BLOOMBERG COMMODITY INDICES: Total Return Calculation details and examples

BCOM Total Return objective

The BCOM Total Return Index reflects the returns on a fully collateralized investment in BCOM. This combines the returns of the BCOM Excess Return index with the returns on cash collateral invested on a Repo Cash account tracking the Secured Overnight Financing Rate (SOFR).

Index Calculation Methodology

Total Return Subindex BCOMT will be computed according to the following formulation:

$$BCOMT_t = BCOMT_{t-1} \times \left(\frac{BCOME_t}{BCOME_{t-1}} + IRR_t\right)$$

Where IRR_t is the Interest Rate Return on Index Business Day t and it will be computed according to the following formulation:

If the Index Business Day t is a Reference Rate Day and Index Business Day $t-1$ is either a Reference Rate Day or the Index Base Day:

$$IRR_t = \left[\prod_{r \in ReferenceRateDays(t-1,t)} \left(1 + (ARR_{r-1} + Spread) \times \frac{DAYS_{r-1,r}}{DCC}\right)\right] - 1$$

Where:

t	Index Business Day for which calculation is made.
$t-1$	Index Business Day immediately preceding Index Business Day t.
r	A Reference Rate Day. Reference Rate Day are day on which the interest is realized for the period ending on such day, and the Reference Rate is set for the period starting on such day.
$r-1$	The Reference Rate Days immediately preceding Reference Rate Day r
$ReferenceRateDays(t-1,t)$	The set of calendar days from, and excluding, Index Business Day $t-1$ to, and including, Index Business Day t, that are Reference Rate Days;
ER_t	Excess Return Index level on the Index Business Day t.
TR_t	Total Return Index level on the Index Business Day t.
ARR_{r-1}	Is the Applicable Reference Rate on Reference Rate Days $r-1$ defined as the latest Reference Rate published as of a previous day prior to such Index Business Day t.
$Spread$	Is the Spread over the Applicable Reference Rate, as specified in Table 1
DCC	Day Count Convention Denominator as specified in the below table.

$DAYS_{r,r-1}$	the number of calendar days from, and excluding, Reference Rate Days $r-1$ to, and including, Reference Rate Days r

If the Index Business Day t is not a Reference Rate Day and Index Business Day $t-1$ is a Reference Rate Day:

$$IRR_t = \left(1 + (ARR_{r_0-1} + Spread) \times \frac{DAYS_{r_0,t}}{DCC}\right) \times CRA_t - 1$$

Where the Cash Reset Adjustment CRA_t on Index Business Day t is:

$$CRA_t = \left[\prod_{r \in ReferenceRateDays(t-1,r_0)} \left(1 + (ARR_{r-1} + Spread) \times \frac{DAYS_{r-1,r}}{DCC}\right)\right]$$

Where:

r_0	The Reference Rate Day that falls immediately before Index Business Day t
$r_0 - 1$	The Reference Rate Day immediately preceding Reference Rate Day r_0
$ReferenceRateDays(t-1, r_0)$	The set of calendar days from, and excluding, Index Business Day $t-1$ to, and including, Index Business Day r_0, that are Reference Rate Days. If $t-1$ and r_0 are the same day, the set is considered empty.

IRR_t represents the r_0-to-date return of the index collateral since latest Reference Rate Day r_0 .

CRA_t represents the interest rate return accrued on any Reference Rate Day r that was not an Index Business Day between Index Business Days $t-1$ and t.

If the Index Business Day t is not a Reference Rate Day and Index Business Day $t-1$ is also not a Reference Rate Day and there is no Reference Rate Day r between t and $t-1$:

$$IRR_t = \left(1 + (ARR_{r_0-1} + Spread) \times \frac{DAYS_{r_0,t}}{DCC}\right) \times IRA_t - 1$$

Where the Interest Rate Adjustment IRA_t on Index Business Day t is:

$$IRA_t = \frac{1}{(ARR_{r_0-1} + Spread) \times \frac{DAYS_{r_0,t-1}}{DCC} + 1}$$

and it represents the discount of the r_0 to $(t-1)$ return of the index collateral since latest Reference Rate Day r_0. This adjustment is necessary so that interest rate returns between two Reference Rate Days are not accounted twice.

Otherwise, if the Index Business Day t is a Reference Rate Day and Index Business Day $t-1$ is not a Reference Rate Day:

$$IRR_t = \left[\prod_{r \in ReferenceRateDays(r^*,t)} \left(1 + (ARR_{r-1} + Spread) \times \frac{DAYS_{r-1,r}}{DCC}\right)\right] \times IRA_t - 1$$

Where the Interest Rate Adjustment IRA_t on Index Business Day t is:

$$IRA_t = \frac{1}{\prod_{h \in IndexBusinessDays(r^*,t-1)}(1 + IRR_h)}$$

Where:

r^*	The Reference Rate Day that is also an Index Business Day that is equal or falls immediately before Index Business Day $t-1$
$IndexBusinessDays(r^*, t-1)$	The set of Index Business Days from, and excluding, Index Business Day r^* to, and including, Index Business Day $t-1$

and it represents the discount of any Interest Rate Return calculated on any Index Business Day h that is not a Reference Rate Day, prior to Index Business Day $t-1$ but after the latest Index Business Day that is also a Reference Rate Day r^*. This adjustment is necessary so that interest rate returns between two Reference Rate Days are not accounted twice.

If the Index Business Day t is not a Reference Rate Day and Index Business Day $t-1$ is also not a Reference Rate Day and there exist one or more Reference Rate Days r between t and $t-1$:

$$IRR_t = \left(1 + (ARR_{r_0-1} + Spread) \times \frac{DAYS_{r_0,t}}{DCC}\right) \times IRA_t \times CRA_t - 1$$

Where the Interest Rate Adjustment IRA_t and the Cash Reset Adjustment CRA_t on Index Business Day t are:

$$IRA_t = \frac{1}{(ARR_{r_0(t-1)-1} + Spread) \times \frac{DAYS_{r_0(t-1),t-1}}{DCC} + 1}$$

$$CRA_t = \left[\prod_{r \in ReferenceRateDays(t-1,t)} \left(1 + (ARR_{r-1} + Spread) \times \frac{DAYS_{r-1,r}}{DCC}\right)\right]$$

Where:

$r_0(t-1)$	The Reference Rate Day that falls immediately before Index Business Day $t-1$
$r_0(t-1)-1$	The Reference Rate Day immediately preceding Reference Rate Day $r_0(t-1)$

IRA_t represents the discount of the $r_0(t-1)$ to $(t-1)$ return of the index collateral since latest Reference Rate Day r_0. This adjustment is necessary so that interest rate returns between two Reference Rate Days are not accounted twice.

CRA_t represents the interest rate return accrued on any Reference Rate Day r that was not an Index Business Day between Index Business Days $t-1$ and t.

Currency	Reference Rate	Ticker	Spread[1]	DCC
USD	SOFR Secured Overnight Financing Rate	SOFRRATE Index	0	360

TABLE 1 - SOFR REFERENCE RATE PARAMETERS

$BCOMT_t$ is rounded to 8 decimal places.

SOFR model

The calculation of the return associated with the collateral is based on a Repo Rate Cash account model. This model tracks the value of a notional cash deposit accruing interests at a relevant overnight rate. Unlike a traditional fixed-rate deposit, the interest rate applied to the account varies daily, reflecting market repo rates.

A day on which interest is paid, and a new interest rate is set for the next payment period is referred to as a Reference Rate Day.

For the BCOM Total Return Index, the Repo Cash Deposit account model resets on each New York Federal Reserve business day and interest is calculated using the Secured Overnight Financing Rate (SOFR) index {SOFRRATE Index <GO>}.

In this model, returns over a date range are calculated using compounding:

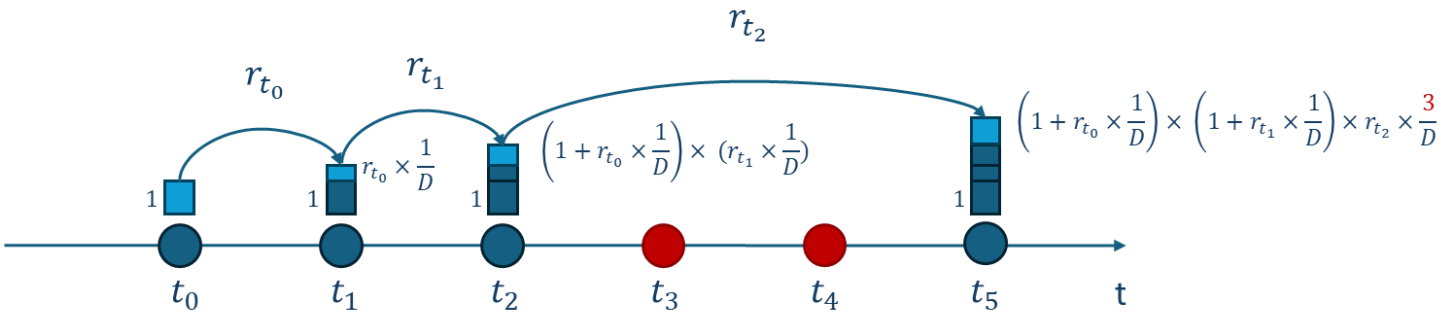

FIGURE 1 - REPO CASH DEPOSIT RETURN EXAMPLE

[1] The Spreads applicable to each ARR have initially been set to zero, though they may periodically be adjusted where the BOC determines that there have been material changes to the funding cost or rate differential applicable to a hypothetical investment grade issuer of Index-linked products and that changes are therefore warranted to maintain the applicable Index as a benchmark for a currency hedged investment in commodities.

On any day between two Reference Rate Days, returns are calculated based on the change in mark-to-market value of the cash deposit position:

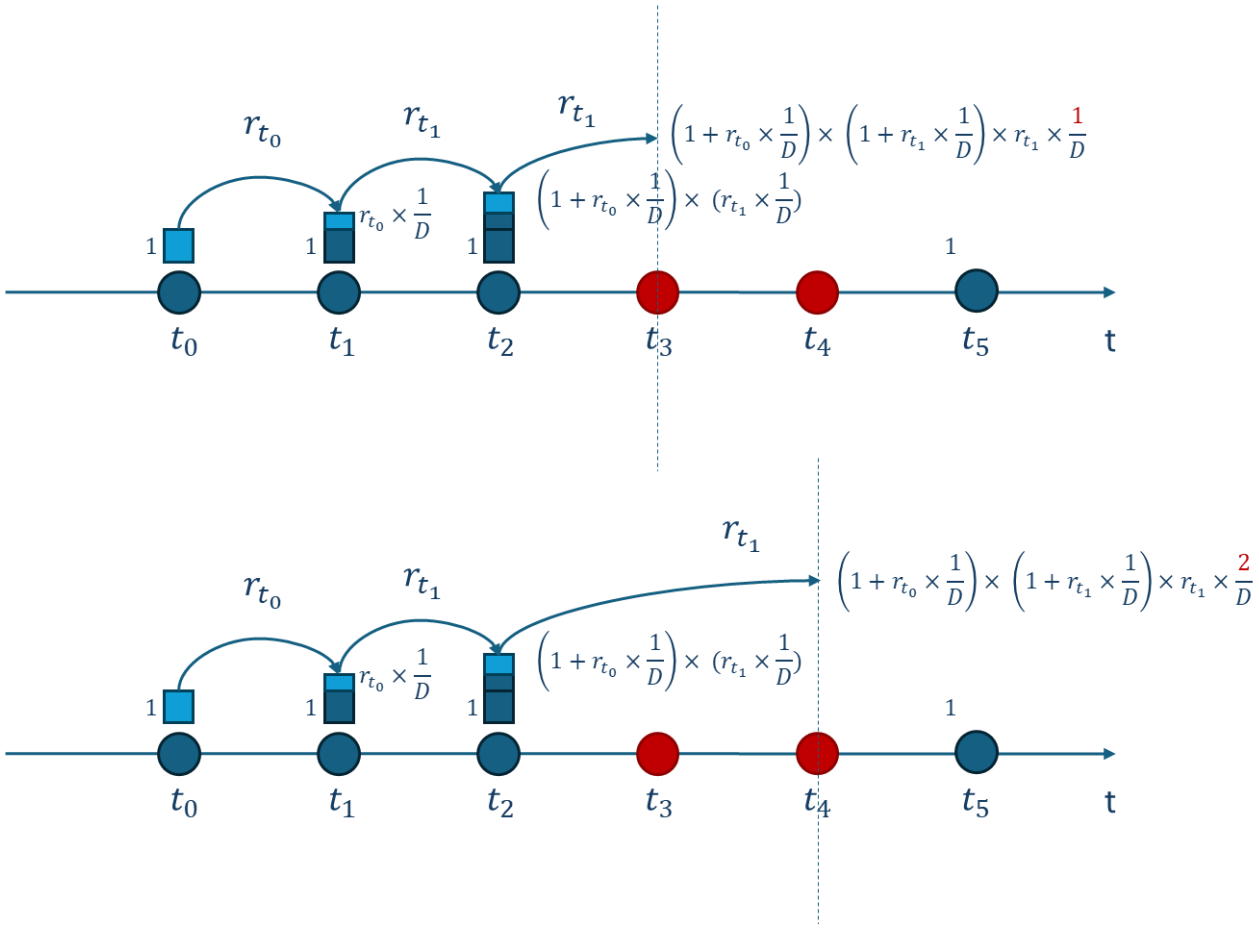

FIGURE 2 - REPO CASH DEPOSIT VALUATION ON REFERENCE RATE HOLIDAYS

A key dynamic in overnight interest rates is that they are typically published with a one-day lag relative to the day they apply to. As illustrated in Figure 2, the rate r_{t_2} is published only on the subsequent Reference Rate Day t_5. As a result, r_{t_2} cannot be used to calculate the mark-to-market value of the collateral position on t_3 and t_4; instead, the last available rate, r_{t_1} is used.

In the BCOM Total Return methodology, these principles are applied to calculate the daily interest rate return on the fully collateralised investment in the BCOM Excess Return index.

BCOM Total Return calculation scenarios

In the calculation of the SOFR BCOM Total Return index, the reset calendar of the selected overnight rate plays an important role in the fair valuation of the collateral amount and its relevant returns. This approach is fundamentally different from the methodology used when calculating BCOM Total Return with Treasury Bills (T-Bills) as the collateral instrument.

Due to these differences, the calculation of the interest rate return is broken down into 5 distinct formulations. These reflect the different scenarios of how the Index calculation calendar and the interest rate calendar intersect. This section provides a breakdown of each of these separate formulations.

Each scenario is defined based on whether the Index Business Day being calculated and its preceding Index Business Day are also Reference Rate Days, and whether a Rate Reset Day occurred between them.

Standard Calculation

This formulation applies where both the Index Business Day t and the preceding Index Business Day $t-1$ are also Reference Rate Days.

$$IRR_t = \left[\prod_{r \in ReferenceRateDays(t-1,t)} \left(1 + (ARR_{r-1} + Spread) \times \frac{DAYS_{r-1,r}}{DCC}\right)\right] - 1 \quad (1)$$

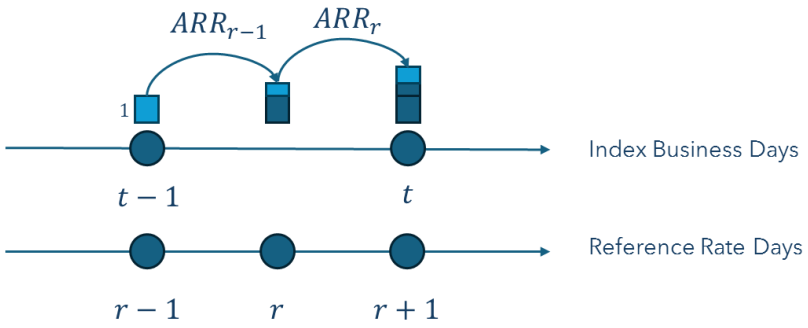

FIGURE 3 - COLLATERAL RETURN IN STANDARD CALCULATION

The return for the day is calculated as the compounded return over any Reference Rate Day that fall between the two, as illustrated in Figure 3.

Calculation on Reference Rate Holidays

As introduced in the previous section, when calculating the collateral value on a day that is not a Reference Rate Day, the mark-to-market of the collateral position is calculated using the latest available interest rate published for the Reference Rate. In the index formulation, a correction term (the Cash Reset Adjustment) is introduced to account for any possible Reference Rate Days that occurred between the Index Business Day t and the preceding Index Business Day $t-1$. This ensures that any return that the collateral generated because of such Reference Rate Days is accurately reflected.

$$IRR_t = \left(1 + (ARR_{r_0-1} + Spread) \times \frac{DAYS_{r_0,t}}{DCC}\right) \times CRA_t - 1 \quad (2)$$

$$CRA_t = \left[\prod_{r \in ReferenceRateDays(t-1,r_0)} \left(1 + (ARR_{r-1} + Spread) \times \frac{DAYS_{r-1,r}}{DCC}\right)\right] \quad (3)$$

It is important to note that, due to the publication lag described in the previous section, ARR_{r_0} is not available until the next Reference Rate Day following Index Business Day t. Therefore, the methodology uses the latest available interest rate ARR_{r_0-1} for the calculation.

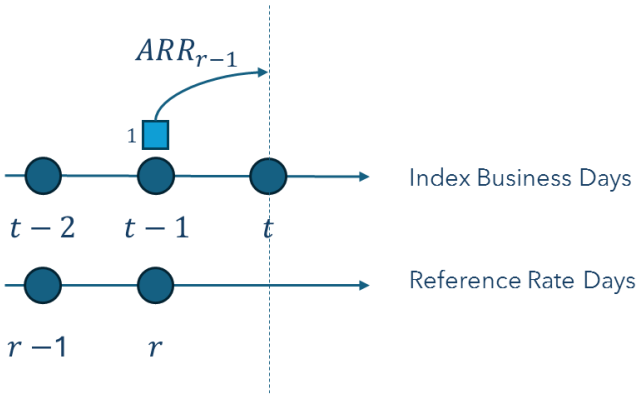

FIGURE 4 - COLLATERAL RETURN ON NON-REFERENCE RATE DAYS

The basic scenario ($CRA_t = 1$), and a more general scenario ($CRA_t \neq 1$) are illustrated in Figure 4 and Figure 5, respectively.

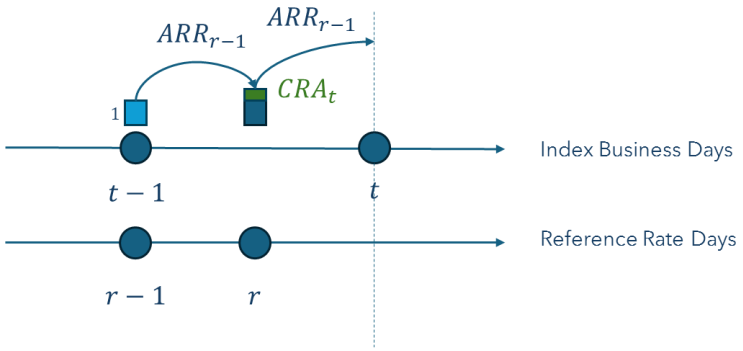

FIGURE 5 - COLLATERAL RETURN ON NON-REFERENCE RATE DAY WITH CRA

Calculation after a Reference Rate Holiday

When a return is calculated as shown in Figure 4 or Figure 5, it is compounded into the index value for that day.

As a result, when computing the return for an Index Business Day following a Reference Rate Holiday, an adjustment factor is applied. This adjustment discounts the mark-to market return calculated on $t-1$, ensuring that the return on t can be calculated as a mark-to-market return from the most recent Reference Rate day up to t.

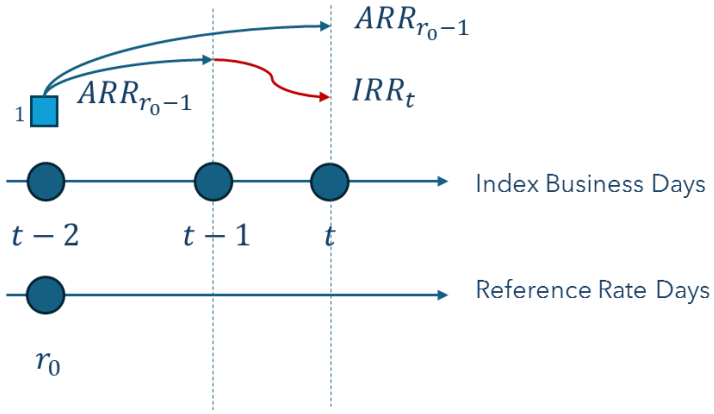

FIGURE 6 - COLLATERAL CALCULATION AFTER A REFERENCE RATE HOLIDAY

In the BCOM Total Return methodology, the discounting adjustment applies to returns after a Reference Rate Holiday is called the Interest Rate Adjustment (IRA_t). The calculation of IRA_t depends on whether the Index Business Day t is itself a Reference Rate Day. Equation (4) and (5) apply to the case where t is not a Reference Rate Day. In this case, the collateral return is calculated as a mark-to-market return from the previous Reference Rate Day r_0. A diagram of this dynamic is shown in Figure 6.

$$IRR_t = \left(1 + (ARR_{r_0-1} + Spread) \times \frac{DAYS_{r_0,t}}{DCC}\right) \times IRA_t - 1 \quad (4)$$

$$IRA_t = \frac{1}{(ARR_{r_0-1}+Spread)\times\frac{DAYS_{r_0,t-1}}{DCC}+1} \quad (5)$$

Equation (6) and (7) apply where t is a Reference Rate Day. In this case, the collateral return is calculated by compounding the actual cash return over any Rate Reference Rate Days between the latest Index Business Day t that was also a Rate Reference Day (r^*). IRA_t is calculated to discount any mark-to-market return previously included on any previous Index Business Day that were not Reference Rate Days. A diagram of this dynamic is shown in Figure 7.

$$IRR_t = \left[\prod_{r\in ReferenceRateDays(r^*,t)}\left(1 + (ARR_{r-1} + Spread) \times \frac{DAYS_{r-1,r}}{DCC}\right)\right] \times IRA_t - 1 \quad (6)$$

$$IRA_t = \frac{1}{\prod_{h \in IndexBusinessDays(r^*, t-1)}(1+IRR_h)} \quad (7)$$

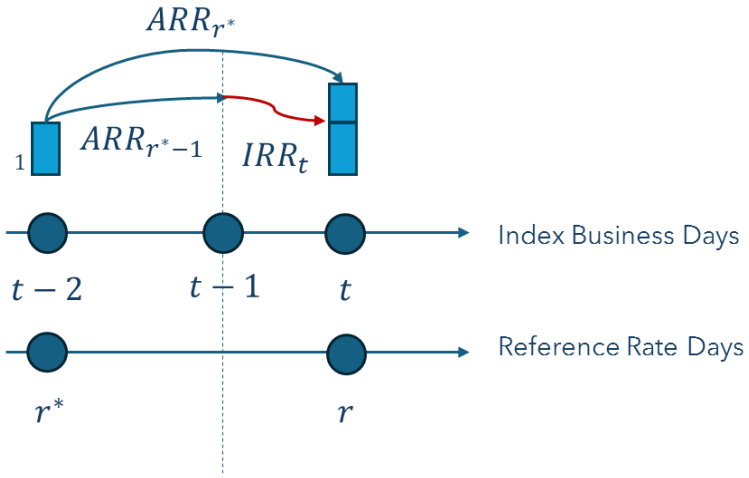

FIGURE 7 - COLLATERAL CALCULATION AFTER A REFERENCE RATE HOLIDAY

Worked Examples

This section illustrates how the formulations described in the previous section are applied to 5 scenarios, each reflecting different combinations of Index Business Days and Reference Rate Days.

Scenario 1 – Aligned Index Business days and Reference Rate days

In this scenario, the Index Business Calendar and the Rate Reference Calendar is perfectly aligned. As such, the standard calculation using equation (1) applies.

t		Index Business Days	Reference Rate Days	ARR	t-1	IRR
d0	2024-12-02	B	B	4.580%		
d1	2024-12-03	B	B	4.590%	2024-12-02	0.000127222
d2	2024-12-04	B	B	4.590%	2024-12-03	0.0001275
d3	2024-12-05	B	B	4.590%	2024-12-04	0.0001275
d4	2024-12-06	B	B	4.590%	2024-12-05	0.0001275
d5	2024-12-09	B	B	4.590%	2024-12-06	0.0003825

The breakdown of the calculation for IRR on d1 (with one calendar day between two consecutive Index Business Days) and on d5 (with multiple calendar days between two consecutive Index Business Days, i.e. a weekend) is:

$$IRR_{d1} = \left[\prod_{r \in ReferenceRateDays(d0,d1)} \left(1 + ARR_{r-1} \times \frac{DAYS_{r-1,r}}{DCC}\right)\right] - 1 =$$
$$= \left(1 + ARR_{d0} \times \frac{DAYS_{d0,d1}}{DCC}\right) - 1 = 4.58\% \times \frac{1}{DCC}$$

$$IRR_{d5} = \left[\prod_{r \in ReferenceRateDays(d0,d1)} \left(1 + ARR_{r-1} \times \frac{DAYS_{r-1,r}}{DCC}\right)\right] - 1 =$$
$$= \left(1 + ARR_{d4} \times \frac{DAYS_{d4,d5}}{DCC}\right) - 1 = 4.59\% \times \frac{3}{DCC}$$

Scenario 2 – Simple Index Business Holiday

A similar calculation is used when there is a single Index Business Holiday that is also a Reference Rate Day. Here, the return is calculated by compounding two days of collateral returns at two different interest rates, as per equation (1).

t		Index Business Days	Reference Rate Days	ARR	t-1	IRR
d0	2024-12-02	B	B	4.580%		
d1	2024-12-03	B	B	4.590%	2024-12-02	0.000127222
d2	2024-12-04	B	B	4.580%	2024-12-03	0.0001275
d3	2024-12-05	H	B	4.600%		
d4	2024-12-06	B	B	4.610%	2024-12-04	0.000255016

The breakdown of the calculation on d4 is:

$$IRR_{d4} = \left[\prod_{r \in ReferenceRateDays(d2,d4)} \left(1 + ARR_{r-1} \times \frac{DAYS_{r-1,r}}{DCC}\right)\right] - 1 =$$
$$= \left(1 + ARR_{d2} \times \frac{DAYS_{d2,d3}}{DCC}\right) \times \left(1 + ARR_{d3} \times \frac{DAYS_{d3,d4}}{DCC}\right) - 1 =$$
$$= \left(1 + 4.58\% \times \frac{1}{DCC}\right) \times \left(1 + 4.60\% \times \frac{1}{DCC}\right) - 1$$

Scenario 3 – Simple Rate Reference holiday

This example shows how the presence of a Rate Reference Holiday on a valid Index Business Day (d2) affects the calculation of the IRR. As explained previously, on d2, the return is calculated using a mark-to-market of the cash position 1 day after the previous reset. This is captured by equations (2) and (3). Since d1 is a Reference Rate Day, $CRA_{d2}$is equal to 1.

On d3, the full return over the two calendar days is calculated, but an IRA is applied to discount the return already included in d2, so that the 1 day of mark-to-market return is not compounded again in the index return.

t		Index Business Days	Reference Rate Days	ARR	t-1	r0	r*	IRA	CRA	IRR
d0	2024-12-02	B	B	4.580%						
d1	2024-12-03	B	B	4.590%	2024-12-02	2024-12-02	2024-12-02	1	1	0.000127222
d2	2024-12-04	B	H		2024-12-03	2024-12-03	2024-12-03	1	1	0.000127222
d3	2024-12-05	B	B	4.600%	2024-12-04	2024-12-03	2024-12-03	0.999872794	1	0.000127762
d4	2024-12-06	B	B	4.610%	2024-12-05	2024-12-05	2024-12-05	1	1	0.000127778
d5	2024-12-09	B	B	4.590%	2024-12-06	2024-12-06	2024-12-06	1	1	0.000384167
d6	2024-12-10	B	B	4.590%	2024-12-09	2024-12-09	2024-12-09	1	1	0.0001275

The breakdown of the calculation for IRR on d2 and on d3 is:

$$IRR_{d2} = \left(1 + ARR_{r_0-1} \times \frac{DAYS_{r_0,t}}{DCC}\right) \times CRA_t - 1 =$$

$$= \left(1 + ARR_{d0} \times \frac{DAYS_{d1,d2}}{DCC}\right) \times \prod_{r \in ReferenceRateDays(d1,d1)} \left(1 + ARR_{r-1} \times \frac{DAYS_{r-1,r}}{DCC}\right) - 1 =$$

$$= 4.58\% \times \frac{1}{DCC}$$

$$IRR_{d3} = \left[\prod_{r \in ReferenceRateDays(r^*,t)} \left(1 + ARR_{r-1} \times \frac{DAYS_{r-1,r}}{DCC}\right)\right] \times IRA_t - 1 =$$

$$= \frac{\left[\prod_{r \in ReferenceRateDays(d1,d3)} \left(1 + ARR_{r-1} \times \frac{DAYS_{r-1,r}}{DCC}\right)\right]}{\prod_{h \in IndexBusinessDays(d1,d2)}(1 + IRR_h)} - 1 =$$

$$= \frac{\left(1 + ARR_{d1} \times \frac{DAYS_{d1,d3}}{DCC}\right)}{(1 + IRR_{d2})} - 1$$

It is worth noting that, due to the lagged publication schedule of SOFR rate, the ARR_{d1} will not be published until the next Reference Rate Day d3, as such ARR_{d0} is used in the calculation of IRR_{d2}

Scenario 4 – Multiple Consecutive Index Business Holidays

This is similar to scenario 1, but here multiple consecutive Index Business Days occur (d3 and d4). The return on d5 is calculated by compounding across the three Reference Rate Days.

t		Index Business Days	Reference Rate Days	ARR	t-1	IRR
d0	2024-12-02	B	B	4.580%		
d1	2024-12-03	B	B	4.590%	2024-12-02	0.000127222
d2	2024-12-04	B	B	4.580%	2024-12-03	0.0001275
d3	2024-12-05	H	B	4.600%		
d4	2024-12-06	H	B	4.610%		
d5	2024-12-09	B	B	4.590%	2024-12-06	0.000639281
d6	2024-12-10	B	B	4.590%	2024-12-09	0.0001275

The breakdown of the calculation on d5 is:

$$IRR_{d5} = \left[\prod_{r \in ReferenceRateDays(d2,d5)} \left(1 + ARR_{r-1} \times \frac{DAYS_{r-1,r}}{DCC}\right)\right] - 1 =$$

$$= \left(1 + ARR_{d2} \times \frac{DAYS_{d2,d3}}{DCC}\right) \times \left(1 + ARR_{d3} \times \frac{DAYS_{d3,d4}}{DCC}\right) \times \left(1 + ARR_{d4} \times \frac{DAYS_{d4,d5}}{DCC}\right) - 1 =$$

$$= \left(1 + 4.58\% \times \frac{1}{DCC}\right) \times \left(1 + 4.60\% \times \frac{1}{DCC}\right) \times \left(1 + 4.61\% \times \frac{3}{DCC}\right) - 1$$

Scenario 5 – Multiple Consecutive Reference Rate Holidays

In this scenario, two consecutive Reference Rate Holidays (d2 and d3) occur. This requires applying the IRA on two consecutive days: d3 and d4. On d3, following equations (4) and (5), the IRA ensures that the cash return from d1 to d2 is not compounded twice in the index. On d4, following equations (6) and (7), it ensures that both cash returns from d1 to d2 and from d1 to d3 are not accounted for twice by the index.

t		Index Business Days	Reference Rate Days	ARR	t-1	r0	r*	IRA	CRA	IRR
d0	2024-12-02	B	B	4.580%						
d1	2024-12-03	B	B	4.590%	2024-12-02	2024-12-02	2024-12-02	1	1	0.000127222
d2	2024-12-04	B	H		2024-12-03	2024-12-03	2024-12-03	1	1	0.000127222
d3	2024-12-05	B	H		2024-12-04	2024-12-03	2024-12-03	0.999872794	1	0.000127206
d4	2024-12-06	B	B	4.610%	2024-12-05	2024-12-03	2024-12-03	0.99974562	1	0.000128023
d5	2024-12-09	B	B	4.590%	2024-12-06	2024-12-06	2024-12-06	1	1	0.000384167
d6	2024-12-10	B	B	4.590%	2024-12-09	2024-12-09	2024-12-09	1	1	0.0001275

The breakdown of the calculation on d2, d3 and d4 is:

$$IRR_{d2} = \left(1 + ARR_{r_0-1} \times \frac{DAYS_{r_0,t}}{DCC}\right) \times CRA_t - 1 =$$

$$= \left(1 + ARR_{d0} \times \frac{DAYS_{d1,d2}}{DCC}\right) \times \prod_{r \in ReferenceRateDays(d1,d1)} \left(1 + ARR_{r-1} \times \frac{DAYS_{r-1,r}}{DCC}\right) - 1 =$$

$$= 4.58\% \times \frac{1}{DCC}$$

$$IRR_{d3} = \left(1 + ARR_{r_0-1} \times \frac{DAYS_{r_0,t}}{DCC}\right) \times IRA_t - 1 = \frac{\left(1 + ARR_{d0} \times \frac{DAYS_{d1,d3}}{DCC}\right)}{ARR_{r_0(t-1)-1} \times \frac{DAYS_{r_0(t-1),t-1}}{DCC} + 1} - 1 =$$

$$= \frac{\left(1 + ARR_{d0} \times \frac{DAYS_{d1,d3}}{DCC}\right)}{ARR_{d0} \times \frac{DAYS_{d1,d2}}{DCC} + 1} - 1 = \frac{(1 + 4.58\% \times \frac{2}{DCC})}{1 + 4.58\% \times \frac{1}{DCC}} - 1 = \frac{4.58\% \times \frac{1}{DCC}}{1 + 4.58\% \times \frac{1}{DCC}}$$

$$IRR_{d4} = \left[\prod_{r \in ReferenceRateDays(r^*,t)} \left(1 + ARR_{r-1} \times \frac{DAYS_{r-1,r}}{DCC}\right)\right] \times IRA_t - 1 =$$

$$= \frac{\left[\prod_{r \in ReferenceRateDays(d1,d4)} \left(1 + ARR_{r-1} \times \frac{DAYS_{r-1,r}}{DCC}\right)\right]}{\prod_{h \in IndexBusinessDays(d1,d3)}(1 + IRR_h)} - 1 =$$

$$= \frac{\left(1 + ARR_{d1} \times \frac{DAYS_{d1,d4}}{DCC}\right)}{(1 + IRR_{d2}) \times (1 + IRR_{d3})} - 1 = \frac{\left(1 + 4.59\% \times \frac{3}{DCC}\right)}{\left(1 + 4.58\% \times \frac{1}{DCC}\right) \times \left(1 + \frac{4.58\% \times \frac{1}{DCC}}{1 + 4.58\% \times \frac{1}{DCC}}\right)} - 1$$

Also in this case, it is worth mentioning how ARR_{d0} is used both in the calculation of IRR_{d2} and IRR_{d3} , to reflect the lagged publication of SOFR, where ARR_{d1} would only be published on d4.

Glossary

Index Business Day	A day which is a BCOM Publication Date
Rate Reference Date	A day on which the interest is realized for the period ending on such day, and the Reference Rate is set for the period starting on such day.
t	Index Business Day for which calculation is made.
$t-1$	Index Business Day immediately preceding Index Business Day t.
r	A Reference Rate Day.
$r-1$	The Reference Rate Days immediately preceding Reference Rate Day r
$ReferenceRateDays(t-1,t)$	The set of calendar days from, and excluding, Index Business Day $t-1$ to, and including, Index Business Day t, that are Reference Rate Days;
ER_t	Excess Return Index level on the Index Business Day t.
TR_t	Total Return Index level on the Index Business Day t.
ARR_{r-1}	Is the Applicable Reference Rate on Reference Rate Days $r-1$ defined as the latest Reference Rate published as of a previous day prior to such Index Business Day t.
DCC	Day Count Convention Denominator as specified in the below table.
$DAYS_{r,r-1}$	the number of calendar days from, and excluding, Reference Rate Days $r-1$ to, and including, Reference Rate Days r
r_0	The Reference Rate Day that falls immediately before Index Business Day t
r_0-1	The Reference Rate Day immediately preceding Reference Rate Day r_0
$ReferenceRateDays(t-1,r_0)$	The set of calendar days from, and excluding, Index Business Day $t-1$ to, and including, Index Business Day r_0, that are Reference Rate Days. If $t-1$ and r_0 are the same day, the set is considered empty.
r^*	The Reference Rate Day that is also an Index Business Day that is equal or falls immediately before Index Business Day $t-1$
$IndexBusinessDays(r^*,t-1)$	The set of Index Business Days from, and excluding, Index Business Day r^* to, and including, Index Business Day $t-1$
Interest Rate Adjustment (IRA_t)	Return adjustment that discounts any mark-to market return calculated on Index Business Day $t-1$ which is not a Reference Rate Day, ensuring that that return on t can be calculated as the mark-to-market return from the most recent Reference Rate Day up to t.
Cash Reset Adjustment (CRA_t)	Return adjustment that accounts for any Reference Rate Days that occurred between the Index Business Day t and the preceding Index Business Day $t-1$

Who can I contact with questions on the total return methodology change?

If you have any questions, please contact the Bloomberg Help Desk (<Help><Help>), or create a support ticket in Customer Service Center (CSC) at https://service.bloomberg.com. The commodities team can be reached at commodities@bloombergindices.com.

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