Managing Interest Rate Risk

LLOYDS BANK

Risk-Free Rate Calculation Conventions

The new 'risk-free' benchmark interest rates (RFRs), and the way they are applied to loans and derivatives, differ from traditional benchmark interest rates. This note explains how the daily RFR's are combined to generate rates for longer interest rate periods.

Risk-Free Rates (RFRs)

- RFRs such as SONIA or SOFR are daily overnight rates which are described as 'risk-free', or more correctly near risk-free. Because they are overnight rates they have no material term risk nor do they incorporate significant bank credit risk.
- The rates are published daily in arrears. In order to generate an interest rate which applies over a period of time – a week or a month for example – these daily rates need to be combined.
- The individual overnight RFR's are combined on either a 'compound' basis (where the individual rates are multiplied together, or "interest on interest") or a 'simple' basis (where the individual rates are added together). More details on compounding methods are provided below.

Rate calculation methodologies

- A daily compounded RFR can present a practical issue because the resulting rate is only known at the end of the Calculation Period. You need to know the last daily rate in order to calculate the rate for the full period.
- With SONIA, for example, the rate for a given London business day is published at 9am the following business day.
- The market is developing a number of approaches or conventions to address this issue. The most popular methods are:
    - adding a short delay to payments (a '*payment lag*')
    - using daily rates from a few days prior (an *'observation lag' or 'observation shift'*)
- However, there is currently no single preferred approach being used across the market. A range of different conventions are being used (see table below). Your Lloyds Bank representative can give you more information about the methods available.
- In most circumstances, any difference in the rate calculated using these different methodologies is likely to be very small.

Daily compounded RFR Floating Rate conventions

Not all options are available for all products. However the table below provides a glossary to help you to understand what is meant by the different terms. If you have any questions please speak to your usual Lloyds Bank contact who will be able to help you.

Convention	Description	Commentary
No lag or shift	Rate calculated by compounding the daily RFR rates for each day of the Interest Period	The **Interest Period**, **Rate Calculation Period** and **Day Count Period** are all the same.
Observation "lag" (or "look-back")	Rate calculated by compounding the daily RFR rates over the **Interest Period** using the RFR from a fixed number of business days <u>before</u> each business day of the **Interest Period**	On a "2-day lag" – the **Rate Calculation Period** is shifted 2 days earlier than the **Day Count Period** and **Interest Periods**
Observation "shift" ("loan" convention)	Rate calculated by compounding the daily RFR rates for each day of an **Observation Period** which starts a fixed number of business days before the **Interest Period** i.e. the **Observation Period** starts a fixed number of business days before **Interest Period** starts *In most circumstances, the difference in the rate calculated using a 5-day shift and a 5-day lag is likely to be very small and may only occur when there are bank holidays within the period*	On a "2-day shift" both the **Rate Calculation Period** and **the Day Count Period** are shifted 2 days earlier than the **Interest Period**
Observation "shift" (ISDA fallback convention)	Rate calculated by compounding the daily RFR rates for each day of an **Observation Period** which is a set number of days earlier than the **Interest Period** i.e. the **Observation Period** starts a fixed number of business days before Interest Period starts **Observation Period** end date is a <u>fixed number of months</u> after the **Observation Period** start date	For a 2-day "shift" using the ISDA fallback convention, both the **Rate Calculation Period** and **the Day Count Period** are shifted 2 days earlier than the **Interest Period** However, unlike for Lag and Shift above, the **Observation Period** end date is not determined by reference to the **Interest Period** end date.
Payment Delay	Rate calculated by compounding the daily RFR rates for each day of the **Interest Period**. Payments occur a fixed number of business days <u>after</u> the end of the **Interest Period**	For a 2-day "payment delay" the **Interest Period, Rate Calculation Period** and **Day Count Period** used are the same. However, payment of interest is delayed by 2 days.

Definitions:

Rate Calculation Period - the period of time over which the RFR is observed

Day Count Period - the period of time over which the day weightings are observe**d**

Day Weightings - the number of days each daily RFR applies for, typically 1 for Mon–Thurs, 3 for Friday

Interest Period - the period of time over which interest accrues

Observation Period - the period of time over which the RFR and in some cases the day weightings are observed

Classification: Public

Illustration: approaches to compounded SONIA

GBP floating leg rolling monthly on 12th of each month

In this example worked for a 2-day observation lag, the Floating Rate is calculated by compounding each observed RFR over the Interest Period, weighting each observation by the number of relevant calendar days e.g. the RFR applicable to a Friday is weighted for 3 calendar days to allow for the weekend.

The Floating Rate is defined by ISDA using the following formula: $\left[\prod_i \left(1+\frac{r_i \times n_i}{N}\right)-1\right] \times \frac{N}{d_c}$, where

r_i is the interest rate (e.g. SONIA in GBP) applicable on business day i

n_i is the number of calendar days for which rate r_i applies (typically 1, except on Fridays where it is typically 3, and preceding public holidays)

N is the number of days in a year per the local market convention (i.e. 365 for GBP; 360 for USD, EUR)

d_c is the number of *calendar* days in the relevant period (being the sum of all n_i in the period), and

Π_i denotes the product over all business days i in the period

Example of Calculation for 2-day observation lag

Accrual Start	Accrual End	SONIA	Day count (n)	SONIA with 2 day lag (r)	Notional	Interest (Notional *r*n/ 365)	Daily Compounded Rate (1+r*n/365)
Fri 08 Jan 2021	Mon 11 Jan 2021	0.1000%					
Mon 11 Jan 2021	Tue 12 Jan 2021	0.1015%					
Tue 12 Jan 2021	Wed 13 Jan 2021	0.1059%	1	0.1000%	10,000,000	27	1.000003
Wed 13 Jan 2021	Thu 14 Jan 2021	0.1082%	1	0.1015%	10,000,027	28	1.000003
Thu 14 Jan 2021	Fri 15 Jan 2021	0.1052%	1	0.1059%	10,000,055	29	1.000003
Fri 15 Jan 2021	Mon 18 Jan 2021	0.1043%	3	0.1082%	10,000,084	89	1.000009
Mon 18 Jan 2021	Tue 19 Jan 2021	0.0997%	1	0.1052%	10,000,173	29	1.000003
Tue 19 Jan 2021	Wed 20 Jan 2021	0.1006%	1	0.1043%	10,000,202	29	1.000003
Wed 20 Jan 2021	Thu 21 Jan 2021	0.0979%	1	0.0997%	10,000,231	27	1.000003
Thu 21 Jan 2021	Fri 22 Jan 2021	0.0971%	1	0.1006%	10,000,258	28	1.000003
Fri 22 Jan 2021	Mon 25 Jan 2021	0.0965%	3	0.0979%	10,000,285	80	1.000008
Mon 25 Jan 2021	Tue 26 Jan 2021	0.0977%	1	0.0971%	10,000,366	27	1.000003
Tue 26 Jan 2021	Wed 27 Jan 2021	0.1008%	1	0.0965%	10,000,392	26	1.000003
Wed 27 Jan 2021	Thu 28 Jan 2021	0.1013%	1	0.0977%	10,000,419	27	1.000003
Thu 28 Jan 2021	Fri 29 Jan 2021	0.1007%	1	0.1008%	10,000,446	28	1.000003
Fri 29 Jan 2021	Mon 01 Feb 2021	0.1026%	3	0.1013%	10,000,473	83	1.000008
Mon 01 Feb 2021	Tue 02 Feb 2021	0.1007%	1	0.1007%	10,000,557	28	1.000003
Tue 02 Feb 2021	Wed 03 Feb 2021	0.1012%	1	0.1026%	10,000,584	28	1.000003
Wed 03 Feb 2021	Thu 04 Feb 2021	0.0999%	1	0.1007%	10,000,612	28	1.000003
Thu 04 Feb 2021	Fri 05 Feb 2021	0.1006%	1	0.1012%	10,000,640	28	1.000003
Fri 05 Feb 2021	Mon 08 Feb 2021	0.0986%	3	0.0999%	10,000,668	82	1.000008
Mon 08 Feb 2021	Tue 09 Feb 2021	0.1020%	1	0.1006%	10,000,750	28	1.000003
Tue 09 Feb 2021	Wed 10 Feb 2021	0.0975%	1	0.0986%	10,000,777	27	1.000003
Wed 10 Feb 2021	Thu 11 Feb 2021		1	0.1020%	10,000,804	28	1.000003
Thu 11 Feb 2021	Fri 12 Feb 2021		1	0.0975%	10,000,832	27	1.000003
						858.97	**0.10114%**

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