LIBOR ALTERNATIVES AND TRANSITION

Emirates NBD

INDEX

INTRODUCTION TO LIBOR TRANSITION

What is changing?

The London Interbank Offered Rates (LIBORs), administered by the ICE Benchmark Administration, are being replaced with various alternative nearly Risk-Free Rates (RFRs). LIBORs are currently published in Five currencies and Seven tenors. Regulatory bodies across several jurisdictions have set up working groups to facilitate the transition away from LIBORs and to develop robust alternatives.

Why?

A lack of liquidity in the unsecured wholesale lending market following the financial crisis of 2007 – 2008 resulted in fewer transaction-based rates being submitted to support LIBOR and as a result there was an increased reliance placed on 'expert judgement' of banks to determine LIBOR rates instead of rates corresponding to actual transactions. In 2012, a number of banks were fined by the UK Financial Conduct Authority (FCA) for having manipulated interbank offer rates (IBOR) which they had submitted during the financial crisis.

Sources: FCA Fine Enforcements

When?

On 5th March 2021, the FCA announced that after 31st December 2021 all of the following rates would cease and/or would no longer be representative of such underlying markets: GBP LIBOR for all tenors, USD LIBOR for 1 week & for 2 months, and all tenors of LIBOR for JPY, CHF and EUR.

After 30th June 2023, the following rates will cease and/or will no longer be representative of such underlying markets: USD LIBOR for overnight, 1 month, 3 months, 6 months and 12 months.

INTRODUCTION TO LIBOR TRANSITION

What do you need to do?

- Familiarize yourself with the RFRs which will replace the corresponding LIBOR rates and the interest rate calculation methodologies for those RFRs.
- Ensure your internal systems and processes are ready to manage RFR referencing facilities.
- Seek professional advice in respect of new RFR referencing facilities and existing LIBOR referencing facilities that will be transitioned to RFR referencing.
- Agree to the terms that will apply to your existing LIBOR referencing facilities with ENBD that will be transitioned to RFR referencing facilities.

How we are supporting you?

ENBD has a dedicated team to prepare the Bank for a smooth and timely transition from LIBORs to RFRs.

As a customer of ENBD, you may access the relevant resources on the ENBD website (including FAQs) and liaise with your relationship manager to discuss the transitioning of your existing LIBOR referencing products to RFR referencing products, alongside the associated timelines for that transition.

ALTERNATIVES TO LIBOR – NEARLY RISK-FREE RATES (RFRS)

Regulatory bodies across several jurisdictions have set up working groups to facilitate the transition away from LIBORs and to develop robust alternatives. For instance, the Federal Reserve Bank of New York has set up the Alternative Reference Rates Committee (ARRC) and the Bank of England has set up the Working Group on Sterling Risk-Free Rates (UKRFRWG). These working groups have recommended RFRs in respect of the outgoing LIBORs as set out below.

Currency	Outgoing Rate	Recommended RFR	Rate Type	More information – link to the Working Group
USD	USD LIBOR	SOFR (Secured Overnight Financing Rate)	Secured	Alternative Reference Rates Committee
GBP	GBP LIBOR	SONIA (Sterling Overnight Index Average)	Unsecured	Working Group on Sterling Risk-Free Rates
EUR	EUR LIBOR / EONIA	€STR (Euro Short-Term Rate)	Unsecured	Working Group on Euro Risk-Free Rates
CHF	CHF LIBOR	SARON (Swiss Average Rate Overnight)	Secured	National Working Group on Swiss Franc Reference Rates
JPY	JPY LIBOR	TONAR (Tokyo Overnight Average Rate)	Unsecured	Cross-Industry Committee on Japanese Yen Interest Rate Benchmarks
SGD	SOR / SIBOR	SORA (Singapore Overnight Rate Average)	Unsecured	Steering Committee for SOR & SIBOR Transition to SORA

- **RFRs are fully transaction based**: they are backward looking, deriving from actual rates used in the selected underlying markets.
- **Secured Rates** are based on secured collateralized money market instruments.
- **RFRs are "nearly" credit risk free**: they are backward looking , comprising of overnight rates; they are not forward looking and so, do not comprise a credit risk premium or a liquidity tenor adjustment (explained in subsequent slides).

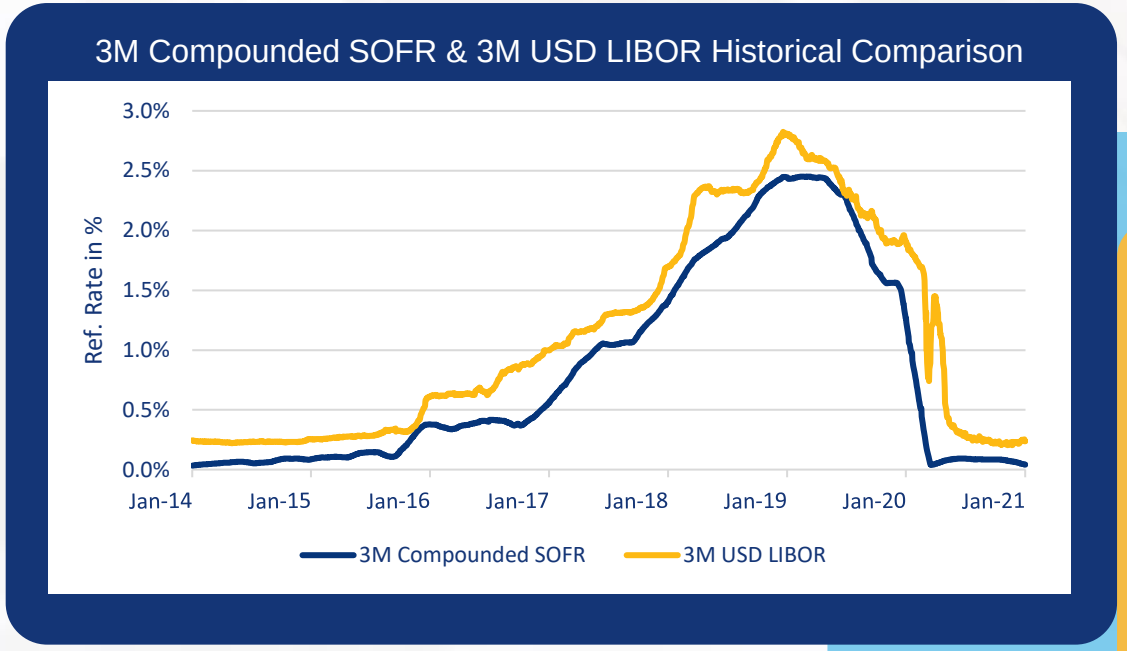
DIFFERENCE IN THE COMPOSITION OF LIBOR AND RFRS

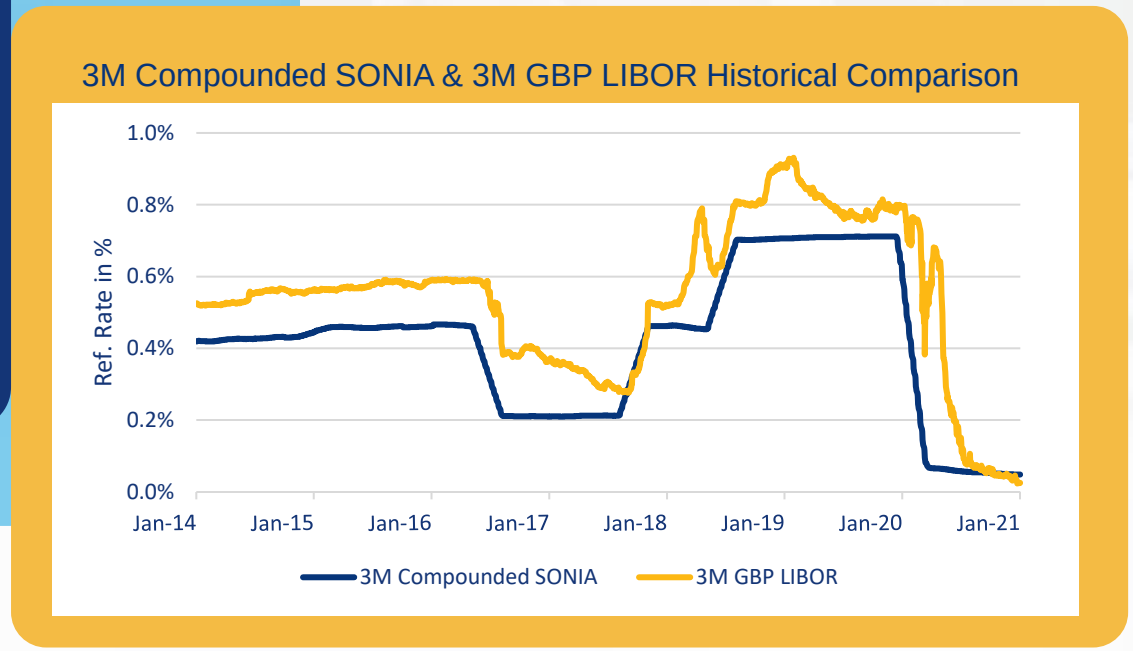
LIBORs and RFRs differ in structure and value. LIBORs comprise of 3 components: (i) credit risk premium (interbank lending between banks), (ii) liquidity tenor adjustment, and (iii) the near Risk-Free rate.

RFRs comprise of only the near Risk-Free Rate, being the relevant overnight rate.

The graphs on the next slide show the historical comparisons for USD and for GBP: for USD (3M compounded SOFR & 3M USD LIBOR); and for GBP (3M compounded SONIA & 3M GBP LIBOR).

DIFFERENCE IN THE COMPOSITION OF LIBOR AND RFRS





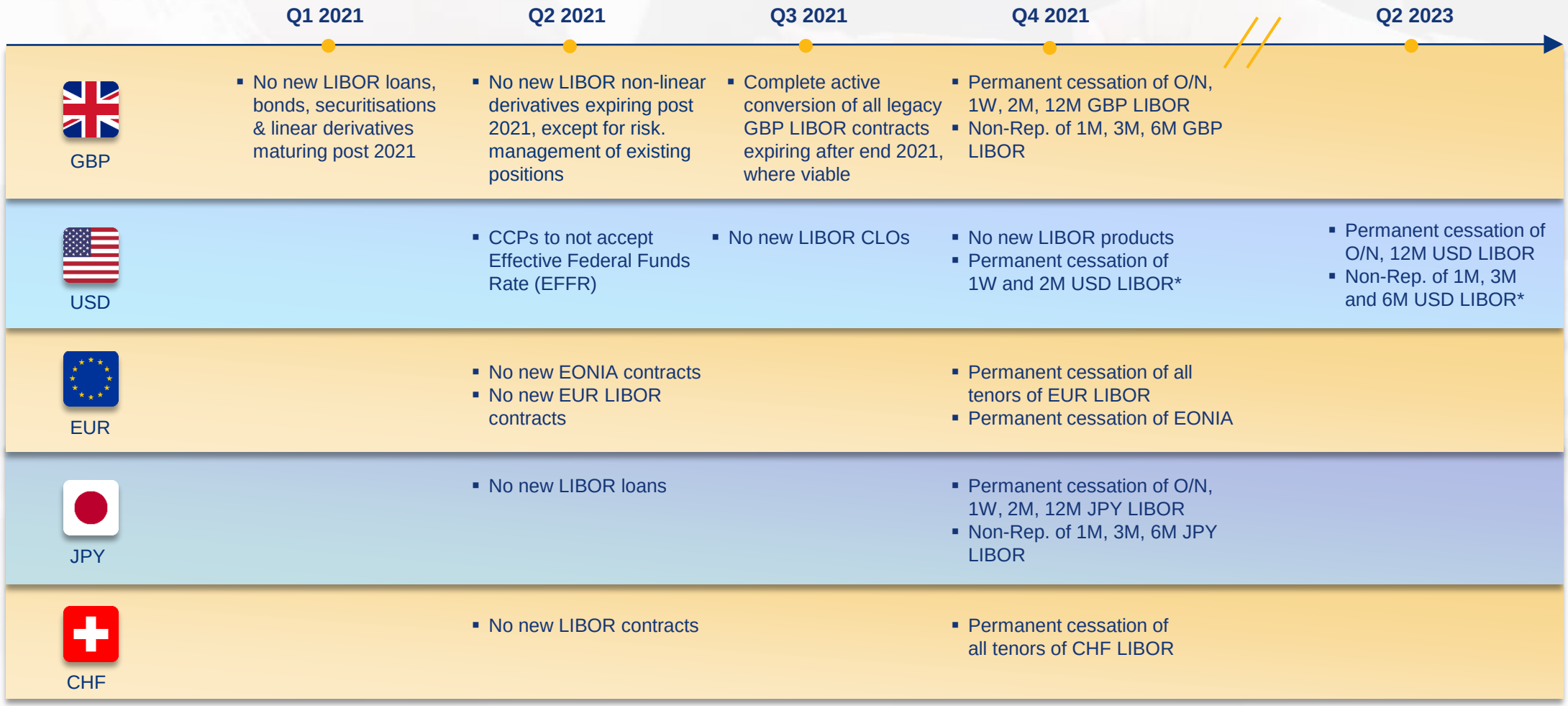
LIBOR CESSATION TIMELINES AND OTHER INTERIM REGULATORY MILESTONES

On 5 March, 2021, the FCA announced the cessation and/or non-representativeness dates for all the Thirty Five LIBORs.

Currency	Cessation and/or Non-Representativeness Date	Cessation Tenors	Non-Representativeness Tenors
GBP	31-Dec-2021	O/N, 1W, 2M, 12M	1M, 3M, 6M
USD	31-Dec-2021	1W, 2M	-
	30-Jun-2023	O/N, 12M	1M, 3M, 6M
JPY	31-Dec-2021	O/N, 1W, 2M, 12M	1M, 3M, 6M
EUR	31-Dec-2021	All 7 LIBOR settings	-
CHF	31-Dec-2021	All 7 LBOR settings	-

- **Cessation** means the permanent cessation of publication of the relevant tenor of the respective LIBORs
- **Non-representativeness** means that the LIBOR rates are not expected to be representative of the underlying market that they are intended to measure.

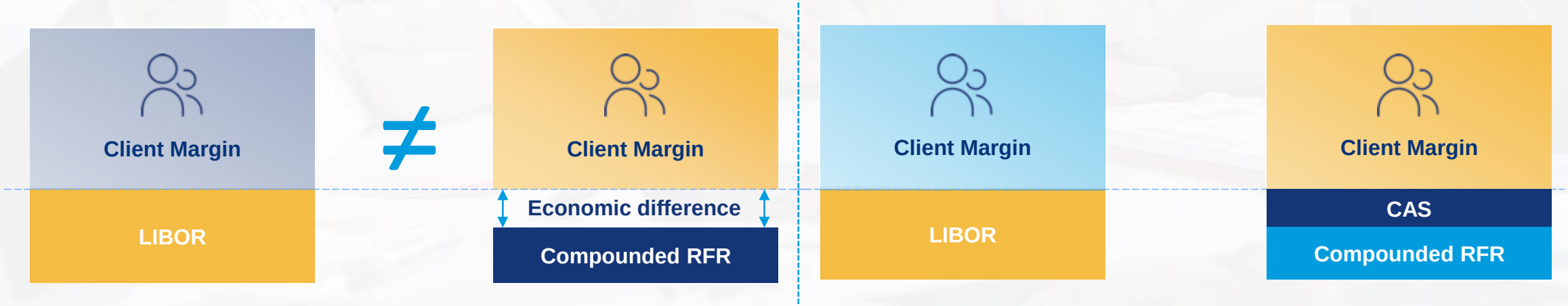
LIBOR CESSATION TIMELINES AND OTHER INTERIM REGULATORY MILESTONES



*"LIBOR cessation" refers to the permanent cessation of publication of the respective LIBOR rates. "Non-Representativeness" refers to FCA announcing that the respective LIBOR is no longer representative of the underlying market that it is intended to measure, and that representativeness will not be restored.

INTRODUCTION TO CREDIT ADJUSTMENT SPREAD (CAS)

As demonstrated earlier, the difference in the composition of LIBORs and RFRs means that the rates vary in magnitude. Therefore, an interest rate for a loan computed as “LIBOR + Margin” will be economically different to a “Compounded RFR + Margin”. In order to avoid any value transfer between parties, a credit adjustment spread will be added on to the compounded RFR to align value transition so that “RFR +CAS” will equate to “LIBOR”. For transitioning loans, the margin remains the same. This concept is depicted in the figure below.



Use of Credit Adjustment Spread (CAS) is recommended to account for the “Economic Difference”

	LIBOR	SONIA
Facility Amount	GBP 50,000,000	GBP 50,000,000
Term	5 years	5 years
Ref Rate	3M LIBOR	SONIA
LIBOR	0.15%	N/A
SONIA	N/A	0.06%
Margin	0.50%	0.50%
Adjustment Spread	N/A	0.09%
All-in-Rate	0.65%	0.65%

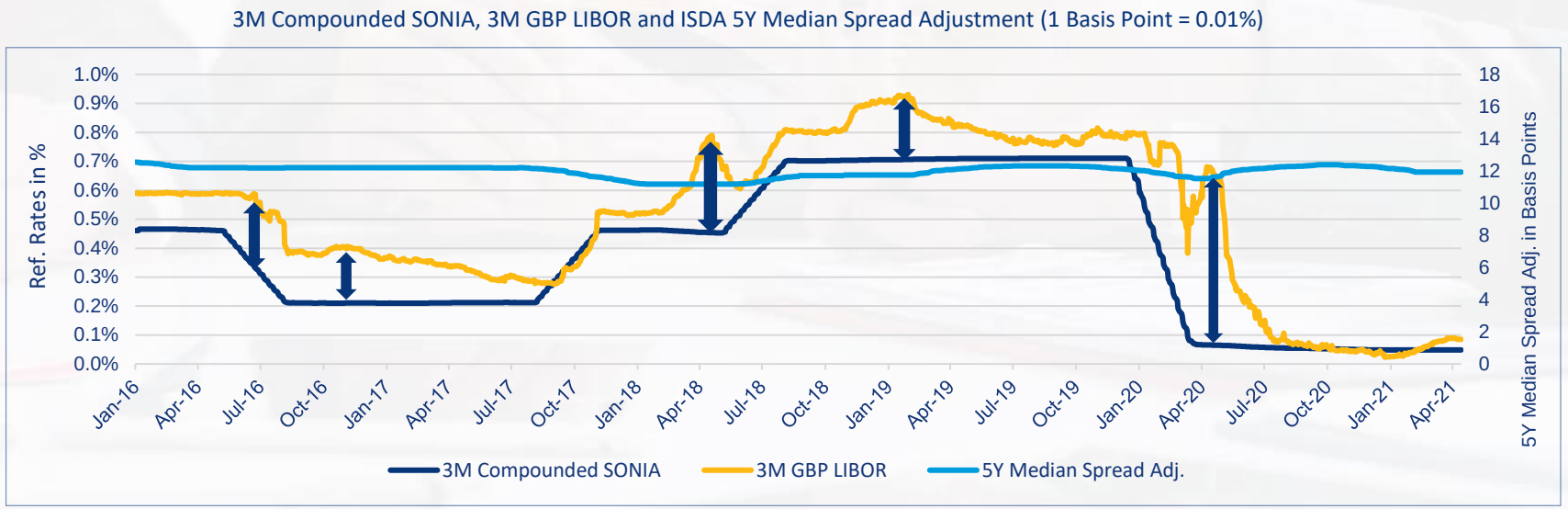
For transitioning assets, the original margin will remain the same and so, CAS will be added to the RFR.

CALCULATION OF CREDIT ADJUSTMENT SPREAD (CAS)

ISDA 5Y Median Spread Adjustment

As recommended by several supervisory bodies, including ARRC, UKRFRWG, International Swaps and Derivatives Association (ISDA), the ISDA 5Y historical median spread adjustment shall apply as the CAS for transitioning assets. This methodology calculates the CAS as the median of the spot spreads between LIBOR and the compounded RFR over a 5-year historical period. These spreads are officially published by Bloomberg.

The FCA announcement on 5 March, 2021 triggered, an "Index Cessation Event" under the ISDA 2020 IBOR Protocol. This means that the ISDA 5Y Median Spread Adjustment for each of the LIBOR Tenors for each of the relevant currencies was determined and so, such CAS values are fixed as of 5 March 2021. The graph shows a historical comparison of the 3M compounded SONIA, 3M GBP LIBOR and the corresponding ISDA 5Y median spread adjustment.



The table below shows the fixed ISDA 5Y Median Spread Adjustment for GBP and USD. All the spreads are publicly available on Bloomberg's website. Please click here for more information.

Currency								
GBP	Tenor	Overnight	1W	1M	2M	3M	6M	12M
	ISDA 5Y Median Spread Adjustment (Bps)	-0.24	1.68	3.26	6.33	11.93	27.66	46.44
USD	Tenor	Overnight	1W	1M	2M	3M	6M	12M
	ISDA 5Y Median Spread Adjustment (Bps)	0.644	3.839	11.448	18.456	26.161	42.826	71.513

CALCULATION OF CREDIT ADJUSTMENT SPREAD (CAS)

Methodologies discussed in the Financial Markets

While the ISDA 5Y Median Spread Adjustment is widely accepted, recommended by regulatory working groups, and is expected to be the industry standard in applying the Credit Adjustment Spread for transitioning LIBOR referencing assets, market stakeholders did consider alternative credit adjustment spreads, as noted in detail below.

Please click here for more information.

5Y ISDA Median Spread (Expected to be the industry standard)	Forward Looking Market Spread
5-year historical median of LIBOR - RFR	Calculated using linear interpolation between differing tenors of LIBOR vs RFR forward looking basis swaps
Relatively lower risk due to fixed spread and not sensitive to the changes in the financial markets	Relatively higher risk due to market sensitive spread
Consistent with derivatives markets as per the ISDA protocol	Consistent with current market spreads
Recommended by BoE and ARRC	Liquidity aspect should be taken into consideration.

Currency	LIBOR Tenor	5Y ISDA Median spread (bps)*
GBP	3M	11.93
	6M	27.66
	12M	46.44
USD	3M	26.161
	6M	42.826
	12M	71.513
EUR	3M	9.62
	6M	15.37
	12M	29.93
JPY	3M	0.835
	6M	5.809
	12M	16.600
CHF	3M	0.31
	6M	7.41
	12M	20.48

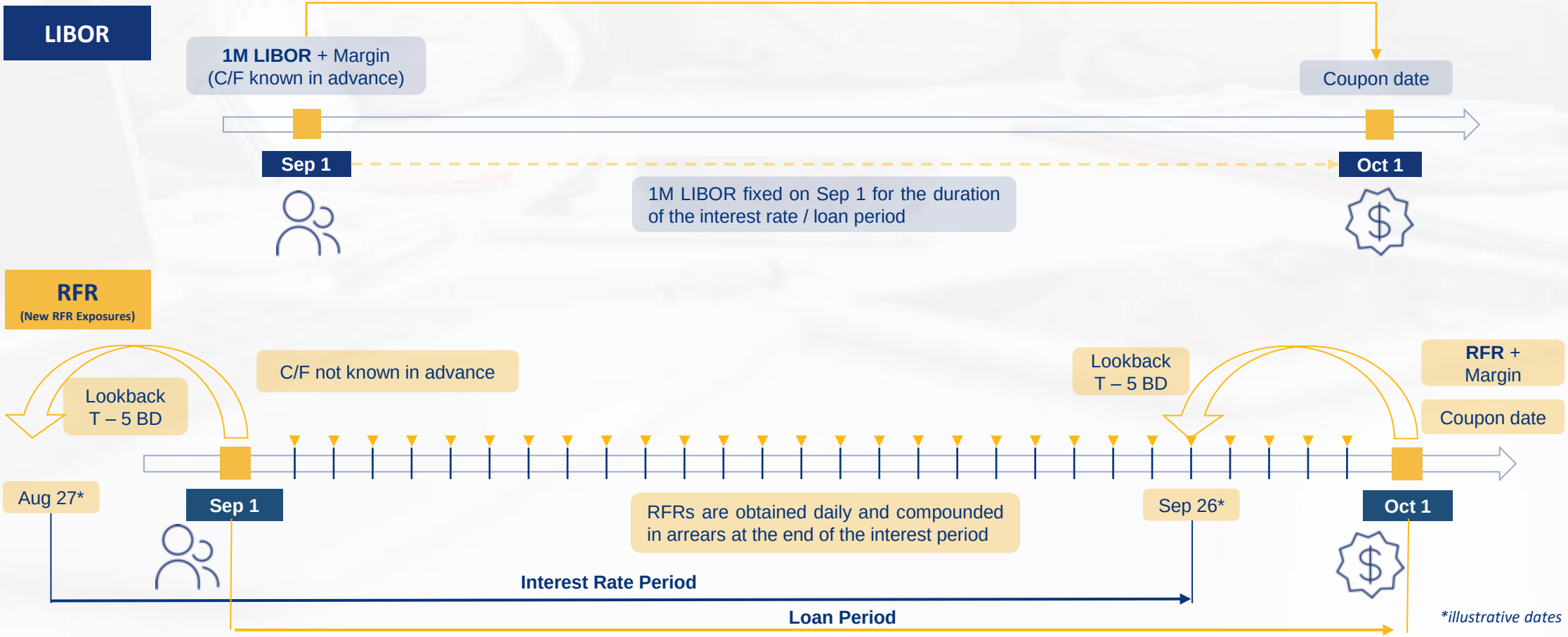
* Fixed as of 05 March 2021

Please note that while there are alternatives for the calculation of the CAS for transitioning LIBOR referencing assets, the ISDA 5Y Median Spread Adjustment is expected to be the industry standard

DIFFERENCE IN INTEREST RATE CALCULATION BETWEEN LIBOR AND RFR

One of the fundamental differences between LIBORs and RFRs is that the former are forward-looking rate with a term structure, whereas the latter are backward-looking overnight rates only.

Hence, while we have a 1M, 3M or a 6M LIBOR, the same is not true for RFRs. The term structure for LIBOR allowed banks and counterparties to calculate at the start of the interest period the interest amount that would be payable at the end of the interest period. For RFRs, the interest payable at the end of the interest period can only be determined at the end of the period because the RFR to be applied to each day in the interest period is not known until after that day has occurred.



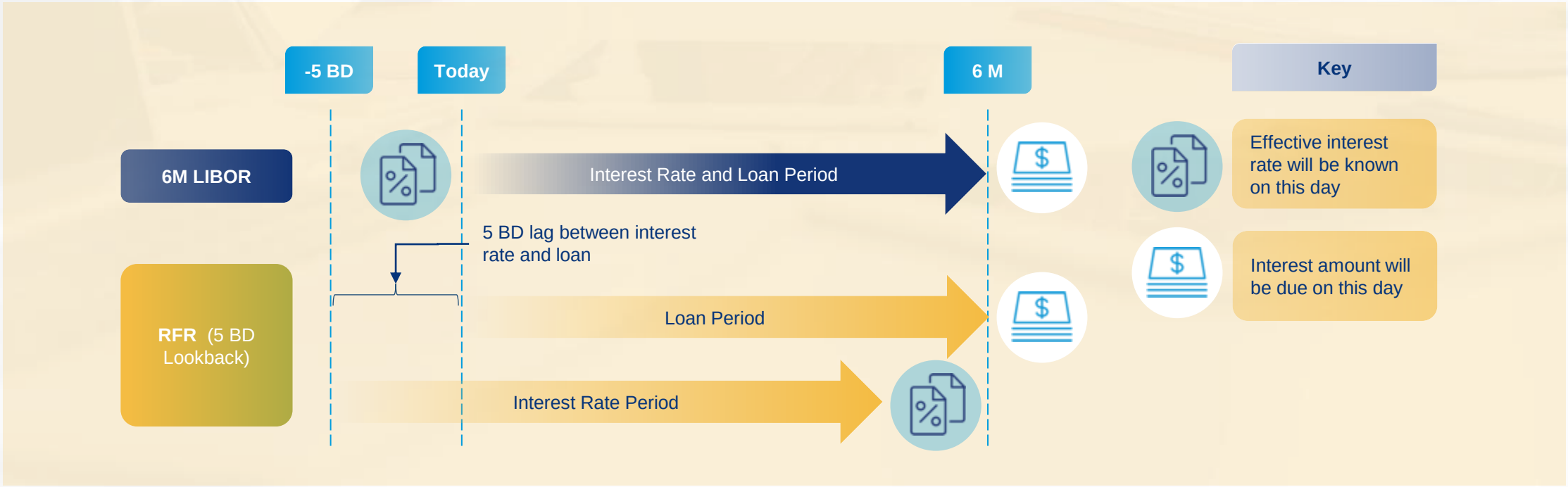
DIFFERENCE IN INTEREST RATE CALCULATION BETWEEN LIBOR AND RFR - LOOKBACK MECHANISM

In order to provide sufficient time to notify an obligor of the interest amount payable at the end of an interest period, a “lookback” mechanism (akin to a lag period) is applied.

This mechanism introduces a lag period (typically 5 business days before the beginning of the interest period) whereby the RFR is applied from the beginning of that lag period until the beginning of a corresponding lag period at the end of the interest period (again, typically 5 business days before the end of the interest period).

The 5 busines day lag period is referred to as “5 RFR banking day (5 BD) lookback period” and is emerging as one of the popular options in the market.

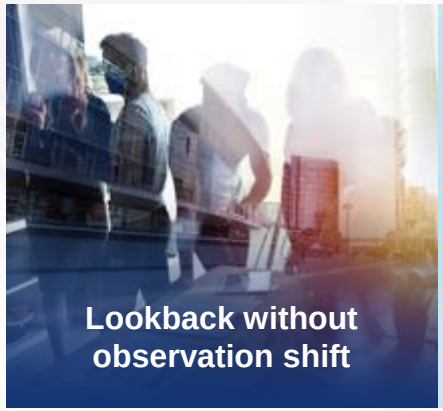
The figure below depicts this concept.



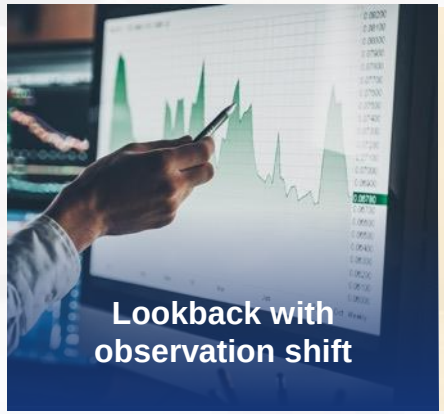
INTEREST RATE CALCULATION CONVENTION FOR RFRS

Lookback with/without observation shift

As per the previous slide, the lookback mechanism allows for notice to be given to obligors by applying the RFR from the beginning of the lookback period which starts before the relevant interest period.



Compounded rate is calculated based on no. of calendar days in current interest period i.e., applicable RFR for each day within a loan period is weighted based on no. of calendar days in the interest period.



Compounded rate is calculated based on no. of calendar days in the observation period i.e., applicable RFR for each day within a loan period is weighted based on no. of calendar days in the observation period

Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu
31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Non-banking days

Non-banking days

Item	Current interest day = Thursday 9th	Current interest day = Tuesday 14th
5 Lookback Days for which rate observed	Thursday 2nd	Friday 3rd
Weight without Observation Shift (based on interest period)	**5** Thursday 9th (current interest day) followed by 4 non-banking days	**1** Tuesday 14th (current interest day) followed by a banking day
Weight with observation shift (based on observation period)	**1** Thursday 2nd (Lookback day) followed by a banking day	**3** Friday 3rd (Lookback day) followed by 2 non-banking days

INTEREST RATE CALCULATION CONCEPT FOR RFRs

Since Risk Free Rates are based on the actual secured or unsecured transactions and is an overnight rate, the methods outlined below could be used for the calculation of the interest for the period as per RFR market conventions.

Simple Interest		Calculated by applying the day's RFR rate to outstanding principal
Compound Interest in Arrears	**Balance Compounding (BC)**	Calculated by applying the day's RFR rate to outstanding principal and accrued unpaid interest.
	Cumulative Compounded Rate (CCR)	Calculated by compounding the period's daily RFR rates and applying this rate to the principal
	Non-Cumulative Compounded Rate (NCCR)	The daily interest accrual under the non-cumulative compounded rate effectively derives the daily compounded rate and applies this rate to the outstanding principal.

Practical Example

Currency	RFR	Compounding Convention	Loan Period	Interest Rate Period	Principal
GBP	SONIA	5 RFR Banking Day Lookback	22-Mar-2021 to 25-Mar-2021	15-Mar-2021 to 18-Mar-2021	GBP 10,000,000.00

SONIA Rates Input:	
15-Mar-2021	0.0497%
16-Mar-2021	0.0493%
17-Mar-2021	0.0494%

BC Interest	CCR Interest	NCCR Interest
£ 40.66	£ 40.66	£ 40.66

The interest amount will be same for all the three interest rate calculation methodologies for compound interest as long as consistent rounding conventions are applied. Detailed workings presented in the appendix

TRANSITIONING LIBOR REFERENCING FACILITIES

- As discussed above, RFRs are calculated differently to LIBORs and so, we will need to make amendments to your current LIBOR referencing facilities in order to transition them to RFR referencing facilities.
- In line with applicable regulatory guidance, ENBD has started transitioning all LIBOR exposures with the intention to complete the transition of GBP LIBOR referencing facilities by no later than 30 September 2021.
- We will provide you with a draft facility amendment letter (or equivalent document) along with amended General Terms and Conditions (together the "**Amendment Documents**"). The Amendment Documents will apply to the facilities being transitioned to RFR facilities alongside all of your other credit facilities that you have with ENBD so that, in the usual way, all of your credit facilities with ENBD will be documented in one place. You may wish to consult your independent legal advisor to assist in your review.

The principal changes that will apply to the LIBOR referencing facilities being transitioned to RFR referencing facilities under the Amendment Documents

- **Disapplying LIBOR provisions**
- **Determining RFR** (SONIA for GBP; SOFR for USD)
- **Interest periods, interest amounts and lookback** – interest amounts due at the end of the interest period can only be determined at the end of that interest period; applying a lookback period allows for interest amount due to be determined prior to its due date
- **RFR calculation methodology** – non-cumulative compounded rate (**NCCR**) / cumulative compounded rate (**CCR**) or any other methodology that produces substantially the same results
- **Application of Credit Adjustment Spread –** 5Y ISDA Median Spread Adjustment
- **Market Disruption** in respect of the RFR
- **Fallback provisions**
- **Voluntary Prepayment**

KEY STANDARDS FOR RFR LOANS WITH ENBD

Interest Calculation Methodology

- RFR compounded in arrears. Margin will not be compounded.
- 5 business day lookback without observation shift.
- Day count – Market convention (ACT / 365 or ACT / 360)
- Transitioning loans: Margin will remain unchanged.
- New loans: Margin shall be determined on a deal by deal basis.
- Methodology: NCCR, CCR or any other method resulting in substantially the same interest amount.

Credit Adjustment Spread (CAS) for Transitioning Loans

- ISDA 5Y Median Spread Adjustment between LIBOR and the corresponding RFR compounded in arrears (as published by Bloomberg)
- The 5Y ISDA Median Spreads Adjustment is fixed as of 5 March, 2021 for all 35 LIBORs.
- Pricing is expected to be [Compounded RFR + CAS] + Margin for original loan.

Principal Prepayments for Bilateral Loans

In line with best practice as per UKRFRWG and ARRC, all principal prepayments to be proportionally allocated to reduce principal and accrued interest as of the date of prepayment.

Others

- Market disruption rate: to be defaulted to cost of funds or any other method documented.
- Break costs: to be decided on a deal by deal basis.
- Rounding: RFRs to be rounded at 4dp and interest amounts to be rounded at 2dp at the end of the interest period.

KEY NEXT STEPS FOR YOU

- Ensure that you understand the changes in the interest rate calculation methodologies pertaining to the transition from LIBOR referencing assets to RFR referencing assets.
- Identify the impact of LIBOR transition across your business, including your financial exposures linked to LIBOR and any contractual arrangements referring to LIBOR.
- Ensure that your internal IT systems are updated to manage RFR referencing facilities.
- Consider taking professional advice in respect of new RFR referencing facilities and your existing LIBOR referencing facilities that will be transitioned to RFR referencing facilities.
- Ensure to engage with your financial institution(s) prior to the relevant cessation date(s) to agree on terms that will apply to your existing LIBOR referencing facilities with your financial institution(s) that will be transitioned to RFR referencing facilities.

APPENDIX

Worked example

Loan / Interest Period	Principal
3 day interest period (all RFR banking days)	1,000,000,000

Hypothetical rates*	
Day 1	5%
Day 2	6%
Day 3	7%

Compound Interest Formula: $\left[\prod_{i=1}^{d_0}\left(1+\frac{DailyRate_{i-LP}\times n_i}{N}\right)-1\right]\times\frac{N}{d}$

$$Compound\ Interest: \left[\left(1+\frac{0.05\times 1}{365}\right)\left(1+\frac{0.06\times 1}{365}\right)\left(1+\frac{0.07\times 1}{365}\right)-1\right]\times\frac{365}{3}=6.0009772215\%$$

$$Interest\ Due\ using\ Compounding\ in\ arrears = 6.0009772215\%\times\frac{3}{365}\times 1{,}000{,}000{,}000 = 493{,}231$$

Simple Interest Formula: $\left[\sum_{i=1}^{d_0}\left(\frac{DailyRate_{i-LP}\times n_i}{N}\right)\right]\times\frac{N}{d}$

$$Simple\ Interest: \left[\left(\frac{0.05\times 1}{365}\right)+\left(\frac{0.06\times 1}{365}\right)+\left(\frac{0.07\times 1}{365}\right)\right]\times\frac{365}{3}=6.0\%$$

$$Interest\ Due\ using\ Simple\ interest\ in\ arrears = 6.0\%\times\frac{3}{365}\times 1{,}000{,}000{,}000 = 493{,}151$$

Impact of Compounding = 493,231 – 493,151 = 80

Where:	
d_0	number of RFR Banking Days during the Loan Period
i	series of whole numbers from one to d_0, each representing the relevant RFR Banking Day in chronological order during the Loan Period
$DailyRate_{i\text{-}LP}$	for any RFR Banking Day i during the Loan Period, the Daily Rate for the RFR Banking Day which is the applicable Lookback Period prior to that RFR Banking Day i
n_i	for any RFR Banking Day i, the number of calendar days from, and including, that RFR Banking Day i up to, but excluding, the following RFR Banking Day
d	number of calendar days during that Loan Period
N	Market convention for quoting number of days in the year (N = 360 for the USD, N = 365 for the GBP)

* Due to near-zero interest rates (SONIA / SOFR) and shorter (3 days) period used in the example above, the effect of compounding would not be clearly evident using actual rates. Therefore, hypothetical rates are used to show the impact of compounding. The impact of compounding will be higher in high interest rate environments.

Balance Compounding (BC)

The simple daily accrued interest methodology can be calculated as follows:

$$A_{t+1} = A'_t + (i_t \times P_t)$$

For compounded interest methodology, daily interest accrual is charged both on outstanding principal and on accrued but unpaid interest.

$$A_{t+1} = A'_t + i_t \times (P_t + A'_t)$$

For the Compounded Balance methodology, the daily interest accrual is simply calculated by applying the appropriate day's RFR rate to outstanding principal and accrued but unpaid interest.

$$A_{t+1} - A'_t = i_t \times (P_t + A'_t)$$

Where:	
i_t	the effective interest rate for date t
P_t	Outstanding principal for date t
A_t	the unpaid accrued interest for date t before any interest paydown
A'_t	the unpaid accrued interest for date t after any interest paydown

Balance Compounding (BC) Continued..

Currency	RFR	Compounding Convention	Loan Period	Interest Rate Period	Principal
GBP	SONIA	5 RFR Banking Day Lookback	22-Mar-2021 to 25-Mar-2021	15-Mar-2021 to 18-Mar-2021	GBP 10,000,000.00

SONIA Rates Input:	
15-Mar-2021	0.0497%
16-Mar-2021	0.0493%
17-Mar-2021	0.0494%

$$Day\ 1: \frac{0.0497\%}{365} \times 10{,}000{,}000 = £\ 13.61644$$

$$Day\ 2: \frac{0.0493\%}{365} \times (10{,}000{,}000 + 13.61644) = £\ 13.50687$$

$$Day\ 3: \frac{0.0494\%}{365} \times (10{,}000{,}000 + 13.61644 + 13.50687) = £\ 13.53426$$

$$\boldsymbol{Interest\ Due\ using\ BC = 13.61644 + 13.50687 + 13.53426 = £\ 40.66}$$

$$Effective\ annualised\ interest\ rate\ for\ 3\ days: \left[\left(1 + \frac{0.000497 \times 1}{365}\right)\left(1 + \frac{0.000493 \times 1}{365}\right)\left(1 + \frac{0.000494 \times 1}{365}\right) - 1\right] \times \frac{365}{3} = 0.04946673\%$$

Cumulative Compounded Rate (CCR)

$$Compound\ Interest\ Formula: \left[\prod_{i=1}^{d_0}\left(1+\frac{DailyRate_{i-LP}\times n_i}{N}\right)-1\right]\times\frac{N}{d}$$

Where:	
d_0	number of RFR Banking Days during the Cashflow Period
i	series of whole numbers from one to $d0$, each representing the relevant RFR Banking Day in chronological order during the Cashflow Period
$DailyRate_{i\text{-}LP}$	for any RFR Banking Day i during the Cashflow Period, the Daily Rate for the RFR Banking Day which is the applicable Lookback Period prior to that RFR Banking Day i
n_i	for any RFR Banking Day i, the number of calendar days from, and including, that RFR Banking Day i up to, but excluding, the following RFR Banking Day
d	number of calendar days during that Cashflow Period
N	Market convention for quoting number of days in the year (N = 360 for the USD, N = 365 for the GBP)

Cumulative Compounded Rate (CCR) Continued..

Currency	RFR	Compounding Convention	Loan Period	Interest Rate Period	Principal
GBP	SONIA	5 RFR Banking Day Lookback	22-Mar-2021 to 25-Mar-2021	15-Mar-2021 to 18-Mar-2021	GBP 10,000,000.00

SONIA Rates Input:	
15-Mar-2021	0.0497%
16-Mar-2021	0.0493%
17-Mar-2021	0.0494%

$$Compound\ Interest: \left[\left(1+\frac{0.000497\times 1}{365}\right)\left(1+\frac{0.000493\times 1}{365}\right)\left(1+\frac{0.000494\times 1}{365}\right)-1\right]\times\frac{365}{3}=0.04946673\%$$

$$\boldsymbol{Interest\ Due\ using\ CCR = 0.04946673\% \times \frac{3}{365} \times 10{,}000{,}000 = £\,40.66}$$

Non-Cumulative Compounded Rate (NCCR)

The previous section explained the concept of compounding in arrears and simple average interest. In this section, we intend to show a worked example of one of the interest rate calculation methodologies recommended by the Bank of England Sterling RFR Working Group – **non-cumulative compounded rate (NCCR)**. (Source: Recommendations for SONIA Loan Market Conventions)

Emirates NBD systems may follow a different, but mathematically equivalent calculation to NCCR, however, the results of such calculations are aligned with those of the NCCR.

Step 1: Annualised Cumulative Compounded Rate

$$ACCDR = \left[\prod_{i=1}^{d_0}\left(1 + \frac{DailyRate_{i-LP} \times n_i}{N}\right) - 1\right] \times \frac{N}{tn_i}$$

Step 2: Unannualized Cumulative Compounded Rate

$$UCCDR = ACCDR \times \frac{tn_i}{N}$$

Step 3: Daily Non-Cumulative Compounded RFR

$$NCCR = (UCCDR_i - UCCDR_{i-1}) \times \frac{N}{n_i}$$

Step 4: Daily Interest

$$Daily\ Interest = \frac{NCCR}{N} \times Principal$$

Non-Cumulative Compounded Rate (NCCR) Continued…

Where:	
d_0	number of RFR Banking Days during the Loan Period
i	series of whole numbers from one to $d0$, each representing the relevant RFR Banking Day in chronological order during the Loan Period
$DailyRate_{i\text{-}LP}$	for any RFR Banking Day i during the Cumulation Period, the Daily Rate for the RFR Banking Day which is the applicable Lookback Period prior to that RFR Banking Day i
n_i	for any RFR Banking Day i in the Cumulation Period, the number of calendar days from, and including, that RFR Banking Day i up to, but excluding, the following RFR Banking Day
tn_i	number of calendar days from, and including, the first day of the Cumulation Period to, but excluding, the RFR Banking Day which immediately follows the last day of the Cumulation Period
N	Market convention for quoting number of days in the year (N = 360 for the USD, N = 365 for the GBP)
$ACCDR$	Annualised Cumulative Compounded Daily Rate for that Cumulated RFR Banking Day
$UCCDR_i$	Unannualised Cumulative Compounded Daily Rate for that RFR Banking Day i
$UCCDR_{i-1}$	in relation to that RFR Banking Day i, the Unannualised Cumulative Compounded Daily Rate for the immediately preceding RFR Banking Day (if any) during that Interest Period

INTEREST RATE CALCULATION METHODOLOGY FOR RFR LOANS

Non-Cumulative Compounded Rate (NCCR) Continued…

Currency	RFR	Compounding Convention	Loan Period	Interest Rate Period	Principal
GBP	SONIA	5 RFR Banking Day Lookback	22-Mar-2021 to 25-Mar-2021	15-Mar-2021 to 18-Mar-2021	GBP 10,000,000.00

SONIA Rates Input:	
15-Mar-2021	0.0497%
16-Mar-2021	0.0493%
17-Mar-2021	0.0494%

Day 1:

$$Step\ 1:\ ACCDR_1 = \left[\left(1 + \frac{0.000497 \times 1}{365}\right) - 1\right] \times \frac{365}{1} = 0.0497\%$$

$$Step\ 2:\ UCCDR_1 = 0.0497\% \times \frac{1}{365} = 0.000136164384\%$$

$$Step\ 3:\ NCCR_1 = (0.000136164384\% - 0) \times \frac{365}{1} = 0.0497\%$$

$$Step\ 4:\ Interest\ Due\ for\ Day\ 1 = \frac{0.0497\%}{365} \times 10{,}000{,}000 = £\ 13.6164384$$

Day 2:

$$Step\ 1:\ ACCDR_2 = \left[\left(1 + \frac{0.000497 \times 1}{365}\right)\left(1 + \frac{0.000493 \times 1}{365}\right) - 1\right] \times \frac{365}{2}$$

$$= 0.04950003357\%$$

$$Step\ 2:\ UCCDR_2 = 0.04950003357\% \times \frac{2}{365} = 0.0002712331\%$$

$$Step\ 3:\ NCCR_2 = (0.0002712331\% - 0.000136164384\%) \times \frac{365}{1} = 0.04930008134\%$$

$$Step\ 4:\ Interest\ Due\ for\ Day\ 2 = \frac{0.04930008134\%}{365} \times 10{,}000{,}000 = £\ 13.50687$$

Day 3:

$$Step\ 1:\ ACCDR_3 = \left[\left(1 + \frac{0.000497 \times 1}{365}\right)\left(1 + \frac{0.000493 \times 1}{365}\right)\left(1 + \frac{0.000494 \times 1}{365}\right) - 1\right] \times \frac{365}{3}$$

$$= 0.0494667337\%$$

$$Step\ 2:\ UCCDR_3 = 0.0494667337\% \times \frac{3}{365} = 0.0004065759\%$$

$$Step\ 3:\ NCCR_3 = (0.0004065759\% - 0.0002712331\%) \times \frac{365}{1} = 0.049400122\%$$

$$Step\ 4:\ Interest\ Due\ for\ Day\ 3 = \frac{0.049400122\%}{365} \times 10{,}000{,}000 = £13.53428$$

$$\boldsymbol{Interest\ Due\ using\ NCCR = 13.6164384 + 13.50687 + 13.53428 = £\ 40.66}$$