outstanding on business day i in the Interest Period |
| $n_i$ | the number of calendar days in the Interest Period for which interest is to be processed (the number of calendar days from and including business day i to but excluding the following business day) |
| *N* | the market convention for quoting the number of days in the year (in the United States, the convention for money markets is N = 360, while in the UK it is N=365). |

#### 5.6.1.3 Daily Compounding in Arrears (Non-Cumulative Compounded Rate) for Observation Period Shift – With CCR Rounding

Based on the key ARR conventions that were published by Sterling RFR Working Group, the formula to compute Non-Cumulative Compounded Rate (NCCR) with Observation Period Shift with CCR Rounding Approach is as follows:

**Step 1:** Annualised Cumulative Compounded Rate ($ACR_i$)

$$\left[ \prod_{j=1}^{d_{ob}} \left(1 + \frac{n_j \times r_j}{N}\right) - 1 \right] \times \frac{N}{d_{oc}}$$

---

**Note:** $ACRi$ must be rounded daily to CCR rounding precision.

This Step is same as CCR rate calculation using Observation Period Shift, as elaborated under Section 5.6.1.1

---

**Step 2:** Unannualised Cumulative Compounded RFR ($UCR_i$)

$$ACR_i \times \frac{tcn_i}{N}$$

---

**Note:** $UCRi$ must not be rounded.

This Step is same as Step 2 for calculating NCCR using CCR Rounding Approach, as elaborated under Section 5.6.2.1

---

**Step 3:** Non-Cumulative Compounded RFR ($NCR_i$)

$$\left[ \quad UCR_i - UCR_{i-1BD} \right] \times \frac{N}{cn_i}$$

---

**Note:** $NCRi$ must not be rounded

This Step is same as Step 2 for calculating NCCR using CCR Rounding Approach, as elaborated under Section 5.6.2.1

---

Where,

| | |
|---|---|
| $n_i$ | the number of calendar days in the Interest Period for which interest is to be processed (the number of calendar days from and including business day i to but excluding the following business day) |
| $cn_i$ | the number of calendar days for which $r_i$ applies in the relevant Interest Period. |
| $tcn_i$ | total number of $cn_i$as of the relevant Banking Day within the Interest Period. |
| $d_{oc}$ | the number of calendar days in the Observation Period |
| $n_j$ | the number of calendar days in the Observation Period for which rate $r_j$ applies (on most days, $n_j$ will be 1, but on a Friday, it will generally be 3, and it will also be larger than 1 on the business day before a holiday). This can also be stated as the number of calendar days from and including business day j to but excluding the following business day. |

| | |
|---|---|
| $r_i$ | the interest rate applicable on ARR business day *i* |
| N | the market convention for quoting the number of days in the year |
| BD | Business Day for the specific RFR |
| *i* | represents a series of ordinal numbers representing each business day in the Interest Period for the Alternative Reference Rate (ARR). |

## 5.7 Rates Known Window

Rates Known Date is the earliest date in the interest period by when the ARR rates for the complete interest period can be calculated/determined. Rates Known Window is the period starting from the Rates Known Date in the interest period.

*Rates Known Date = Interest Period End Date + 1^ - (Lookback + Lockout) (business days)*

*^ - Indicates the delay in the number of business days the rate is published.*

Example:

| | |
|---|---|
| **Start Date** | 01-Jul-2020 (Wednesday) |
| **Calculation Period** | 1 Month |
| **End Date** | 31-Jul-2020 (Friday) |
| **Risk Free Rate** | SOFR |
| **Lookback Days** | 5 |
| **Lockout Days** | 0 |
| **Observation Period Shift** | False |

In this example, Rates Known Date using the formula above comes to 27-Jul-2020. So, the ARR rates for the complete interest period can be determined from this date onwards.

## 5.8 Legacy Risk Free Rate Floor

The support for Legacy Risk Free Rate Floor is introduced for legacy LIBOR loans that are transitioning to ARR.

As per conventions, when ARR is used in with Spread Adjustment, only ARR is subject to compounding. To address this limitation, an optional attribute called *Legacy Risk Free Rate Floor* is introduced to enable the Fusion LIBOR Transition Calculator API to incorporate the existing LIBOR floor value from legacy credit agreements. The Fusion LIBOR Transition Calculator API then derives the floor such that:

`Risk Free Rate Floor + Spread Adjustment = Legacy Risk Free Rate Floor`

For instance, if the legacy credit agreement had a LIBOR floor value of 0% and the Spread Adjustment is 0.25%, the Fusion LIBOR Transition Calculator API calculates the effective floor value as -0.25%. This derived floor value is used as the floor for the ARR rate value, indirectly ensuring that the equation mentioned above is true at all times.

Therefore, instead of manually calculating the RFR floor and entering it as a separate value, users only need to provide the LIBOR floor value from the legacy credit agreement and the Spread Adjustment as inputs in the Fusion LIBOR Transition Calculator API.

Following table provides an overview of the functionality.

| Risk Free Rate Floor | Legacy Risk Free Rate Floor | Result | Comment |
|---|---|---|---|
| Not Provided | Not Provided | Risk Free Rate is not floored. | -- |
| Provided | Not Provided | Raw Risk Free Rate is floored using Risk Free Rate Floor and the floored Risk Free Rate Floor is used for compounding. | -- |
| Not Provided | Provided | Derived Risk Free Rate is computed using the formula; Legacy Risk Free Rate Floor – Spread Adjustment.<br>The derived Risk Free Rate Floor is used for flooring, and the floored Risk Free Rate Floor is used for computation. | -- |
| Provided | Provided | Risk Free Rate is floored using Risk Free Rate Floor and the floored Risk Free Rate is used for compounding. | -- |

## 5.9 Supported Holiday Calendars

Fusion LIBOR Transition Calculator follows the respective RFR publishing holiday calendar, which is listed in the following table:

| RFR Name | Holiday Calendar Publisher | Reference URL |
|---|---|---|
| SOFR | Securities Industry and Financial Markets Association (SIFMA) | https://www.sifma.org/resources/general/holiday-schedule/<br>**Note:** Refer only to the **U.S. Holiday Recommendations** section on this page for SOFR. |
| SONIA | Bank of England | https://www.gov.uk/bank-holidays<br>**Note:** Refer to the **UK bank holidays** section on this page. |
| TONAR | Bank of Japan | https://www.boj.or.jp/en/about/outline/holi.htm/ |
| SORA | Ministry of Manpower, Singapore Government | https://www.mom.gov.sg/employment-practices/public-holidays |
| €STR | European Central Bank | https://www.ecb.europa.eu/paym/target/target2/html/index.en.html<br>**Note:** Refer to the days that are listed in **How does TARGET2 work?** Section on this page. |

**Note:** The Fusion LIBOR Transition Calculator API uses the SIFMA US holiday list as the basis for determining the SOFR publishing holiday calendar. However, in unique cases where SOFR is not published on a specific day, despite SIFMA not classifying it as a non-business day, Finastra relies on guidance from the benchmark publishers, industry participants such as LSTA/LMA, and clients.

For instance, on April 7, 2023 (Friday), the New York Fed did not publish the SOFR rate, even though it was considered a business day according to SIFMA. Taking into account feedback from our client base, the ARR Working Group, and guidance from LSTA/LMA, Finastra included April 7, 2023, as a business day in the Fusion LIBOR Transition Calculator API. The SOFR rate used for April 7, 2023, was set to be the same as the rate published for the preceding business day, Thursday, April 6, 2023, which was made available on Monday, April 10, 2023.

It is important to note that adopting this approach may impact the compounding calculations. In scenarios where an interest period includes April 7, 2023, the cumulative compounded rate calculations performed using the Fusion LIBOR Transition Calculator API (using the "Average

Compounded in Arrears" calculation method) may not align with published SOFR Averages or cumulative compounded rates calculated from the published SOFR Index.

## 5.10 Compounded ARR Period Averages

**Note:** This feature is included in the Fusion LIBOR Transition Calculator only and is not supported **as-is** in Fusion Loan IQ's ARR module.

The ARR Calculator App supports the Compounded Period Averages for all the tenors for which LIBOR is published (7 days, 30 days, 60 days, 90 days, 180 days and 360 days). It retrieves **as-is** the published Compounded Period Averages where it is available (for example, for SOFR, 30/90/180 calendar day Compounded SOFR Averages are retrieved as-is). In other cases, the Calculator calculates the Compounded Period Averages using the daily published risk-free reference rates.

The Compounded Period Average can be leveraged for use-cases where Compounding in Advance is used, whereby the interest rate for the coming period (for example, April 1 to June 30) is based on the interest in the previous period (from Jan 1 to Mar 31).

For mathematical formula and calculation, refer to the *Average Compounded In Arrears* section.

## 5.11 ARR Index

**Note:** This feature is included in the Fusion LIBOR Transition Calculator only and is not supported in Fusion Loan IQ's ARR module.

The ARR Calculator App provides the additional ability to calculate the Average Compounded in Arrears Rate for a custom interest period by leveraging the daily published ARR Index, rather than the published risk-free reference rates. The rate calculation using the ARR Index is based the following formula:

Average Compounded In Arrears for the interest period starting (and including) "x" and ending (and including) "y-1" =

$$\left[\frac{ARR\ Index_y}{ARR\ Index_x} - 1\right] \times \frac{360}{d_c}$$

Where,

| | |
|---|---|
| x | the Value/Publication Date of the ARR Index corresponding to the start of the interest period |
| y | the Value/Publication Date of the ARR Index corresponding to one calendar day following the interest period end date |
| $d_c$ | the number of calendar dates in the calculation period spanning the period between *x* and *y-1*. |

**Note:** Currently, only SOFR Compounded in Arrears rate calculation based on SOFR Index is supported.

# 6 Notes/Restrictions

This section lists the various notes/restrictions that are applicable for Fusion LIBOR Transition Calculator.

### Lookback Days

- If the start day of the interest period is a non-business day as per the ARR calendar, the start day of the Lookback will be **k** business days preceding the first business day of the Interest Period. This means that, the same rate will be used for the non-business days and the first business day under the daily compounded rate calculation method. In case of Compounded In Arrears calculation method, determination of start date of the Lookback will be as if the interest period has commenced on the first working day of the interest period.

### Spread and Spread Adjustment

- Spread change within a cycle is not supported in Fusion LIBOR Transition Calculator.
- Spread Adjustment is not a part of compounding.

### ARR Index

- Currently, only SOFR Compounded in Arrears rate calculation based on SOFR Index is supported.
- The SOFR Index reflects the same arithmetic as the SOFR Averages, rates calculated using the SOFR Index with the same start and end dates as the SOFR Averages should effectively produce equivalent results. However, as the SOFR Index is rounded, averages calculated from Index values do not maintain the same precision as the SOFR Averages; as a result, minor differences from the published averages may occasionally occur at the fifth decimal place, when the *Rate Rounding Decimal Points* points is set to 5 or more decimal points. For more information, refer to the New York Fed website (Section: *Data and Calculation Methodology for SOFR Averages and Index*)

### Rates Calculator – Average Compounded in Arrears, Daily Compounded in Arrears (NCCR), Simple ARR, and Simple Average.

- Observation Period Shift is not supported if Lockout days in non-zero.

  **Note:** Observation Period Shift is not applicable for Simple ARR

- If Lockout is greater than business days in the cycle, the rate of the interest period start date (with Lookback/ Observation Period Shift) will be applied for the entire cycle.
- When ACT/ACT day count convention is used:
  - If the interest period occurs within a year (non-Leap year), the system considers the day count as 365 else 366.
  - If an interest period spans across two different years, where one year is a Leap year, the system considers the day count as 365.
- Compounding Factor for NCCR – In certain scenarios when the raw RFR rate drops to zero or close to zero, the Compounding Factor may not represent primarily the effect of compounding but have a high computed value due to differing number calendar days in the interest period and the observation period. In such scenarios, the calculated compounding factor can go to less than -10 or more than 10.

**Interest Calculator – Average Compounded in Arrears**, **Daily Compounded in Arrears (NCCR)**, **Simple ARR**, and **Simple Average**

- Observation Period Shift is not supported if Lockout days in non-zero.

  **Note:** Observation Period Shift is not applicable for Simple ARR

- If Lockout is greater than business days in the cycle, the rate of the interest period start date (with Lookback/ Observation Period Shift) will be applied for the entire cycle.
- When ACT/ACT day count convention is used:
  - If the interest period occurs within a year (non-Leap year), the system considers the day count as 365 else 366.
  - If an interest period spans across two different years, where one year is a Leap year, the system considers the day count as 365.
- If principal change occurs on a holiday, then the principal amount change is effective from the date of the change.
- In a scenario where Interest Period Start Date is a non-business day and there is a principal change on the Interest Period Start Date, the rate applied based on lookback days is inaccurate. This is applicable for all the calculation methods
- For Daily Compounding in Arrears (NCCR) method if CCR Rounding Approach is used, it is recommended that Spread/Spread Adjustment decimal precision must not be higher than the CCR Rounding Precision. If the Spread/Spread Adjustment precision is higher than the CCR Rounding Precision, then the accrued interest amounts for NCCR for a given interest period and for constant principal may not match the corresponding accrued interest amounts using Average Compounded in Arrears for the same interest period.
- **Additional information on Rounding**
  - Simple ARR
    - Daily Interest amount:

      The rounded Simple ARR rate, based on Rounding Decimal Points, is used for calculating daily Interest amount for each interest period date. This amount is rounded as per Payment Rounding in the output.
    - Cumulative Interest amount

      The **unrounded** daily interest amount for each Interest Period Date is added to calculate the Cumulative Interest Amount and the final amount value is rounded as per Payment Rounding.
  - Daily Compounding in Arrears (NCCR)
    - **CCR Rounding Applies = True**
      - Daily Interest amount calculation

        The unrounded NCCR rate (with maximum precision) is used for Interest amount calculation for each interest period date and rounded as per Payment Rounding.
      - Cumulative Interest amount calculation

        The **unrounded** interest amount for each interest Period Date is added for calculating the cumulative Interest amount and the final amount value is rounded as per Payment Rounding.
    - **CCR Rounding Applies = False**

      The same rounding behavior as Simple ARR applies (hyperlink to above sub-section)

- Average Compounded in Arrears and Simple Average

  Cumulative interest amount: The rounded rate (CCR rate or Simple Average) is used for calculating the cumulative Interest amount. This amount is rounded as per Payment Rounding.

### Tenors

- For *tenors* of 30/90/180 days, if the published averages are not available for start or end date because of a holiday, then the system will calculate the rate.
- If tenor is not passed (where rates are calculated for all the tenors) and risk free rates are not available for any of the tenors, then the calculator returns Compounded Averages only for the tenors for which rate data is available.

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**Important:** Currently, SOFR, SONIA, ESTR, TONAR, SORA are supported in Fusion LIBOR Transition Calculator.

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# 7 Release Notes

The **Fusion LIBOR Transition Calculator** Web App Release Notes document highlights the major new features and improvements. It also documents the fixed issues reported by clients, and during internal testing, known issues and workarounds.

## 7.1 Release 1.4

### 7.1.1 New Functionality/Improvements to Existing Functionality (Enhancements/Gaps)

The following functionality has been added/improvement to existing functionality has been made in this release.

| Reference | Functionality | Description |
|---|---|---|
| LIQSC-39972 | Introduction of "Lookback Date" in the Rates/Interest Calculator output | Lookback Date displays the corresponding date for which the *Published Risk Free Rate* is displayed. This date is derived based on the Look back Days and the Interest Period Date.<br>**Note:** This attribute is not displayed when Look back Days is not provided or when Observation Period Shift = True. |

### 7.1.2 Fixed Issues

**Note:** There are no Reportable Fixed Issues in Fusion LIBOR Transition Calculator Web App Release Notes version 1.4.

### 7.1.3 Known Issues

**Note:** There are no Fixed issues in Fusion LIBOR Transition Calculator Web App Release Notes version 1.4.

## 7.2 Release 1.3

### 7.2.1 New Functionality/Improvements to Existing Functionality (Enhancements/Gaps)

The following functionality has been added/improvement to existing functionality has been made in this release.

| Reference | Functionality | Description |
|---|---|---|
| LIQSC-39552 | ARR Calculator Web App v1.3 | • Initial release of the web-app<br>• ARR/Risk Free Rates Supported<br>o SOFR<br>o SONIA<br>o ESTR<br>o TONAR<br>o SORA<br>• ARR Calculations Supported |

| Reference | Functionality | Description |
|---|---|---|
| | | o Rate Calculator<br>o Accrued Interest Calculator<br>o Tenor Rates Calculator<br>o Rates using Index Calculator<br>• ARR Calculation Methods supported<br>o Cumulative Compounding in Arrears<br>o Daily Non-Cumulative Compounding in Arrears<br>o Simple Average<br>o Simple ARR<br>Refer to Section 3 for details |

### 7.2.2 Fixed Issues

**Note:** There are no Fixed issues in Fusion LIBOR Transition Calculator Web App Release Notes version 1.3.

### 7.2.3 Known Issues

**Note:** There are no known issues in Fusion LIBOR Transition Calculator Web App Release Notes version 1.3.