[Members' Market Observation] Walking with the Times, Accumulating as a Normal - A Brief Analysis of the New Base Rate Interest Calculation and Payment Modes

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executive summary

In the real interest rate market, the pattern of interest accrual and payment is an indispensable trading element. For the new benchmark rate, the backward-looking daily compounding method selected by ISDA will need to be adjusted in practice to meet the actual delivery requirements. These adjustments make the details of interest accrual and payment more complicated and require market participants to "keep pace with the times and adapt to the norm".

Regarding the actual interest accrual and payment mode of the new benchmark post-daily compounding, there is currently a lot of discussion among regulators and market participants, and the mainstream mode has not yet been finalized, so we believe that it is essential to understand the overall situation in advance. In this article, we have organized the information accordingly and hope that it will be helpful to you in your actual trading.

- New prime rate and interest in

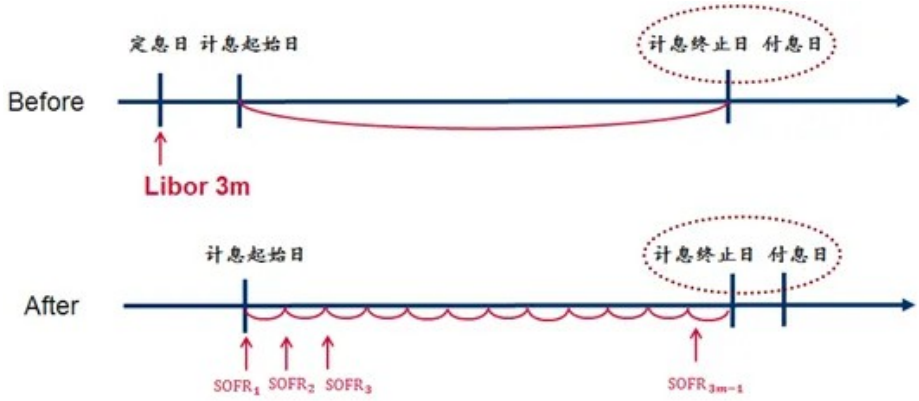
With respect to the new benchmark interest rate's backward daily compounding [illegible] brief introduction to the interest accrual and payment modes in the standard case; then expands to the four interest accrual and payment adjustment modes that need to be introduced in the actual transaction; and finally analyzes the current market practice and regulatory discussions.

Under the standard backward daily compounding approach, the derivation of interest can be divided into two steps: the determination of the term rate and the calculation of interest.

1. Determination of the term interest rate

Unlike the old benchmark rates, such as LIBOR, the new benchmark rates, such as SOFR and SONIA, are retrospective overnight rates, which cannot be determined in advance, and are subject to daily compounding at the end of the interest-bearing period to calculate the term rate.

Figure 1 Schematic diagram of backward daily compounding



Specifically, the term rate used for each interest accrual period is derived through equation (1):The term rate

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

corresponding to the backward daily compounding method =

The meaning of each parameter is:

d_b：相关计算期/计息期中，新基准隔夜利率对应的工作日。

i：从 1 到d_b的一系列整数，从第一个工作日开始。

r_i：第 i 日的新基准隔夜利率。

n_i：r_i用于计息的天数，通常是 1，但如果第 i 日为周五则通常是 3。在公共假日期间，

r_i计息将用于节前最后一个工作日至节后第一个工作日。

d_c：计算期/计息期的日历天数。

N：对 SOFR 为 360，对 SONIA 为 365。

Based on the above formula, we can see that the term rate is derived by rolling up the overnight rate daily (also known as compound averaging):

(1) Assume that the original principal is $1 and is invested in an overnight basis.

(2) The sum of the daily principal and interest due is used as the principal of the investment on the following day.

(3) The above operations are carried out for a certain period of time to obtain the final sum of principal and interest.

(4) Subtracting $1 of principal from this gives the holding period yield.

(5) Annualize the holding period rate to get the term rate.

2. Interest calculation

Use the following formula (2), which in turn gives the actual amount of interest (in terms of SOFR):

Interest = Principal x Term Rate x Number of Interest Bearing Days/360

3. Practical examples

For a standard interest rate swap transaction linked to a SOFR with interest starting April 1, 2020 and maturing on May 1, the principal amount is $10 million and interest is paid on the maturity date. Based on Equation (1), the floating end is calculated to have a maturity rate of 0.0193% by using the daily SOFR rate from April 1 to May 1, 2020 (counting heads and tails), and the number of days corresponding to each rate.

In turn, the amount of interest on the floating end is calculated: the number of days of interest accrued is the number of calendar days (counting heads and not tails) from April 1 to May 1, which is 30 days, and the amount of interest is calculated to be $160.83 by using formula (2).

Practical Difficulties

In practical terms, the application of the backward-looking interest rate requires consideration of the time required for interest calculation, reconciliation and payment, as well as the impact of global time zones, which can be difficult to implement without additional mechanisms.

Or take the above example: the last SOFR used to calculate the term rate (the April 30 SOFR) will not be published by the New York Federal Reserve until May 1 at 8:00 a.m. EST. If both parties to the transaction are in the United States, the day of May 1 to calculate the daily compound interest rate for the entire interest-bearing period, and on that day to prepare sufficient funds and pay interest, and is still a very hasty thing. If the transaction party within our country, then 8:00 p.m. Beijing time on May 1 to calculate the accurate interest rate, the same day to pay interest is an impossible thing.

Therefore, in actual transactions, the new benchmark interest rate transactions need to

fine-tune the interest accrual and payment model to allow sufficient time for both parties to the transaction

Between.

III Interest accrual and

As a result, actual transactions in the new prime rate are often based on the standard scenario, with interest accruals and payments adjusted using the following methodology, all of which are referred to below as the "interest accruals and payments adjustment model":

- Backward-Shift (also known as Observation Period Shift),
- Lookback (Lag, also known
- as Lookback),Lockout

  Delayed Payment (also known as Payment Delay)

Based on the three variables of the posterior daily compound interest rate formula: each overnight interest rate, the number of days corresponding to each overnight interest rate, and the number of days of interest accrued over the entire interest-bearing period, N, and in conjunction with the above example we analyze them individually, from the easiest to the most difficult:

1、Delayed Payment (Delayed Payment)

If you use the 2 business day Delayed Payment, the interest payment date is extended backward to May 5 (May 2 and May 3 are Saturdays and Sundays), and other transaction elements remain unchanged.

If a 2 business day lockout is used, for the calculation of the maturity rate, the same rate is used for the last fixed interest date of the SOFR in formula (1) - April 30th and the first two fixed interest dates (April 29th and April 28th), which is the rate on April 28th. This means that the overnight rates for the last two fixed interest dates, April 29 and April 30, are "locked in".

For interest, it is calculated using the adjusted term rate described above, the actual number of days in the interest-bearing period and the principal amount.

3, look back (Lag)

If a 2-business day Lag is used, for the calculation of the term interest rate, the interest rate used for each business day in equation (1) is the interest rate that existed 2 business days prior to it, but the number of days of interest accruing corresponding to each interest rate is not shifted forward to correspond to the original business day.

Table 1 Parameters for calculating the term interest rate in the Lag

工作日	r_i	n_i（与工作日属性一致）
2020/04/01	$r_{2020/03/30}$	1 个日历天数
2020/04/02	$r_{2020/03/31}$	1 个日历天数
2020/04/03	$r_{2020/04/01}$	3 个日历天数
……	……	……
2020/04/30	$r_{2020/04/28}$	1 个日历天数

model

For interest, it is calculated using the adjusted term rate described above, the actual number of days in the interest-bearing period and the principal amount.

4. Backward-Shift

If a 2-business-day Backward-Shift is used, for the calculation of the term interest rate, **the interest rate used for each business day** in Equation (1) **is the rate that was in effect 2 business days earlier, and the number of days of accrued interest corresponding to** each rate is **also shifted forward by 2 business days to** correspond to the actual attributes of each rate (Note: i.e., if the interest rate used for Monday is the interest rate that was in effect the previous Thursday, the number of days of accrued interest that rate is multiplied by is 1. Tuesday is last Friday's rate, the number of days of accrued interest multiplied by that rate is 3).

Table 2 Parameters for calculating term rates in Backward-Shift mode

工作日	r_i	n_i（与利率属性一致）
2020/04/01	$r_{2020/03/30}$	1 个日历天数
2020/04/02	$r_{2020/03/31}$	1 个日历天数
2020/04/03	$r_{2020/04/01}$	1 个日历天数
2020/04/06	$r_{2020/04/02}$	1 个日历天数
2020/04/07	$r_{2020/04/03}$	3 个日历天数
……	……	……
2020/04/30	$r_{2020/04/28}$	1 个日历天数

For interest, it is calculated using the above adjusted term rate, the actual number of days in the interest-bearing period (2020/04/01 to 2020/05/01, counting heads and not tails), and the principal amount.

In Backward-Shift mode, the observation period for the interest rate is "2020/03/30 to 2020/04/29", which is used to calculate the maturity period.

Interest rate. When the interest rate is calculated, the above term rate is applied to the interest period "2020/04/01 to 2020/05/01" (both periods are counted at the beginning and not at the end). This is the major difference between the Backward-Shift model and the other three models.

IV Market discussions on interest

All four of these models are utilized in the current market for new benchmark rate products. There have also been many regulatory and market discussions on the agreement on the modes of interest accrual and payment adjustment after the conversion of LIBOR to the new benchmark rate. In the following, we will introduce the situation of interest rate derivatives and cash products from the perspectives of new benchmark transactions and the conversion of LIBOR-linked transactions.

1. Interest rate derivatives

（1） Transactions linked to new benchmarks

The interest rate derivatives linked to SOFR and SONIA are mainly overnight index swaps OIS, which use backward-looking daily compounding for interest accrual. Currently, participants in this market are mainly from Europe and the United States, and most of the transactions use the Delayed Payment mode, in which most SONIA products delay interest payment for 0 working days and most SOFR products delay interest payment for 2 working days.

In April 2020, currency swaps and foreign currency interest rate swap products in China's domestic interbank market added new benchmark floating interest rate products such as SOFR and SONIA.

rates, the actual transaction also follows a pattern of deferring interest payments for a number of days.

At the same time, with the wider application of the new prime rate to cash products, it is natural that interest rate derivatives, as their interest rate risk management tools, need to give

more consideration to the accrual and payment of interest on cash products, as will be specifically described in Part 2 of this section.

（2） LIBOR-linked surviving transactions

For the LIBOR surviving transaction after the permanent termination of LIBOR, the Swaps and Derivatives Association (ISDA), as the lead institution for interest rate conversion, has basically already determined that: the LIBOR rate will be converted to a backward-looking daily compounding of, for example, SOFR and a spread will be appended to it to form an OIS transaction. For the converted interest accrual and payment adjustment model, it needs to be agreed in advance in the back-up mechanism.

In this regard, ISDA conducted a market consultation entitled "Final parameters for benchmark fallback adjustments" at the end of 2019. In the consultation document issued to market participants (used to collect suggestions): **for delayed payment, ISDA does not consider it appropriate to include it in the ISDA definition, but rather to set it up as agreed in the specific transaction.ISDA initiated a consultation on Backward-Shift versus Lockout, and published the final results of the consultation in November of last year: the majority of respondents preferred Backward-Shift. The vast majority of respondents preferred Backward-Shift,** although in the case of actual switching, the parties can still make adjustments on a case-by-case basis. In the latest version of the revised ISDA Definitions 2006 consultation paper, there is no specific description of the interest-bearing and interest-paying adjustment model, so we will need to keep an eye on it.

One may wonder why Backward-Shift is more popular in the market when it is the most complex of the four mechanisms. The reasons are as follows:

For the U.S. dollar, the New York Fed released the SOFR Average and the SOFR Index on March 2 of this year.The SOFR Index takes

Calculated using backward-looking daily compounding, it is released to the public each business day. The base period for the index is the first day of the SOFR - April 2, 2018 - with an initial value of 1. The daily SOFR index measures the sum of the principal and interest earned from the first day of the SOFR to that day, invested with daily compounding. Therefore, to calculate the term interest rate for a period of time under the **Backward-Shift** daily compounding method, divide the maturity date SOFR index by the starting date SOFR index, subtract 1 and then annualize the interest rate.**The introduction of the SOFR index makes it easier to use the Backward-Shift model.**

Figure 2 SOFR Index Trend from March 2 to Present

Source: Bloomberg. For

sterling, the Bank of England's SONIA Compounded Index, which is scheduled to be launched by the Bank of England in July 2020, will be used as the basis for the SONIA Compounded Index.

Index), which is of the same nature as the SOFR index.

2. Cash products

For the application of the new benchmark interest rate in the context of cash products, the current market and regulation have not established the use of the post-daily compounding method of calculation, which does not preclude the use of simple average interest rates, forward-looking term rates and other methods. This paper only discusses the interest accrual and payment adjustment model under the backward daily compounding method.

(1) Transactions linked to new benchmarks

Compared to interest rate derivatives, the application of the new benchmark rate to cash products (loans, bonds, etc.) is more limited, with floating rate notes being the most popular. (Floating Rate Notes, or FRNs) are predominant. Currently, SONIA and SOFR's surviving floating rate notes are mostly attached with Lag mode. For example, the SOFR Green Floating Rate Notes issued by Bank of China Macau Branch in October 2019 adopted a 1-day Lag and 4-day Lockout arrangement.

For the future model, the British and American regulatory and market more communication but did not do more constraints, the specific interest accrual, interest payment adjustment mode still need to be based on the actual situation of the two sides of the transaction to determine.

A) SOFR products - encouraging freedom of choice

The primary driver of LIBOR reform for U.S. dollar cash products is the Alternative Reference Rates Committee (ARRC). For the interest accrual and interest payment adjustment models for the new benchmark transactions, the ARRC issued the official definitions and supplemental instructions for the SOFR Floating Rate Notes Interest Accrual and Interest Payment Adjustment Models in August and November 2019 (Note:

SOFR Floating Rate Notes Conventions Matrix as well as Appendix), which provide specific instructions for Lag, Backward-Shift and Delayed payment, and emphasized that the interest accrual and payment adjustment models in practice do not constitute mandatory requirements, and that market participants may make their own choices according to the actual situation.

B) SONIA products - keep the existing mainstream model or move with the times?

The main driver of LIBOR reform for sterling cash products is The Working Group on Sterling Risk-Free Reference Rate (hereinafter referred to as the Sterling Working Group). Based on what we have learned, the evolving discussions between the Sterling Working Group and market participants regarding the interest accrual and payment adjustment model can be seen as an indication of the impact of the upcoming introduction of the SONIA compounding index.

In August 2019, the Sterling Working Group published the results of its consultation with the market on transaction interest accrual and payment adjustment models for SONIA cash product transactions, among others (as shown in Table 3). **The market prefers the Lag model in relation to sterling cash products** (note: according to data published by the BOE, as of January 2020, the market's leading SONIA cash products - SONIA bonds (including floating rate notes and asset securitizations) with an issued principal amount of £70 billion and a volume of over 140, all using the Lag model), and is different for interest rate swaps. At the same time, however, **the Pound Sterling Working Group has made the point that market participants should consider seeking to attach the Lag model to interest rate swaps to match the Lag model cash products when they are hedged.**

Table 3 Results of the market consultation published by the Sterling Working Group in August 2 0 1 9

Convention	OIS	Bonds	Loans
Day count	Interest accrual is ACT/365 (fixed)	Interest accrual is ACT/365 (fixed)	Usually ACT/365 (fixed)
Business day convention for payments	Modified Following	Modified Following	Usually 'Modified Following'
Rounding of SONIA rate	4 decimal places at the end of the compounding period[2]	New SONIA-linked bonds may be rounded to 4 decimal places at the end of the compounding period	4 decimal places at the end of the compounding period may be used
Lag	No lag in payment	5 day period seen as sensible for most	Variable lag approach, coalescing to 5 day period where achievable
Margin treatment	N/A	Margin should be added after rate compounding	Margin should be added after rate compounding

Source: Bank of England.

Things were later reversed: in March 2020 in response to the SONIA Floating Rate Notes' interest accrual and payment adjustment model, the Sterling Working Group issued another

An official statement expressing a preference for recommending

- Backward-Shift even more. The main points of the
- document include a welcome to the SONIA compounding
- index.
- In the SONIA bond market, the use of the SONIA Compound Interest Index would simplify and standardize the calculation of interest on SONIA products and reduce operational risk. It would therefore promote the use of SONIA compound interest in various products (including loans).
- SONIA compounding index, which can be easily used for Backward-Shift approach SONIA products, but not for Lag approach

SONIA products.

The Working Group does not make recommendations on which approach is more appropriate.

（2） LIBOR-linked

surviving transactions A)

US dollar cash products

The ARRC is also the primary lead on fallback provisions for U.S. dollar cash products, and in its fallback provisions issued for major U.S. dollar cash products, in addition to the

In addition to the retail products, requirements have been put forward on the modes of interest accrual and interest payment adjustment after the conversion of USD LIBOR into SOFR: Lag and/or Lockout (Note: the original text adopts the term suspension period suspension period, which is often used in bond issuance, and the nature of which is the same as that of lockout), etc., so that all parties will be informed of the specific interest prior to the end of the interest accrual period amount, the specific model of which is determined by the relevant body of each product, subject to the following conditions:

The first step is to consider using the interest accrual and interest payment adjustment model that has been recommended or selected by the relevant regulatory body (Relevant Governmental Body for determining compounded SOFR).

If it is not possible to determine the recommended model for regulation, it is up to the relevant subject to

产品	相关主体
浮息票据 FRN	发行人或其任命者
银团贷款	Administrative Agent
双边商业贷款	资金融出方 Lender
资产证券化产品	指定的交易代表 Designated Transaction Representative *（注：指对于某一资产证券化交易，交易文件所指明的：在向替代基准利率转换时履行特定义务的一方。）*

determine it based on market practice. Table 4

Subjects determining the model of interest accrual and payment adjustment after interest rate switching for cash products

Source: ARRC For

fallback provisions for consumer cash products such as variable-rate mortgage ARMs, considering their specificity, the ARRC's interest in the converted

The rate form does not explicitly recommend "backward daily compounding", nor does it describe the corresponding interest accrual and payment adjustment model.

B) Pound sterling cash products

Recently, the regulators and industry associations have been releasing texts regarding the interest accrual and payment adjustment model for sterling LIBOR deposited cash products after the interest rate switch, but it may take some time before the finalization of the back-up mechanism for loans and bonds will be available.

In the case of the Sterling Working Group, it is understood that there is currently no fallback provision for providing relevant recommendations as in the case of the ARRC, which published in the results of the August 2019 market consultation the market's view that the interest accrual and interest payment adjustment models for cash products can vary during the LIBOR to SONIA conversion process.

The European Loan Market Association (LMA) published a draft "Interest Rate Option Agreement for the Transition to Alternative Reference Rates for Surviving Transactions" in October last year, which is intended to

in reducing the heavy workload of one-to-one modifications to historical loan contracts by agreement. The draft agreement's interest accrual and interest payment adjustment model for conversion transactions

The formula does not make specific provisions, but points out that the principle of the market has to be followed.

"Global Base Rate Reform Series