

The Working Group on Sterling Risk-Free Reference Rates

Working Group on Sterling Risk-Free Rates Detailed Loans Conventions

Published in September 2020 - Updated in March 2021

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*The overall objective of the Working Group on Sterling Risk-Free Reference Rates (the "**Working Group**") is to enable a broad-based transition to SONIA by the end of 2021 across the sterling bond, loan and derivative markets. This will reduce the financial stability risks arising from widespread reliance on GBP LIBOR.*

*The Bank of England and the Financial Conduct Authority ("**FCA**") are each ex-officio members of the Working Group. The views and outputs set out herein do not constitute guidance or legal advice from the Bank of England (including the Prudential Regulation Authority ("**PRA**")) or the FCA and are not necessarily endorsed by the Bank of England (including the PRA) or the FCA.*

¹ Lookback without Observation Shift is also known as the Observation Lag convention

² Also known as 'Interest Period Weighted Observation Shift'

SONIA Loans Market Conventions - Overview

Summary of the recommended SONIA Loan Market Conventions (To be read alongside the Working Group statement)

1. SONIA remains the Working Group's recommended alternative to Sterling LIBOR, implemented via a **compounded in arrears methodology**, and loan markets should now move consistently towards this.
2. Use of a **Five Banking Days Lookback without Observation Shift** is recommended as the standard approach by the Working Group. This aligns with the approach recommended by the Alternative Reference Rate Committee for US dollar loan markets and in the Working Group's view is most likely to be made rapidly available. Whilst this approach is the recommendation, where lenders are also able to offer lookback with an observation shift this remains a viable and robust alternative.
3. Where an interest rate floor is used, the Working Group recognises that it may be necessary to apply the **floor to each daily interest rate before compounding**.
4. **Prepayments**. The Working Group recommends that accrued interest should be paid at the time of principal prepayment.

SONIA Loan Market Conventions and Implementation Approaches

	Loan Conventions		Implementation Approaches		
	Recommended Convention	Alternative Convention	Recommended Approach	Other Considered Approach	Notes
Interest Methodology	Compound in Arrears		Compound the Rate	Compound the Balance	<ul style="list-style-type: none"> Both calculate the same interest except for intra interest period event such as loan trading activity. Compound the rate aligns to the current pro-rata interest distribution.
Interest Calculation	Lookback without Observation Shift ¹	Lookback with Observation Shift ²	Non Cumulative Rate Method ³	Cumulative Rate Method	<ul style="list-style-type: none"> Though Cumulative and Non Cumulative Rate method should calculate the same interest amount where the rounding method is consistent, the Non Cumulative Rate method is preferred for loans as it better supports intra interest period event such as loan trading activity, to distribute interest to the lenders on a pro-rata basis (see page 22)
Lookback/Lag Days	5 Banking Days	Other variables as required			
Rounding	SONIA 4 DP				
Day Count	Actual/ 365		Round Cumulative Rate, do not round Non Cumulative rate	Do not round the Compounded rate	<ul style="list-style-type: none"> The recommended approach will ensure the calculation of interest amount using Cumulative and Non Cumulative rate is the same. (see page 22)

¹ Also known as 'Lag'

² Also known as 'Interest Period Weighted Observation Shift'

³ Preferred where rounding method is consistent to calculate the same interest amount as Cumulative Rate Method (see page 22)

SONIA Loans Market Conventions - Lookback with or without Observation Shift¹

In the UK, the recommendation from the Working Group is for a 5 Banking Days Lookback without Observation Shift¹. Whilst this approach is the recommendation, each of Lookback with or without Observation Shift has benefits and limitations and either approach may be considered appropriate for market participants.

In the US, the ARRC has made a decision to adopt Lookback without Observation Shift¹ where interest is calculated on compound in arrears basis. They also determined that the basis risk between the two methods was minimal.

Compounded in arrears – Lookback without Observation Shift¹ vs Lookback with Observation Shift²

- Key differences between Lookback without Observation Shift (Lag methodology) and Lookback with Observation Shift

	Lookback without Observation Shift ¹	Lookback with Observation Shift ²
Compounded in arrears Rate	<ul style="list-style-type: none">• Compounded rate is calculated based on no. of calendar days in an interest period i.e., applicable SONIA for each day within a loan period is weighted based on no. of calendar days in the interest period.	<ul style="list-style-type: none">• Compounded rate is calculated based on no. of calendar days in an observation period i.e., applicable SONIA for each day within a loan period is weighted based on no. of calendar days in the observation period.
Interest Amount	<ul style="list-style-type: none">• Interest is calculated for the total no. of calendar days in an interest period	<ul style="list-style-type: none">• Interest is calculated for the total no. of calendar days in an interest period
Negative Accrual	<ul style="list-style-type: none">• There would be no scenario where the daily accrual may be negative.	<ul style="list-style-type: none">• If SONIA were to reduce sharply around bank holidays (even if SONIA is not negative) there could be negative accrual on certain days. However, total interest for that interest period will not be negative.

¹ Also known as 'Lag'

² Also known as 'Interest Period Weighted Observation Shift'

Recommended Convention

Lookback without Observation Shift¹

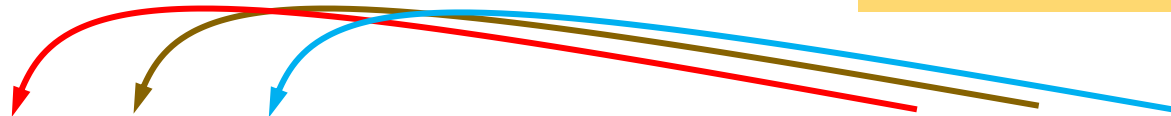
¹ Also known as 'Lag'

Lookback without Observation Shift¹ - Overview

Below is an illustration of 5 Banking Days Lookback rate fixing for a SONIA referencing loan.

- ◆ Rate used (T-5)
- ◆ Interest Payment amount known
- ◆ Rate known/ published (T-4)
- ◆ Interest Payment date (IP)

How does 5 banking days Lookback work?
 Every day of the interest period, 5 banking days prior rate is used.
 For example – if a loan is drawn effective 05-Feb-19 (Tue), the applicable rate will be the rate for 29-Jan-19 (Tue) which is published on 30-Jan-19 (Wed). The same process is repeated throughout the interest/ loan period.



Rate for	28-Jan Mon	29-Jan Tue	30-Jan Wed	31-Jan Thu	01-Feb Fri	02-Feb Sat	03-Feb Sun	04-Feb Mon	05-Feb Tue	06-Feb Wed	07-Feb Thu
Published on	29-Jan Tue	30-Jan Wed	31-Jan Thu	01-Feb Fri	04-Feb Mon	-	-	05-Feb Tue	06-Feb Wed	07-Feb Thu	08-Feb Fri
	0.7054	0.7036	0.7034	0.7034	0.7025	-	-	0.7051	0.7048	0.7066	0.7065

Loan Period - 05-Feb-19 to 12-Feb-19

Observation Date	Start Date	End Date	Daily RFR	Comment
Tue,29-Jan-19	Tue,05-Feb-19	Wed,06-Feb-19	0.7036	Use rate for 29-Jan published on 30-Jan
Wed,30-Jan-19	Wed,06-Feb-19	Thu,07-Feb-19	0.7034	Use rate for 30-Jan published on 31-Jan
Thu,31-Jan-19	Thu,07-Feb-19	Fri,08-Feb-19	0.7034	Use rate for 31-Jan published on 1-Feb
Fri,01-Feb-19	Fri,08-Feb-19	Mon,11-Feb-19	0.7025	Use rate for 1-Feb published on 4-Feb
Mon,04-Feb-19	Mon,11-Feb-19	Tue,12-Feb-19	0.7051	Use rate for 4-Feb published on 5-Feb

¹ Also known as 'Lag'

Lookback without Observation Shift² - Formula

The Non Cumulative Compounded Rate¹ is the recommended implementation approach as it better supports intra period events such as trading activity.

Non Cumulative Compounded Rate - Lookback without Observation Shift²

Compounded Rate calculation

Step 1 Annualised Cumulative Compounded RFR_i (ACR_i)

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

**ACR_i should be rounded daily to x decimal places (as defined in the credit agreement)*

Step 2 Unannualised Cumulative Compounded RFR_i (UCR_i)

$$= ACR_i \times \frac{tn_i}{N}$$

**UCR_i should not be rounded*

Step 3 Non Cumulative Compounded RFR_i (NCR_i)

$$= (UCR_i - UCR_{i-1BD}) \times \frac{N}{n_i}$$

**NCR_i should not be rounded*

ACR (in Step1) is rounded but UCR (in Step 2) and NCR (in Step 3) are not rounded to ensure compounded rate rounding is not duplicated and the interest amount using Cumulative or Non Cumulative Compounded rate is the same.

Interest amount calculation

Step 4 InterestAmount_i

$$= \left[\sum_{i=1}^{d_b} \left(\frac{\text{Principal}_i \times [NCR_i + CAS + Margin] \times n_i}{N} \right) \right]$$

**Interest Amount should be rounded to 2 decimal places at the end of the period only*

¹ Preferred where rounding method is consistent to calculate the same interest amount as Cumulative Rate Method (see page 22)

² Also known as 'Lag'

Cumulative Compounded Rate - Lookback without Observation Shift²

Compounded Rate calculation

Step 1 Final Cumulative Compounded RFR_{db} (FCR_{db})

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

**FCR should be rounded to x decimal places (as defined in the agreement)*

Interest amount calculation

Step 2

$$\text{Interest Amount} = \left(\frac{\text{Principal} \times [FCR_{db} + CAS + Margin] \times tn_i}{N} \right)$$

**Interest Amount should be rounded to 2 decimal places*

Where

- d_b = the number of Banking Days in the Interest Period
- r_i = the interest rate applicable on Banking Day i in the Observation Period, as published on the Banking Day immediately after Banking Day i
- n_i = the number of calendar days for which r_i applies in the relevant Interest Period, (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 Banking Day before a holiday).
- tn_i = total number of n_i as of the relevant Banking Day within the Interest Period.
- N = market convention for quoting the number of days in the year.
- BD = Banking Day for the specific currency only
- i = series of whole numbers from one to d_b , each representing the relevant Banking Day in chronological order from, and including, the first Banking Day in the relevant Interest Period
- CAS = Credit Adjustment Spread (if applicable)

Lookback without Observation Shift¹ - Worked example

Though the Cumulative and Non Cumulative Compounded Rate are different implementation approaches, if the same rounding conventions are used in both the methods, the interest amount will be identical. As illustrated below there is no difference in interest amount using Cumulative and Non Cumulative Compounded Rate

Lookback/Lag Days	5	Margin	2.00%	Rounding Convention (Recommended)	No Rounding	No Rounding	As per Agreement	No Rounding	No Rounding	No Rounding	No Rounding	No Rounding	No Rounding
Year Basis (N)	365	Credit Adjustment Spread	0.05%		16 dp or more	16 dp or more	4 dp	16 dp or more	16 dp or more	16 dp or more	16 dp or more	16 dp or more	16 dp or more

Loan Period - 15-Apr-19 to 15-May-19

Breaking down the Formula				r_i	$\frac{r_i \times n_i}{N}$ (N = 365)	$\prod_{i=1}^{d_p} \left(1 + \frac{r_i \times n_i}{N}\right)$	$\left[\prod_{i=1}^{d_p} \left(1 + \frac{r_i \times n_i}{N}\right) - 1\right] \times \frac{N}{tn_i}$	$ACR_i \times \frac{tn_i}{N}$	$(UCR_i - UCR_{-1BD}) \times \frac{N}{n_i}$	Step 4: Interest				
Observation Date (T-5)	Start Date (T)	No. calendar days in Interest Period	Cumulative Interest Period Days	Daily RFR (SONIA)	Unannualised/ Effective RFR	Compounding Factor	Annualised Cumulative Compounded RFR _i (ACR _i)	Unannualised Cumulative Compounded RFR _i (UCR _i)	Non Cumulative Compounded RFR (NCR _i)	Principal	RFR Interest using Non Cumulative Compounded Rate	Credit Adjustment Spread Interest	Margin Interest	Total Interest
Mon,08-Apr-19	Mon,15-Apr-19	1	1	0.70790%	0.0000193945205	1.0000193945206	0.707900%	0.0000193945205	0.7079000000%	100,000,000	1,939.45	136.99	5,479.45	7,555.89
Tue,09-Apr-19	Tue,16-Apr-19	1	2	0.70720%	0.0000193753425	1.0000387702388	0.707600%	0.0000387726027	0.7073000000%	100,000,000	1,937.81	136.99	5,479.45	7,554.25
Wed,10-Apr-19	Wed,17-Apr-19	1	3	0.70810%	0.0000194000000	1.0000581709909	0.707700%	0.0000581671233	0.7079000000%	100,000,000	1,939.45	136.99	5,479.45	7,555.89
Thu,11-Apr-19	Thu,18-Apr-19	5	8	0.70750%	0.0000969178082	1.0001550944370	0.707600%	0.0001550904110	0.7075400000%	100,000,000	9,692.33	684.93	27,397.26	37,774.52
Fri,12-Apr-19	Tue,23-Apr-19	1	9	0.70740%	0.0000193808219	1.0001744782647	0.707600%	0.0001744767123	0.7076000000%	100,000,000	1,938.63	136.99	5,479.45	7,555.07
Mon,15-Apr-19	Wed,24-Apr-19	1	10	0.70820%	0.0000194027397	1.0001938843898	0.707700%	0.0001938904110	0.7086000000%	100,000,000	1,941.37	136.99	5,479.45	7,557.81
Tue,16-Apr-19	Thu,25-Apr-19	1	11	0.70810%	0.0000194000000	1.0002132881512	0.707700%	0.0002132794521	0.7077000000%	100,000,000	1,938.90	136.99	5,479.45	7,555.34
Wed,17-Apr-19	Fri,26-Apr-19	3	14	0.70840%	0.0000582246575	1.0002715252273	0.707900%	0.0002715232877	0.7086333333%	100,000,000	5,824.38	410.96	16,438.36	22,673.70
Thu,18-Apr-19	Mon,29-Apr-19	1	15	0.70870%	0.0000194164384	1.0002909469377	0.708000%	0.0002909589041	0.7094000000%	100,000,000	1,943.56	136.99	5,479.45	7,560.00
Tue,23-Apr-19	Tue,30-Apr-19	1	16	0.70920%	0.0000194301370	1.0003103827279	0.708100%	0.0003104000000	0.7096000000%	90,000,000	1,749.70	123.29	4,931.51	6,804.49
Wed,24-Apr-19	Wed,01-May-19	1	17	0.70870%	0.0000194164384	1.0003298051928	0.708100%	0.0003298000000	0.7081000000%	90,000,000	1,746.00	123.29	4,931.51	6,800.79
Thu,25-Apr-19	Thu,02-May-19	1	18	0.70960%	0.0000194410959	1.0003492527004	0.708200%	0.0003492493151	0.7099000000%	90,000,000	1,750.44	123.29	4,931.51	6,805.23
Fri,26-Apr-19	Fri,03-May-19	4	22	0.71070%	0.0000778849315	1.0004271648335	0.708700%	0.0004271616438	0.7109500000%	90,000,000	7,012.11	493.15	19,726.03	27,231.29
Mon,29-Apr-19	Tue,07-May-19	1	23	0.70970%	0.0000194438356	1.0004466169748	0.708800%	0.0004466410959	0.7110000000%	90,000,000	1,753.15	123.29	4,931.51	6,807.95
Tue,30-Apr-19	Wed,08-May-19	1	24	0.71090%	0.0000194767123	1.0004661023857	0.708900%	0.0004661260274	0.7112000000%	90,000,000	1,753.64	123.29	4,931.51	6,808.44
Wed,01-May-19	Thu,09-May-19	1	25	0.71030%	0.0000194602740	1.0004855717302	0.708900%	0.0004855479452	0.7089000000%	90,000,000	1,747.97	123.29	4,931.51	6,802.77
Thu,02-May-19	Fri,10-May-19	3	28	0.71070%	0.0000584136986	1.0005440137929	0.709200%	0.0005440438356	0.7117000000%	90,000,000	5,264.63	369.86	14,794.52	20,429.01
Fri,03-May-19	Mon,13-May-19	1	29	0.70980%	0.0000194465753	1.0005634709474	0.709200%	0.0005634739726	0.7092000000%	90,000,000	1,748.71	123.29	4,931.51	6,803.51
Tue,07-May-19	Tue,14-May-19	1	30	0.70940%	0.0000194356164	1.0005829175153	0.709200%	0.0005829041096	0.7092000000%	90,000,000	1,748.71	123.29	4,931.51	6,803.51

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55,370.96 3,904.11 156,164.38 215,439.45

Cumulative Rate Method 55,370.96 3,904.11 156,164.38 215,439.45

Cumulative Rate vs Non Cumulative Rate Method 0.00 0.00 0.00 0.00

¹ Also known as 'Lag'

Alternative Convention

Lookback with Observation Shift²

² Also known as 'Interest Period Weighted Observation Shift'

Lookback with Observation Shift² - Overview

An Observation shift reflects the weightage for the daily applicable rate within an interest period using no. of days in observation period rather than interest period. This methodology differs from the standard lookback methodology in when it accounts for bank holidays.

Observation Date (T-5)	Start Date (T)	End Date	Daily RFR SONIA	No. calendar days in Interest Period	No. calendar days in Observation Period
Fri, 05-Apr-19	Fri, 12-Apr-19	Mon, 15-Apr-19	0.7076	3	3
Mon, 08-Apr-19	Mon, 15-Apr-19	Tue, 16-Apr-19	0.7079	1	1
Tue, 09-Apr-19	Tue, 16-Apr-19	Wed, 17-Apr-19	0.7072	1	1
Wed, 10-Apr-19	Wed, 17-Apr-19	Thu, 18-Apr-19	0.7081	1	1
Thu, 11-Apr-19	Thu, 18-Apr-19	Tue, 23-Apr-19	0.7075	5	1
Fri, 12-Apr-19	Tue, 23-Apr-19	Wed, 24-Apr-19	0.7074	1	3
Mon, 15-Apr-19	Wed, 24-Apr-19	Thu, 25-Apr-19	0.7082	1	1
Tue, 16-Apr-19	Thu, 25-Apr-19	Fri, 26-Apr-19	0.7081	1	1
Wed, 17-Apr-19	Fri, 26-Apr-19	Mon, 29-Apr-19	0.7084	3	1
Thu, 18-Apr-19	Mon, 29-Apr-19	Tue, 30-Apr-19	0.7087	1	5
Tue, 23-Apr-19	Tue, 30-Apr-19	Wed, 01-May-19	0.7092	1	1
Wed, 24-Apr-19	Wed, 01-May-19	Thu, 02-May-19	0.7087	1	1
Thu, 25-Apr-19	Thu, 02-May-19	Fri, 03-May-19	0.7096	1	1
Fri, 26-Apr-19	Fri, 03-May-19	Tue, 07-May-19	0.7107	4	3
Mon, 29-Apr-19	Tue, 07-May-19	Wed, 08-May-19	0.7097	1	1
Tue, 30-Apr-19	Wed, 08-May-19	Thu, 09-May-19	0.7109	1	1
Wed, 01-May-19	Thu, 09-May-19	Fri, 10-May-19	0.7103	1	1
Thu, 02-May-19	Fri, 10-May-19	Mon, 13-May-19	0.7107	3	1
				31	28

- For example: For 18-Apr, the rate applied is from 11-Apr. The no. of days in the interest period is 5 days due to Easter, however the rate for 11-Apr is for 1 day. So Observation Shift would apply the rate 0.7075 for 1 day only.
- Similarly, for 29-Apr the rate applied is from 18-Apr. The no. of days in the interest period is 1 day, however the rate for 18-Apr is for 5 days. So Observation Shift would apply the rate 0.7087 for 5 days.

In this example, compounded rate is calculated for 28 observation period days (A). This is annualised $(A \times \frac{365}{28}) = B$. Interest is then calculated for the total interest period days i.e., 31 days $(B \times \frac{31}{365} \times Prin)$

- To calculate Non Cumulative Compounded Rate (NCCR) for Lookback with Observation Shift,
 - the Cumulative Compounded rate should be annualised daily using calendar days in the observation period. It should also be rounded daily as per the no. of decimal places in the credit agreement; and
 - the Cumulative Compounded rate needs to be adjusted daily using calendar days in the interest period, to ensure NCCR is calculated accurately and the correct amount of interest is charged..
- Please refer to the example for further details.

² Also known as 'Interest Period Weighted Observation Shift'

Lookback with Observation Shift² - Formula

The Non Cumulative Compounded Rate¹ is the recommended implementation approach as it better supports intra period events such as trading activity.

Non Cumulative Compounded Rate - Lookback with Observation Shift²

Compounded Rate calculation

Step 1 Annualised Cumulative Compounded RFR_i (ACR_i)

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

**ACR_i should be rounded daily to x decimal places (as defined in the credit agreement)*

Step 2 Unannualised Cumulative Compounded RFR_i (UCR_i)

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

**UCR_i should not be rounded*

Step 3 Non Cumulative Compounded RFR_i (NCR_i)

$$= (UCR_i - UCR_{i-1BD}) \times \frac{N}{cn_i}$$

**NCR_i should not be rounded*

ACR (in Step1) is rounded but UCR (in Step 2) and NCR (in Step 3) are not rounded to ensure compounded rate rounding is not duplicated and the interest amount using Cumulative or Non Cumulative Compounded rate is the same.

Interest amount calculation

Step 4 InterestAmount_i

$$= \left[\sum_{i=1}^{d_b} \left(\frac{\text{Principal}_i \times [NCR_i + CAS + Margin] \times cn_i}{N} \right) \right]$$

**Interest Amount should be rounded to 2 decimal places at the end of the period only*

¹ Preferred where rounding method is consistent to calculate the same interest amount as Cumulative Rate Method (see page 22)

² Also known as 'Lag'

Cumulative Compounded Rate - Lookback with Observation Shift²

Compounded Rate calculation

Step 1 Final Cumulative Compounded RFR_{db} (FCR_{db})

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

**FCR should be rounded to x decimal places (as defined in the agreement)*

Interest amount calculation

Step 2

$$\text{Interest Amount} = \left(\frac{\text{Principal} \times [FCR_{d_b} + CAS + Margin] \times tcn_i}{N} \right)$$

**Interest Amount should be rounded to 2 decimal places*

Where

- d_b = the number of Banking Days in the Observation Period
- r_i = the interest rate applicable on Banking Day i in the Observation Period, as published on the Banking Day immediately after Banking Day i
- n_i = the number of calendar days for which r_i applies in the relevant Observation Period, (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 Banking Day before a holiday).
- tn_i = total number of n_i as of the relevant Banking Day within the Observation Period.
- 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.
- N = market convention for quoting the number of days in the year.
- BD = Banking Day for the specific currency only
- i = series of whole numbers from one to d_b , each representing the relevant Banking Day in chronological order from, and including, the first Banking Day in the relevant Observation Period
- CAS = Credit Adjustment Spread

Lookback with Observation Shift² - Worked Example

Though the **Cumulative** and **Non Cumulative Compounded Rate** are different implementation approaches, if the same rounding conventions are used in both the methods, the interest amount will be identical. As illustrated below there is no difference in interest amount using Cumulative and Non Cumulative Compounded Rate

Lookback/Lag Days	5	Margin	2.00%	Rounding Convention (Recommended)	No Rounding	No Rounding	As per Agreement	No Rounding	No Rounding	No Rounding	No Rounding	No Rounding	No Rounding
Year Basis (N)	365	Credit Adjustment Spread	0.05%		16 dp or more	16 dp or more	4 dp	16 dp or more	16 dp or more	16 dp or more	16 dp or more	16 dp or more	16 dp or more

Loan Period - 15-Apr-19 to 15-May-19

Breaking down the Formula		n_i	tn_i	cn_i	tcn_i	r_i	$\frac{r_i \times n_i}{N}$ (N = 365)	$\prod_{i=1}^{d_b} \left(1 + \frac{r_i \times n_i}{N}\right)$	$\prod_{i=1}^{d_b} \left(1 + \frac{r_i \times n_i}{N} - 1\right) \times \frac{N}{tn_i}$	$ACR_i \times \frac{tcn_i}{N}$	$(UCR_i - UCR_{i-1,3D}) \times \frac{N}{cn_i}$	Principal	Step 4: Interest			
Observation Date (T-5)	Start Date (T)	No. calendar days in Observation Period	Cumulative Observation Period Days	No. calendar days in Interest Period	Cumulative Interest Period Days	Daily RFR (SONIA)	Unannualised/ Effective RFR	Compounding Factor	Annualised Cumulative Compounded RFR _i (ACR _i)	Unannualised Cumulative Compounded RFR _i (UCR _i)	Non Cumulative Compounded RFR _i (NCR _i)		RFR Interest using Non Cumulative Compounded Rate	Credit Adjustment Spread Interest	Margin Interest	Total Interest
Mon,08-Apr	Mon,15-Apr	1	1	1	1	0.70790%	0.0000193945205	1.0000193945206	0.707900%	0.0000193945205	0.7079000000%	100,000,000	1,939.45	136.99	5,479.45	7,555.89
Tue,09-Apr	Tue,16-Apr	1	2	1	2	0.70720%	0.0000193753425	1.0000387702388	0.707600%	0.0000387726027	0.7073000000%	100,000,000	1,937.81	136.99	5,479.45	7,554.25
Wed,10-Apr	Wed,17-Apr	1	3	1	3	0.70810%	0.0000194000000	1.0000581709909	0.707700%	0.0000581671233	0.7079000000%	100,000,000	1,939.45	136.99	5,479.45	7,555.89
Thu,11-Apr	Thu,18-Apr	1	4	5	8	0.70750%	0.0000193835616	1.000077556801	0.707700%	0.0001551123288	0.7077000000%	100,000,000	9,694.52	684.93	27,397.26	37,776.71
Fri,12-Apr	Tue,23-Apr	3	7	1	9	0.70740%	0.0000581424658	1.0001357026552	0.707600%	0.0001744767123	0.7068000000%	100,000,000	1,936.44	136.99	5,479.45	7,552.88
Mon,15-Apr	Wed,24-Apr	1	8	1	10	0.70820%	0.0000194027397	1.0001551080279	0.707700%	0.0001938904110	0.7086000000%	100,000,000	1,941.37	136.99	5,479.45	7,557.81
Tue,16-Apr	Thu,25-Apr	1	9	1	11	0.70810%	0.0000194000000	1.0001745110370	0.707700%	0.0002132794521	0.7077000000%	100,000,000	1,938.90	136.99	5,479.45	7,555.34
Wed,17-Apr	Fri,26-Apr	1	10	3	14	0.70840%	0.0000194082192	1.0001939226431	0.707800%	0.0002714849315	0.7081666667%	100,000,000	5,820.55	410.96	16,438.36	22,669.86
Thu,18-Apr	Mon,29-Apr	5	15	1	15	0.70870%	0.0000970821918	1.0002910236613	0.708200%	0.0002910410959	0.7138000000%	100,000,000	1,955.62	136.99	5,479.45	7,572.05
Tue,23-Apr	Tue,30-Apr	1	16	1	16	0.70920%	0.0000194301370	1.0003104594530	0.708200%	0.0003104438356	0.7082000000%	90,000,000	1,746.25	123.29	4,931.51	6,801.04
Wed,24-Apr	Wed,01-May	1	17	1	17	0.70870%	0.0000194164384	1.0003298819193	0.708300%	0.0003298931507	0.7099000000%	90,000,000	1,750.44	123.29	4,931.51	6,805.23
Thu,25-Apr	Thu,02-May	1	18	1	18	0.70960%	0.0000194410959	1.0003493294285	0.708400%	0.0003493479452	0.7101000000%	90,000,000	1,750.93	123.29	4,931.51	6,805.73
Fri,26-Apr	Fri,03-May	3	21	4	22	0.71070%	0.0000584136986	1.0004077635327	0.708700%	0.0004271616438	0.7100500000%	90,000,000	7,003.23	493.15	19,726.03	27,222.41
Mon,29-Apr	Tue,07-May	1	22	1	23	0.70970%	0.0000194438356	1.0004272152968	0.708800%	0.0004466410959	0.7110000000%	90,000,000	1,753.15	123.29	4,931.51	6,807.95
Tue,30-Apr	Wed,08-May	1	23	1	24	0.71090%	0.0000194767123	1.0004467003299	0.708900%	0.0004661260274	0.7112000000%	90,000,000	1,753.64	123.29	4,931.51	6,808.44
Wed,01-May	Thu,09-May	1	24	1	25	0.71030%	0.0000194602740	1.0004661692968	0.709000%	0.0004856164384	0.7114000000%	90,000,000	1,754.14	123.29	4,931.51	6,808.93
Thu,02-May	Fri,10-May	1	25	3	28	0.71070%	0.0000194712329	1.0004856496066	0.709000%	0.0005438904110	0.7090000000%	90,000,000	5,244.66	369.86	14,794.52	20,409.04
Fri,03-May	Mon,13-May	4	29	1	29	0.70980%	0.000077863014	1.0005634736848	0.709200%	0.0005634739726	0.7148000000%	90,000,000	1,762.52	123.29	4,931.51	6,817.32
Tue,07-May	Tue,14-May	1	30	1	30	0.70940%	0.0000194356164	1.0005829202527	0.709200%	0.0005829041096	0.7092000000%	90,000,000	1,748.71	123.29	4,931.51	6,803.51
		30	30										55,371.78	3,904.11	156,164.38	215,440.27
Cumulative Rate Method												55,371.78	3,904.11	156,164.38	215,440.27	
Cumulative Rate vs Non Cumulative Rate Method												0.00	0.00	0.00	0.00	

² Also known as 'Interest Period Weighted Observation Shift'

Lookback with Observation Shift² - Sharp Decrease in Interest Rate - No Negative Interest

The below example illustrates the impact on daily interest calculation during the recent sharp reduction in SONIA due to COVID-19 situation.

- 11-Mar-20 – SONIA reduced by approx. 63%
- 20-Mar-20 – SONIA reduced further by approx. 27%

Even though there was an overall reduction of approx. 90% in SONIA, daily interest amount is not negative as there were no bank holidays and the no. of days in observation and interest period are same on each day.

Lookback Days	5
Year Basis	365

Rounding Convention (Recommended)	No Rounding	No Rounding	As per Agreement	No Rounding	No Rounding
	16 dp or more	16 dp or more	4 dp	16 dp or more	16 dp or more
			Cumulative Compounded Rate		Non Cumulative Compounded Rate

Observation Date (T-5)	Start Date (T)	End Date	No. calendar days in Interest Period	No. calendar days in Observation Period	Daily RFR	Unannualised/ Effective Rate	Compounding Factor	Annualised Compounded RFR _i (ACR _i)	Unannualised Cumulative Compounded RFR _i (UCR _i)	Non Cumulative Compounded RFR _i (NCR _i)	Principal	Daily RFR Interest using Non Cumulative Compounded Rate
Mon, 02-Mar-20	Mon, 09-Mar-20	Tue, 10-Mar-20	1	1	0.70890	0.00001942192	1.00001942192	0.708900000	0.00001942192	0.708900000000	100,000,000.00	1,942.19
Tue, 03-Mar-20	Tue, 10-Mar-20	Wed, 11-Mar-20	1	1	0.70980	0.00001944658	1.00003886887	0.709400000	0.00003887123	0.709900000000	100,000,000.00	1,944.93
Wed, 04-Mar-20	Wed, 11-Mar-20	Thu, 12-Mar-20	1	1	0.71000	0.00001945205	1.00005832168	0.709600000	0.00005832329	0.710000000000	100,000,000.00	1,945.21
Thu, 05-Mar-20	Thu, 12-Mar-20	Fri, 13-Mar-20	1	1	0.70890	0.00001942192	1.00007774473	0.709400000	0.00007774247	0.708800000000	100,000,000.00	1,941.92
Fri, 06-Mar-20	Fri, 13-Mar-20	Mon, 16-Mar-20	3	3	0.70870	0.00005824932	1.00013599858	0.709100000	0.00013599178	0.708700000000	100,000,000.00	5,824.93
Mon, 09-Mar-20	Mon, 16-Mar-20	Tue, 17-Mar-20	1	1	0.70910	0.00001942740	1.00015542862	0.709100000	0.00015541918	0.709100000000	100,000,000.00	1,942.74
Tue, 10-Mar-20	Tue, 17-Mar-20	Wed, 18-Mar-20	1	1	0.70910	0.00001942740	1.00017485903	0.709200000	0.00017487123	0.710000000000	100,000,000.00	1,945.21
Wed, 11-Mar-20	Wed, 18-Mar-20	Thu, 19-Mar-20	1	1	0.20920	0.00000573151	1.00018059154	0.659200000	0.00018060274	0.209200000000	100,000,000.00	573.15
Thu, 12-Mar-20	Thu, 19-Mar-20	Fri, 20-Mar-20	1	1	0.20930	0.00000573425	1.00018632682	0.618300000	0.00018633699	0.209300000000	100,000,000.00	573.42
Fri, 13-Mar-20	Fri, 20-Mar-20	Mon, 23-Mar-20	3	3	0.20930	0.00001720274	1.00020353277	0.530600000	0.00020351781	0.209033333333	100,000,000.00	1,718.08
Mon, 16-Mar-20	Mon, 23-Mar-20	Tue, 24-Mar-20	1	1	0.20960	0.00000574247	1.00020927640	0.509200000	0.00020926027	0.209600000000	100,000,000.00	574.25
Tue, 17-Mar-20	Tue, 24-Mar-20	Wed, 25-Mar-20	1	1	0.21350	0.00000584932	1.00021512694	0.490800000	0.00021514521	0.214800000000	100,000,000.00	588.49
Wed, 18-Mar-20	Wed, 25-Mar-20	Thu, 26-Mar-20	1	1	0.21480	0.00000588493	1.00022101314	0.474500000	0.00022100000	0.213700000000	100,000,000.00	585.48
Thu, 19-Mar-20	Thu, 26-Mar-20	Fri, 27-Mar-20	1	1	0.21340	0.00000584658	1.00022686101	0.460000000	0.00022684932	0.213500000000	100,000,000.00	584.93
Fri, 20-Mar-20	Fri, 27-Mar-20	Mon, 30-Mar-20	3	3	0.07060	0.00000580274	1.00023266506	0.404400000	0.00023266849	0.070800000000	100,000,000.00	581.92
Mon, 23-Mar-20	Mon, 30-Mar-20	Tue, 31-Mar-20	1	1	0.07230	0.00000198082	1.00023464635	0.389300000	0.00023464658	0.072200000000	100,000,000.00	197.81
Tue, 24-Mar-20	Tue, 31-Mar-20	Wed, 01-Apr-20	1	1	0.07360	0.00000201644	1.00023666326	0.375600000	0.00023667945	0.074200000000	100,000,000.00	203.29
Wed, 25-Mar-20	Wed, 01-Apr-20	Thu, 02-Apr-20	1	1	0.07500	0.00000205479	1.00023871854	0.363100000	0.00023875068	0.075600000000	100,000,000.00	207.12
Thu, 26-Mar-20	Thu, 02-Apr-20	Fri, 03-Apr-20	1	1	0.07290	0.00000199726	1.00024071628	0.351400000	0.00024068493	0.070600000000	100,000,000.00	193.42

25	25
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24,068.49

² Also known as 'Interest Period Weighted Observation Shift'

Lookback with Observation Shift² - Sharp Decrease in Interest Rate - resulting in Negative Interest

The below example illustrates the impact on daily interest calculation during the recent sharp reduction in SONIA due to COVID-19 situation but using it hypothetically around Easter bank holiday, just to show the impact of a sharp decrease in SONIA around bank holidays.

- When the no. of days in interest period is less than the no. of days in observation period (on 14-Apr-20 and 20-Apr-20), the interest amount just for those days will be negative. A total of approx. £6.2k in this example.

- This is not the case if the no. of days in interest period is equal or more than the no. of days in the observation period.

If Lookback without Observation Shift¹ is used for the same scenario, interest accrual would never be negative on any day of the interest period.

Lookback Days	5
Year Basis	365

Rounding Convention (Recommended)	No Rounding	No Rounding	As per Agreement	No Rounding	No Rounding
	16 dp or more	16 dp or more	4 dp	16 dp or more	16 dp or more
			Cumulative Compounded Rate		Non Cumulative Compounded Rate

Observation Date (T-5)	Start Date (T)	End Date	No. calendar days in Interest Period	No. calendar days in Observation Period	Daily RFR	Unannualised/ Effective Rate	Compounding Factor	Annualised Cumulative Compounded RFR _i (ACR _i)	Unannualised Cumulative Compounded RFR _i (UCR _i)	Non Cumulative Compounded RFR _i (NCR _i)	Principal	Daily RFR Interest using Non Cumulative Compounded Rate
Fri, 20-Mar-20	Fri, 27-Mar-20	Mon, 30-Mar-20	3	3	0.70890	0.00005826575	1.00005826575	0.70890000	0.00005826575	0.7089000000	100,000,000.00	5,826.58
Mon, 23-Mar-20	Mon, 30-Mar-20	Tue, 31-Mar-20	1	1	0.70980	0.00001944658	1.00007771346	0.70910000	0.00007770959	0.7097000000	100,000,000.00	1,944.38
Tue, 24-Mar-20	Tue, 31-Mar-20	Wed, 01-Apr-20	1	1	0.71000	0.00001945205	1.00009716703	0.70930000	0.00009716438	0.7101000000	100,000,000.00	1,945.48
Wed, 25-Mar-20	Wed, 01-Apr-20	Thu, 02-Apr-20	1	1	0.70890	0.00001942192	1.00011659083	0.70930000	0.00011659726	0.7093000000	100,000,000.00	1,943.29
Thu, 26-Mar-20	Thu, 02-Apr-20	Fri, 03-Apr-20	1	1	0.70870	0.00001941644	1.00013600954	0.70920000	0.00013601096	0.7086000000	100,000,000.00	1,941.37
Fri, 27-Mar-20	Fri, 03-Apr-20	Mon, 06-Apr-20	3	3	0.70910	0.00005828219	1.00019429965	0.70920000	0.00019430137	0.7092000000	100,000,000.00	5,829.04
Mon, 30-Mar-20	Mon, 06-Apr-20	Tue, 07-Apr-20	1	1	0.70910	0.00001942740	1.00021373083	0.70920000	0.00021373151	0.7092000000	100,000,000.00	1,943.01
Tue, 31-Mar-20	Tue, 07-Apr-20	Wed, 08-Apr-20	1	1	0.20920	0.00000573151	1.00021946356	0.66750000	0.00021945205	0.2088000000	100,000,000.00	572.05
Wed, 01-Apr-20	Wed, 08-Apr-20	Thu, 09-Apr-20	1	1	0.20930	0.00000573425	1.00022519906	0.63230000	0.00022520274	0.2099000000	100,000,000.00	575.07
Thu, 02-Apr-20	Thu, 09-Apr-20	Tue, 14-Apr-20	5	1	0.20930	0.00000573425	1.00023093460	0.60210000	0.00029692603	0.5235800000	100,000,000.00	7,172.33
Fri, 03-Apr-20	Tue, 14-Apr-20	Wed, 15-Apr-20	1	3	0.20960	0.00001722740	1.00024816598	0.53280000	0.00027734795	-0.7146000000	100,000,000.00	-1,957.81
Mon, 06-Apr-20	Wed, 15-Apr-20	Thu, 16-Apr-20	1	1	0.21350	0.00000584932	1.00025401674	0.51510000	0.00028224658	0.1788000000	100,000,000.00	489.86
Tue, 07-Apr-20	Thu, 16-Apr-20	Fri, 17-Apr-20	1	1	0.21480	0.00000588493	1.00025990317	0.49930000	0.00028726849	0.1833000000	100,000,000.00	502.19
Wed, 08-Apr-20	Fri, 17-Apr-20	Mon, 20-Apr-20	3	1	0.21340	0.00000584658	1.00026575126	0.48500000	0.00031890411	0.3849000000	100,000,000.00	3,163.56
Thu, 09-Apr-20	Mon, 20-Apr-20	Tue, 21-Apr-20	1	5	0.07060	0.00000967123	1.00027542507	0.40210000	0.00027541096	-1.5875000000	100,000,000.00	-4,349.32
Tue, 14-Apr-20	Tue, 21-Apr-20	Wed, 22-Apr-20	1	1	0.07230	0.00000198082	1.00027740644	0.38940000	0.00027738082	0.0719000000	100,000,000.00	196.99
Wed, 15-Apr-20	Wed, 22-Apr-20	Thu, 23-Apr-20	1	1	0.07360	0.00000201644	1.00027942343	0.37770000	0.00027939452	0.0735000000	100,000,000.00	201.37
Thu, 16-Apr-20	Thu, 23-Apr-20	Fri, 24-Apr-20	1	1	0.07500	0.00000205479	1.00028147880	0.36690000	0.00028145753	0.0753000000	100,000,000.00	206.30

28	28
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28,145.75

² Also known as 'Interest Period Weighted Observation Shift'

Lookback without Observation Shift¹ vs with Observation Shift²

¹ Also known as 'Lag'

² Also known as 'Interest Period Weighted Observation Shift'

Comparison between Lookback without Observation Shift¹ vs Lookback with Observation Shift² - Worked Example

In the below example of 1 month loan, the difference in compounded interest between Lookback without Observation Shift¹ and with Observation Shift² is only £0.82 on a principal of £100,000,000.00

Lookback without Observation Shift¹ vs Lookback with Observation Shift²

Lookback Days	5
Year Basis	365

Rounding Convention	Desired	As per Agreement	No Rounding	As per Agreement	No Rounding
		4 dp	16 dp or more	4 dp	16 dp or more

Observation Date (T-5)	Start Date (T)	End Date	No. calendar days in Interest Period	No. calendar days in Observation Period	Daily SONIA	Lookback without Observation Shift		Lookback with Observation Shift		Principal	SONIA Interest Amount		Difference with vs without Obsv. Shift
						Annualised Cumulative Compounded SONIA _{db} (ACS _{db})	Non Cumulative Compounded SONIA _{db} (NCS _{db})	Annualised Cumulative Compounded SONIA _{db} (ACS _{db})	Non Cumulative Compounded SONIA _{db} (NCS _{db})		Lookback without Observation Shift	Lookback with Observation Shift	
Mon,08-Apr	Mon,15-Apr	Tue,16-Apr	1	1	0.70790	0.70790000	0.7079000000000000	0.70790000	0.7079000000000000	100,000,000	1,939.45	1,939.45	0.00
Tue,09-Apr	Tue,16-Apr	Wed,17-Apr	1	1	0.70720	0.70760000	0.7073000000000000	0.70760000	0.7073000000000000	100,000,000	1,937.81	1,937.81	0.00
Wed,10-Apr	Wed,17-Apr	Thu,18-Apr	1	1	0.70810	0.70770000	0.7079000000000000	0.70770000	0.7079000000000000	100,000,000	1,939.45	1,939.45	0.00
Thu,11-Apr	Thu,18-Apr	Tue,23-Apr	5	1	0.70750	0.70760000	0.7075400000000000	0.70770000	0.7077000000000000	100,000,000	9,692.33	9,694.52	-2.19
Fri,12-Apr	Tue,23-Apr	Wed,24-Apr	1	3	0.70740	0.70760000	0.7076000000000000	0.70760000	0.7068000000000000	100,000,000	1,938.63	1,936.44	2.19
Mon,15-Apr	Wed,24-Apr	Thu,25-Apr	1	1	0.70820	0.70770000	0.7086000000000000	0.70770000	0.7086000000000000	100,000,000	1,941.37	1,941.37	0.00
Tue,16-Apr	Thu,25-Apr	Fri,26-Apr	1	1	0.70810	0.70770000	0.7077000000000000	0.70770000	0.7077000000000000	100,000,000	1,938.90	1,938.91	-0.01
Wed,17-Apr	Fri,26-Apr	Mon,29-Apr	3	1	0.70840	0.70790000	0.7086330000000000	0.70780000	0.7081666666666670	100,000,000	5,824.38	5,820.54	3.84
Thu,18-Apr	Mon,29-Apr	Tue,30-Apr	1	5	0.70870	0.70800000	0.7094000000000000	0.70820000	0.7138000000000010	100,000,000	1,943.56	1,955.62	-12.06
Tue,23-Apr	Tue,30-Apr	Wed,01-May	1	1	0.70920	0.70810000	0.7096000000000000	0.70820000	0.7082000000000000	90,000,000	1,749.70	1,746.25	3.45
Wed,24-Apr	Wed,01-May	Thu,02-May	1	1	0.70870	0.70810000	0.7081000000000000	0.70830000	0.7099000000000000	90,000,000	1,746.00	1,750.43	-4.43
Thu,25-Apr	Thu,02-May	Fri,03-May	1	1	0.70960	0.70820000	0.7099000000000000	0.70840000	0.7101000000000000	90,000,000	1,750.44	1,750.94	-0.50
Fri,26-Apr	Fri,03-May	Tue,07-May	4	3	0.71070	0.70870000	0.7109500000000000	0.70870000	0.7100499999999990	90,000,000	7,012.11	7,003.23	8.88
Mon,29-Apr	Tue,07-May	Wed,08-May	1	1	0.70970	0.70880000	0.7110000000000000	0.70880000	0.7110000000000020	90,000,000	1,753.15	1,753.15	0.00
Tue,30-Apr	Wed,08-May	Thu,09-May	1	1	0.71090	0.70890000	0.7112000000000000	0.70890000	0.7112000000000000	90,000,000	1,753.64	1,753.64	0.00
Wed,01-May	Thu,09-May	Fri,10-May	1	1	0.71030	0.70890000	0.7089000000000000	0.70900000	0.7113999999999990	90,000,000	1,747.97	1,754.14	-6.17
Thu,02-May	Fri,10-May	Mon,13-May	3	1	0.71070	0.70920000	0.7117000000000000	0.70900000	0.7090000000000010	90,000,000	5,264.63	5,244.66	19.97
Fri,03-May	Mon,13-May	Tue,14-May	1	4	0.70980	0.70920000	0.7092000000000000	0.70920000	0.7147999999999990	90,000,000	1,748.71	1,762.52	-13.81
Tue,07-May	Tue,14-May	Wed,15-May	1	1	0.70940	0.70920000	0.7092000000000000	0.70920000	0.7092000000000010	90,000,000	1,748.71	1,748.71	0.00

30	30
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55,370.96	55,371.78	-0.82
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Cumulative Rate Method	55,370.96	55,371.78
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Cumulative vs Non Cumulative Method	0.00	0.00
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¹ Also known as 'Lag'

² Also known as 'Interest Period Weighted Observation Shift'

Floor Approach for Legacy Contracts

Floor Approach for Legacy Contracts - Overview

3 different options that have been considered in respect of managing floor for legacy LIBOR loans being converted to SONIA: **Option 1 (RFR approach) is the recommended approach.** It is important to note that all three options would calculate a slightly different interest amount.

	Pros	Cons
Option 1 (RFR approach) If SONIA + CAS is less than floor value, CAS will remain unchanged; SONIA will be adjusted to ensure SONIA + CAS is equal to Floor	(1) Easy and simple to understand (2) Loan system vendors may be able to deliver the required capability quickly	(1) Currently requires calculation/ reconciliation of compounded Sonia component using variable floors for each day in the interest period
Option 2 (CAS approach) If SONIA + CAS is less than floor value, SONIA will remain unchanged; CAS will be adjusted to ensure SONIA + CAS is equal to Floor	(1) Easy and simple to understand (2) Standard calculation/reconciliation of unfloored compounded SONIA component	(1) The adjusted CAS cannot be easily reconciled (2) Loan system vendors may take more time to deliver the required capability
Option 3 (Hybrid approach) If SONIA is negative, it will be deemed zero, CAS will be adjusted to ensure SONIA + CAS is equal to Floor	(1) Same calculation/reconciliation of compounded SONIA component as for all zero floored contracts	(1) The adjusted CAS cannot be easily reconciled (2) Loan system vendors may take longer to deliver the required capability

Scenario		Example
Zero Floor	RFR + CAS is net -ve	RFR + CAS = -0.35% • RFR = -0.60% • CAS = 0.25%
	RFR + CAS is net +ve	RFR + CAS = 0.10% • RFR = -0.15% • CAS = 0.25%
1% Floor	RFR + CAS <1% RFR is +ve CAS is +ve	• RFR = 0.10% • CAS = 0.25%
	RFR + CAS <1% RFR is -ve CAS is +ve	• RFR = -0.15% • CAS = 0.25%

*CAS – Credit Adjustment Spread

Recommended Approach

Option 1 RFR Approach

- RFR = **-0.25%**
- CAS = 0.25%

- RFR = **-0.15%**
- CAS = 0.25%

- RFR = 0.75%
- CAS = 0.25%

- RFR = 0.75%
- CAS = 0.25%

RFR approach
 - RFR adjusted to equal floor
 - CAS will remain unchanged

Option 2 CAS Approach

- RFR = **-0.60%**
- CAS = 0.60%

- RFR = **-0.15%**
- CAS = 0.25%

- RFR = 0.10%
- CAS = 0.90%

- RFR = **-0.15%**
- CAS = 1.15%

CAS approach
 - RFR will remain unchanged
 - CAS adjusted to equal floor

Option 3 Hybrid Approach

- RFR = 0.00%
- CAS = 0.00%

- RFR = 0.00%
- CAS = 0.10%

- RFR = 0.10%
- CAS = 0.90%

- RFR = 0.00%
- CAS = 1.00%

Hybrid approach
 - RFR - if < 0%, will be = 0%
 - CAS adjusted to equal floor

Floor Approach for Legacy Contracts - Lookback without Observation Shift¹ - Worked Example

Example showing a scenario where RFR + Credit Adjustment Spread (CAS) is below floor. The below represents Option 1 – RFR Approach - CAS will remain unchanged; SONIA will be adjusted to ensure SONIA + CAS is equal to Floor

Lookback/Lag Days	5	Margin	2.00%	Rounding Convention (Recommended)	No Rounding	No Rounding	As per Agreement	No Rounding	No Rounding		No Rounding	No Rounding	No Rounding						
Year Basis (N)	365	Credit Adjustment	0.05%		16 dp or more	16 dp or more	4 dp	16 dp or more	16 dp or more		16 dp or more	16 dp or more	16 dp or more	2 dp at the end					
		Floor (RFR + CAS)	1%				Step 1: ACR _i	Step 2: UCR _i	Step 3: NCR _i	Step 4: Interest									
Breaking down the Formula		n _i	tn _i	r _i	$\frac{r_i \times n_i}{N}$ (N = 365)	$\prod_{i=1}^{d_b} \left(1 + \frac{r_i \times n_i}{N}\right)$	$\left[\prod_{i=1}^{d_b} \left(1 + \frac{r_i \times n_i}{N}\right) - 1\right] \times \frac{N}{tn_i}$	$ACR_i \times \frac{tn_i}{N}$	$(UCR_i - UCR_{i-1BD}) \times \frac{N}{n_i}$	$\sum_{i=1}^{d_b} \left(\frac{Principal_i \times [NCR_i + CAS + Margin] \times n_i}{N} \right)$									
Observation Date (T-5)	Start Date (T)	No. calendar days in Interest Period	Cumulative Interest Period Days	Daily published RFR (SONIA)	Daily Floored RFR (SONIA)	Unannualised/ Effective RFR	Compounding Factor	Annualised Cumulative Compounded RFR _i (ACR _i)	Unannualised Cumulative Compounded RFR _i (UCR _i)	Non Cumulative Compounded RFR _i (NCR _i)	Principal	RFR Interest using Non Cumulative Compounded Rate	Credit Adjustment Spread Interest	Margin Interest	Total Interest				
Mon,08-Apr-19	Mon,15-Apr-19	1	1	0.70790%	0.95000%	0.0000260273973	1.0000260273973	0.950000%	0.0000260273973	0.9500000000%	100,000,000	2,602.74	136.99	5,479.45	8,219.18				
Tue,09-Apr-19	Tue,16-Apr-19	1	2	0.70720%	0.95000%	0.0000260273973	1.000052054720	0.950000%	0.0000520547945	0.9500000000%	100,000,000	2,602.74	136.99	5,479.45	8,219.18				
Wed,10-Apr-19	Wed,17-Apr-19	1	3	0.70810%	0.95000%	0.0000260273973	1.0000780842241	0.950000%	0.0000780821918	0.9500000000%	100,000,000	2,602.74	136.99	5,479.45	8,219.18				
Thu,11-Apr-19	Thu,18-Apr-19	5	8	0.70750%	0.95000%	0.0001301369863	1.0002082313720	0.950100%	0.0002082410959	0.9501600000%	100,000,000	13,015.89	684.93	27,397.26	41,098.08				
Fri,12-Apr-19	Tue,23-Apr-19	1	9	0.70740%	0.95000%	0.0000260273973	1.0002342641890	0.950100%	0.0002342712329	0.9501000000%	100,000,000	2,603.01	136.99	5,479.45	8,219.45				
Mon,15-Apr-19	Wed,24-Apr-19	1	10	0.70820%	0.95000%	0.0000260273973	1.0002602976836	0.950100%	0.0002603013699	0.9501000000%	100,000,000	2,603.01	136.99	5,479.45	8,219.45				
Tue,16-Apr-19	Thu,25-Apr-19	1	11	0.70810%	0.95000%	0.0000260273973	1.0002863318557	0.950100%	0.0002863315068	0.9501000000%	100,000,000	2,603.01	136.99	5,479.45	8,219.45				
Wed,17-Apr-19	Fri,26-Apr-19	3	14	0.70840%	0.95000%	0.0000780821918	1.0003644364049	0.950100%	0.0003644219178	0.9501000000%	100,000,000	7,809.04	410.96	16,438.36	24,658.36				
Thu,18-Apr-19	Mon,29-Apr-19	1	15	0.70870%	0.95000%	0.0000260273973	1.0003904732875	0.950200%	0.0003904931507	0.9516000000%	100,000,000	2,607.12	136.99	5,479.45	8,223.56				
Tue,23-Apr-19	Tue,30-Apr-19	1	16	0.70920%	0.95000%	0.0000260273973	1.0004165108477	0.950200%	0.0004165260274	0.9502000000%	90,000,000	2,342.96	123.29	4,931.51	7,397.75				
Wed,24-Apr-19	Wed,01-May-19	1	17	0.70870%	0.95000%	0.0000260273973	1.0004425490857	0.950200%	0.0004425589041	0.9502000000%	90,000,000	2,342.96	123.29	4,931.51	7,397.75				
Thu,25-Apr-19	Thu,02-May-19	1	18	0.70960%	0.95000%	0.0000260273973	1.0004685880014	0.950200%	0.0004685917808	0.9502000000%	90,000,000	2,342.96	123.29	4,931.51	7,397.75				
Fri,26-Apr-19	Fri,03-May-19	4	22	0.71070%	0.95000%	0.0001041095890	1.0005727463749	0.950200%	0.000572732877	0.9502000000%	90,000,000	9,371.84	493.15	19,726.03	29,591.01				
Mon,29-Apr-19	Tue,07-May-19	1	23	0.70970%	0.95000%	0.0000260273973	1.0005987886793	0.950300%	0.0005988191781	0.9525000000%	90,000,000	2,348.63	123.29	4,931.51	7,403.42				
Tue,30-Apr-19	Wed,08-May-19	1	24	0.71090%	0.95000%	0.0000260273973	1.0006248316614	0.950300%	0.0006248547945	0.9503000000%	90,000,000	2,343.21	123.29	4,931.51	7,398.00				
Wed,01-May-19	Thu,09-May-19	1	25	0.71030%	0.95000%	0.0000260273973	1.0006508753214	0.950300%	0.0006508904110	0.9503000000%	90,000,000	2,343.21	123.29	4,931.51	7,398.00				
Thu,02-May-19	Fri,10-May-19	3	28	0.71070%	0.95000%	0.0000780821918	1.0007290083350	0.950300%	0.0007289972603	0.9503000000%	90,000,000	7,029.62	369.86	14,794.52	22,194.00				
Fri,03-May-19	Mon,13-May-19	1	29	0.70980%	0.95000%	0.0000260273973	1.0007550547064	0.950300%	0.0007550328767	0.9503000000%	90,000,000	2,343.21	123.29	4,931.51	7,398.00				
Tue,07-May-19	Tue,14-May-19	1	30	0.70940%	0.95000%	0.0000260273973	1.0007811017558	0.950300%	0.0007810684932	0.9503000000%	90,000,000	2,343.21	123.29	4,931.51	7,398.00				
											30	74,201.10	3,904.11	156,164.38	234,269.59				
												Cumulative Rate Method				74,201.10	3,904.11	156,164.38	234,269.59
												Cumulative Rate vs Non Cumulative Rate Method				0.00	0.00	0.00	0.00

¹ Also known as 'Lag'

Floor Approach for Legacy Contracts - Lookback with Observation Shift² - Worked Example

Example showing a scenario where RFR + Credit Adjustment Spread (CAS) is below floor. The below represents Option 1 – RFR Approach - CAS will remain unchanged; SONIA will be adjusted to ensure SONIA + CAS is equal to Floor

Lookback Days	5	Margin	2.00%	Rounding Convention (Recommended)	No Rounding	No Rounding	As per Agreement	No Rounding	No Rounding		No Rounding	No Rounding	No Rounding					
Year Basis (N)	365	Credit Adjustment Spread	0.05%		16 dp or more	16 dp or more	4 dp	16 dp or more	16 dp or more		16 dp or more	16 dp or more	16 dp or more	2 dp at the end				
Loan Period - 15-Apr-19 to 15-May-19		Floor (RFR + CAS)	1%			Step 1: ACR _i	Step 2: UCR _i	Step 3: NCR _i	Step 4: Interest									
Breaking down the Formula		n _i	tn _i	cn _i	tcn _i	r _i	$\frac{r_i \times n_i}{N}$ (N = 365)	$\prod_{i=1}^{d_b} \left(1 + \frac{r_i \times n_i}{N}\right)$	$\prod_{i=1}^{d_b} \left(1 + \frac{r_i \times n_i}{N}\right) - 1$	$\frac{d_b}{N} \times \frac{N}{tn_i}$	$ACR_i \times \frac{tcn_i}{N}$	$(UCR_i - UCR_{i-180}) \times \frac{N}{cn_i}$	$\sum_{i=1}^{d_b} \left(\frac{Principal_i \times [NCR_i + CAS + Margin] \times cn_i}{N} \right)$					
Observation Date (T-5)	Start Date (T)	No. calendar days in Observation Period	Cumulative Observation Period Days	No. calendar days in Interest Period	Cumulative Interest Period Days	Daily published RFR (SONIA)	Daily Floored RFR (SONIA)	Unannualised/ Effective RFR	Compounding Factor	Annualised Cumulative Compounded RFR _i (ACR _i)	Unannualised Cumulative Compounded RFR _i (UCR _i)	Non Cumulative Compounded RFR _i (NCR _i)	Principal	RFR Interest using Non Cumulative Compounded Rate	Credit Adjustment Spread Interest	Margin Interest	Total Interest	
Mon,08-Apr	Mon,15-Apr	1	1	1	1	0.70790%	0.95000%	0.0000260273973	1.0000260273973	0.950000%	0.0000260273973	0.95000000000%	100,000,000	2,602.74	136.99	5,479.45	8,219.18	
Tue,09-Apr	Tue,16-Apr	1	2	1	2	0.70720%	0.95000%	0.0000260273973	1.0000520554720	0.950000%	0.0000520547945	0.95000000000%	100,000,000	2,602.74	136.99	5,479.45	8,219.18	
Wed,10-Apr	Wed,17-Apr	1	3	1	3	0.70810%	0.95000%	0.0000260273973	1.0000780842241	0.950000%	0.0000780821918	0.95000000000%	100,000,000	2,602.74	136.99	5,479.45	8,219.18	
Thu,11-Apr	Thu,18-Apr	1	4	5	8	0.70750%	0.95000%	0.0000260273973	1.0001041136537	0.950000%	0.0002082191781	0.95000000000%	100,000,000	13,013.70	684.93	27,397.26	41,095.89	
Fri,12-Apr	Tue,23-Apr	3	7	1	9	0.70740%	0.95000%	0.0000780821918	1.0001822039749	0.950100%	0.0002342712329	0.95090000000%	100,000,000	2,605.21	136.99	5,479.45	8,221.64	
Mon,15-Apr	Wed,24-Apr	1	8	1	10	0.70820%	0.95000%	0.0000260273973	1.0002082361144	0.950100%	0.0002603013699	0.95010000000%	100,000,000	2,603.01	136.99	5,479.45	8,219.45	
Tue,16-Apr	Thu,25-Apr	1	9	1	11	0.70810%	0.95000%	0.0000260273973	1.0002342689315	0.950100%	0.0002863315068	0.95010000000%	100,000,000	2,603.01	136.99	5,479.45	8,219.45	
Wed,17-Apr	Fri,26-Apr	1	10	3	14	0.70840%	0.95000%	0.0000260273973	1.0002603024262	0.950100%	0.0003644219178	0.95010000000%	100,000,000	7,809.04	410.96	16,438.36	24,658.36	
Thu,18-Apr	Mon,29-Apr	5	15	1	15	0.70870%	0.95000%	0.0001301369863	1.0003904732875	0.950200%	0.0003904931507	0.95160000000%	100,000,000	2,607.12	136.99	5,479.45	8,223.56	
Tue,23-Apr	Tue,30-Apr	1	16	1	16	0.70920%	0.95000%	0.0000260273973	1.0004165108477	0.950200%	0.0004165260274	0.95020000000%	90,000,000	2,342.96	123.29	4,931.51	7,397.75	
Wed,24-Apr	Wed,01-May	1	17	1	17	0.70870%	0.95000%	0.0000260273973	1.0004425490857	0.950200%	0.0004425589041	0.95020000000%	90,000,000	2,342.96	123.29	4,931.51	7,397.75	
Thu,25-Apr	Thu,02-May	1	18	1	18	0.70960%	0.95000%	0.0000260273973	1.0004685880014	0.950200%	0.0004685917808	0.95020000000%	90,000,000	2,342.96	123.29	4,931.51	7,397.75	
Fri,26-Apr	Fri,03-May	3	21	4	22	0.71070%	0.95000%	0.0000780821918	1.0005467067815	0.950200%	0.0005727232877	0.95020000000%	90,000,000	9,371.84	493.15	19,726.03	29,591.01	
Mon,29-Apr	Tue,07-May	1	22	1	23	0.70970%	0.95000%	0.0000260273973	1.0005727484081	0.950200%	0.0005987561644	0.95020000000%	90,000,000	2,342.96	123.29	4,931.51	7,397.75	
Tue,30-Apr	Wed,08-May	1	23	1	24	0.71090%	0.95000%	0.0000260273973	1.0005987907125	0.950300%	0.0006248547945	0.95260000000%	90,000,000	2,348.88	123.29	4,931.51	7,403.67	
Wed,01-May	Thu,09-May	1	24	1	25	0.71030%	0.95000%	0.0000260273973	1.0006248336948	0.950300%	0.0006508904110	0.95030000000%	90,000,000	2,343.21	123.29	4,931.51	7,398.00	
Thu,02-May	Fri,10-May	1	25	3	28	0.71070%	0.95000%	0.0000260273973	1.0006508773548	0.950300%	0.0007289972603	0.95030000000%	90,000,000	7,029.62	369.86	14,794.52	22,194.00	
Fri,03-May	Mon,13-May	4	29	1	29	0.70980%	0.95000%	0.0001041095890	1.0007550547064	0.950300%	0.0007550328767	0.95030000000%	90,000,000	2,343.21	123.29	4,931.51	7,398.00	
Tue,07-May	Tue,14-May	1	30	1	30	0.70940%	0.95000%	0.0000260273973	1.0007811017558	0.950300%	0.0007810684932	0.95030000000%	90,000,000	2,343.21	123.29	4,931.51	7,398.00	
		30		30										74,201.10	3,904.11	156,164.38	234,269.59	
													Cumulative Rate Method		74,201.10	3,904.11	156,164.38	234,269.59
													Cumulative Rate vs Non Cumulative Rate Method		0.00	0.00	0.00	0.00

² Also known as 'Interest Period Weighted Observation Shift'

Cumulative vs Non Cumulative Rate and the Proposed Rounding Approach

Cumulative vs Non Cumulative Compounded Rate and the Proposed Rounding Approach

Cumulative vs Non Cumulative Compounded Rate

While Cumulative and Non Cumulative Compounded Rate methods are different implementation approaches, if the same rounding convention is adopted, the interest amount will be same.

- Cumulative Compounded Rate calculates the compounded rate at the end of the interest period and it is applied to the whole period. It allows calculation of interest for the whole period using a single compounded rate..
- Non Cumulative Compounded Rate is derived from Cumulative Compounded Rate i.e., Cumulative rate as of current day minus Cumulative rate as of prior Banking day. This generates a daily compounded rate which allows the calculation of a daily interest amount.

Recommendation

It is recommended to adopt **Non Cumulative Compounded Rate** method

Reason for the recommendation

- Since Cumulative Compounded Rate calculates the applicable compounded rate at the end of the interest period, complexity is added when supporting intra period events such as loan trading activity.
- Non Cumulative Compounded Rate being a daily compounded rate, better supports intra period events such as loan trading activity and specifically to distribute interest to lenders on a pro-rata basis.
See below for Working Group's recommendation on how to ensure the total accrued interest amount calculated using the cumulative and non-cumulative compounded rate is always the same.

Rounding the Compounded Rate

The Working Group's recommendation is for SONIA to be rounded (and not truncated) to 4 decimal places and sterling amounts be rounded to two decimal places.

To ensure the total accrued interest amount due from the borrower, calculated using the Cumulative and Non-Cumulative Compounded Rate is always the same, the Working Group's recommendation is for:

- the Annualised Cumulative Compounded Rate (ACR) to be rounded on a daily basis (based on the number of decimal places stated in the credit agreement);
- the Non Cumulative Compounded Rate (NCR) derived from the daily Cumulative Compounded Rate not to be rounded;
- the daily compounded RFR interest component calculated using the Cumulative or Non-Cumulative Compounded Rate not to be rounded (so that the total accrued interest calculated as the sum of these daily compounded RFR interest components does not carry forward rounded amounts); and
- the sterling amount of total accrued interest due from the borrower (i.e. compounded RFR component + margin + Credit Adjustment Spread (if applicable)), whether generated using the Cumulative Compounded Rate or the sum of daily unrounded amounts calculated using the Non-Cumulative Compounded Rate, to be rounded to two decimal places at the end of the period only.