

Market conventions for ZARONIA-linked loans

prepared by
**The Market Practitioners Group's
Cash Market Workstream**



SOUTH AFRICAN RESERVE BANK



Contents

1. Background	4
2. Existing and alternative reference rates	4
3. Cash Market Workstream mandate	5
4. Problem statement	5
5. Design principles	6
6. Convention recommendations	7
7. Recommended conventions and alternatives	8
7.1. Interest period	8
7.2. Business day calendar	8
7.3. Business day convention	8
7.4. Accrual day count convention	8
7.5. Floating rate reference	9
7.6. Publication time	9
7.7. Publication/Calculation lag	9
7.8. Cumulative compounded rate calculation	9
7.9. Non-cumulative compounded rate	10
7.10.CCR/NCCR convention	11
7.11.Margin	11
7.12.Cash flow rounding	11
7.13.Floors	11
7.14.Alternative calculation methods	12
7.15.Credit adjustment spread	12
7.16.Prepayments	13
7.17.Secondary market settlement delays	13
7.18.Hedging	14
8. Use of formulae and examples	14
Appendix A CCR calculation (lookback without observation shift)	15
Appendix B Daily NCCR calculation (lookback without observation shift)	16
Appendix C Lookback without observation shift	17
Appendix D Lookback with observation shift	18
Appendix E International market conventions	19
Glossary	20
References	21

Tables and figures

List of tables

1	RFRWS's recommended properties for a viable replacement reference rate.	4
2	Loan conventions.	7
3	Lookback without observation shift example.	17
4	Lookback with observation shift example.	18
5	Market conventions for USD-, GBP- and EUR-denominated loans.	19

1. Background

The highly publicised irregularities relating to the production of interbank offered rates (IBORs) in 2012 – see, for example, [Hou and Skeie, 2014] – initiated a global regulatory response to reform major interest rate benchmarks. The use of IBORs in financial markets has subsequently reduced substantially in favour of more robust alternative reference rates (ARRs), namely overnight reference rates (ONRRs) which are *near risk-free*.

South Africa has also embarked on the transition journey with the release of the consultative paper [SARB, 2018] prepared by the South African Reserve Bank (SARB), which detailed its initial proposal to reform domestic benchmark and reference rates. The SARB subsequently formed the Market Practitioners Group (MPG) in 2019 to manage the process of adoption and transition to a new overnight interest rate, the South African Overnight Index Average (ZARONIA). The MPG is a joint public and private sector body, comprising representatives from the SARB, the Financial Sector Conduct Authority (FSCA), and senior professionals from a variety of market interest groups active in the domestic capital and loan markets.

2. Existing and alternative reference rates

The traditional suite of benchmark rates in South Africa consists of a set of Johannesburg Interbank Average Rates (Jibars), quoted on the following tenors 1-, 3-, 6-, 9- and 12-month, see [SARB-MMRR, 2021]. Currently, the 3-month Jibar rate is the most commonly used benchmark rate for financial instruments with floating interest rate exposure that are denominated in South African rand (ZAR). Like certain other IBORs, Jibar lacks the primary market activity which puts it at risk of not being representative of the underlying market it is meant to measure. In 2020, the Risk-Free Reference Rate Workstream (RFRWS) published its recommended properties for a viable replacement reference rate for Jibar – see [SARB-RFRWS, 2020]. The RFRWS's recommendations are summarised as follows:

Table 1: RFRWS's recommended properties for a viable replacement reference rate.

Theme	General feature	Definition	Importance
Integrity	Reliability	<i>Proper governance and administration to safeguard against manipulation or error.</i>	<i>Market integrity and functioning.</i>
	Robustness	<i>Clear rules for reference rate production, including transparent and well-known fallbacks in periods of market stress.</i>	<i>Availability and usability in times of market stress.</i>
	Representative	<i>Rate drawn from a representative sample of transactions from the market in question.</i>	<i>Correct pricing basis.</i>
Efficacy	Frequency	<i>Rates calculated daily to facilitate market functioning.</i>	<i>Pricing of new contracts, mark-to-market valuation.</i>
	Availability	<i>Published on dedicated sites.</i>	<i>Verification of contracts.</i>
	Transmission	<i>Market operations ensure functioning markets, liquidity and price transmission.</i>	<i>Monetary policy and financial stability objectives.</i>
Appropriate	Choice	<i>Provide a suite of reference rates for different applications.</i>	<i>Clear distinction between risk-free and risky secured or unsecured transactions.</i>

Considering the above recommendations, the MPG has designated the ZARONIA rate as the preferred successor rate to replace the set of Jibars and the South African Futures Exchange overnight rate (SAFEX ON). The conceptual design of ZARONIA was rigorously tested, using actual transactional data to ensure that it is reliable, robust and sufficiently stable – see [SARB, 2020] and [SARB, 2021] for more information. The designation of ZARONIA as the preferred successor rate forms part of a larger transition roadmap which includes

establishing a successor rate, adoption of the successor rate in both derivatives and cash markets, transitioning legacy contracts and eventual cessation of Jibar. See the [SARB MPG's](#) webpage for a snapshot of the transition roadmap. Since ZARONIA is an overnight rate with a one-day publication lag and cash instruments pay interest periodically, in order to create a robust term structure from ZARONIA directly based on the overnight rate itself, and to provide a reflection of ZARONIA over the interest period, the market conventions have been defined in arrears as ZARONIA over an interest period will not be known at the start of the interest period (only at the end).

3. Cash Market Workstream mandate

The MPG relies on dedicated workstreams to carry out its objectives. The workstreams provide technical input and recommendations to the MPG on specific issues that are relevant to the transition from Jibar. Members of these workstreams are drawn from a diverse set of market practitioners with requisite knowledge and expertise to give effect to the mandate of the MPG as well as shape industry opinions on the reform agenda.¹

The Cash Market Workstream (CMW), constituted in 2021, with a mandate to:

- *Overcome barriers that the cash market may face using ZARONIA for the following target product set, which for the loan market includes:*
 - *Corporate loans*
 - *Preference share funding*
 - *Intercompany loans*
 - *Intracompany loans (using benchmarks to do valuations)*
 - *Trade finance*
 - *Unlisted structured notes (i.e. the domestic multi-term notes (DMTN)) programmes*
- *Apply current market conventions and methodologies to inform a target product set of conventions in line with market standards.*
- *Highlight the operational and implementation requirements to adopt a risk-free rate (RFR).*
- *Determine a set of conventions with which to meet industry needs post transition.*

Furthermore, the CMW is tasked with making recommendations on the development of a forward-looking term rate. In line with global developments, it is envisaged that such a term rate will likely be determined using derivatives market activity that will be based on ZARONIA, and hence, it may take some time before a viable term-rate is proposed. Consequently, this paper does not cover forward-looking term ZARONIA. Market participants are strongly encouraged to consider the application of backward-looking, compounded ZARONIA rates as proposed in this document to the greatest extent possible. Market developments towards the establishment of a forward-looking term ZARONIA will be published in due course. This should not delay transitioning in the market.

4. Problem statement

For the loan market to function efficiently, market participants need a standard set of conventions for the use of ZARONIA, given that it is a daily backward-looking overnight near RFR whereas Jibar is a forward-looking term rate with various tenors and includes a credit and liquidity premium.

The CMW sub working group embarked upon a process to formulate a set of recommended conventions. The

¹For more information, please refer to: [SARB Market Practitioners Group](#).

results of these for ZARONIA-linked loans are presented in this white paper together with reasons for the selections. These recommendations are intended to serve as the basis for new loans that reference ZARONIA and which can be incorporated in legal agreements. The loan market requires bespoke agreements tailored to the client's needs.

This working paper should serve as a resource for the loan market participants to consider when using ZARONIA for linked loans. It is not meant to prescribe, mandate, or limit the ways in which loan market participants may transact based on their needs and requirements.

Please note that this paper does not cover a forward-looking term ZARONIA.

5. Design principles

The CMW participants were guided by a set of principles that helped determine conventions under which the loan market could function, using the successor rate. These principles ensure that conventions support market functioning and align with the benchmark's characteristics. These principles may be described as follows:

Price transmission

- *Reflect relevant interest rate conditions for respective interest accrual periods.*
- *Avoid non-representative samples.*
- *Accurately reflect the time value of money.*

Market functioning

- *Align with established market conventions and practices (both local and international) where possible, while catering for specific nuances (e.g. business day, day-count, payment lags, etc.).*
- *Ensure that practical impacts are observed and accommodated, where possible (e.g. settlement).*
- *Enable comparison in transactions through standardisation, where relevant.*
- *Aid in the functioning of primary and secondary markets.*

Operational

- *Alleviate administrative burdens.*
- *Enable sufficient time for confirmations and payment instructions.*
- *Ensure interest accrual periods and payment dates are cognisant of non-business days.*
- *Accommodate users over different time zones.*

Alignment

- *Avoid unnecessary fragmentation.*
- *Economic benefits should be consistent with deposits, repurchase agreements (repos) and derivative markets.*
- *Easily align derivative market hedges to avoid potential basis risk and hedging costs.*
- *Hedge effectiveness could be impacted if not closely coupled.*

6. Convention recommendations

This section presents recommendations and suggestions for the key conventions for floating rate loans linked to ZARONIA. The main objective is to provide the market with recommended conventions for the use of ZARONIA in arrears over an interest period. Unlike the current suite of Jibars, it should be understood that ZARONIA is near risk-free, so any rate based on ZARONIA will contain minimal credit and funding spreads, if any.

It must be emphasised that the recommendations detailed in Table 2 are voluntary and do not preclude any loan market participant from negotiating a more bespoke agreement to suit individual requirements.

Table 2: Loan conventions.

Feature	Recommended convention	Comment	Reference
Interest period	1M, 3M, 6M and 12M.	<i>Loan market participants are free to choose interest periods that suit their needs.</i>	7.1.
Business day calendar	ZAJO	<i>As published by the relevant providers, in accordance with the Public Holidays Act 36 [RSA, 1994].</i>	7.2.
Settlement lag	0 bd	<i>A primary market feature which defines the issue and settlement date for a newly issued linked loan.</i>	
Business day convention	Modified Following	<i>Applied in accrual period date generation.</i>	7.3.
Non-standard first period	Short-Stub	<i>In line with international conventions.</i>	
Accrual day count convention	ACT/365 Fixed	<i>Used for the calculation of floating interest.</i>	7.4.
Floating reference rate	ZARONIA	<i>As recommended by the SARB's MPG.</i>	7.5.
Publication/ Calculation lag	1 bd	<i>Published on a T+1 basis. As indicated by the SARB.</i>	7.7.
Publication time	10:00	<i>If no errors, then ZARONIA will be published at 10:00, else publication is at 12:00, as indicated by the SARB.</i>	7.6.
Annualised compounded rate ACR calculation	Compounded, 5 bd lookback, without observation shift	<i>Backward-looking without any fixing adjustments. The resultant rate is commonly referred to as the cumulative compounded rate (CCR).</i>	7.8.
Payment lag	0 bd	<i>No payment lag.</i>	7.8.
ACR/CCR rounding convention	Simple, 6 dp	<i>Or 4 dp in % format.</i>	7.8.
Margin treatment	Not Compounded - added post compounding	<i>Fixed simple rate added to the CCR for general floating coupon calculation, if necessary.</i>	7.11.
Interest amount rounding	2 dp	<i>Or to the nearest ZAc.</i>	7.12.
Credit adjustment spread (CAS)	To be confirmed	<i>Designed to minimise value transfer when transitioning legacy agreements.</i>	7.15.

The sub working group considered international market conventions, seen in Appendix E, in arriving at the proposed recommendations for ZARONIA-linked loans.

7. Recommended conventions and alternatives

This section aims to provide the reader with an explanation of the recommended conventions and the rationale behind the selections. The document does not go into exhaustive detail on all the possible selections but should provide the reader with alternatives should the recommendations not serve their need.

7.1. Interest period

The interest period (or choice of interest period) is specified contractually in loan agreements based on the borrower's needs and lender's requirements and stipulates the frequency of interest payments. Interest payments are made during the life of the loan based on the interest periods selected or predetermined.

7.2. Business day calendar

South African business days are Monday to Friday excluding public holidays. South Africa has 12 public holidays as determined by the Public Holidays Act 36 [RSA, 1994]. The Act determines whenever any public holiday falls on a Sunday, the following Monday shall be a public holiday.

The South African calendar – Johannesburg Financial Centre (ZAJO) is used for interest period date generation. The calendar is also used to determine valid business dates for interest compounding and to look back to find the corresponding published ZARONIA.

7.3. Business day convention

The business day convention is the rule used to modify interest periods that end on non-business dates to a good business date. Payments cannot settle on non-business days.

The modified following business day convention adjusts a date that falls on any day other than a business day to be rolled forward or backward – forward if the next business day falls in the current calendar month and backward if the next business day falls in the next calendar month. Other business day conventions include following or preceding business day.

7.4. Accrual day count convention

ZARONIA is quoted as an annualised rate with a day count convention of actual days divided by 365. The number of days in the interest period is calculated by including the first day in the interest period up to, but not including, the last day in the interest period.

Market convention considerations

Recommendations

- **Interest period:** The interest period is broad and allows borrowers and lenders to structure payment periods according to their respective needs.
- **Business day conventions and calendar:** The recommendation is to use a Modified Following business day convention using the ZAJO calendar.
- **Day count conventions:** The recommendation is for ZARONIA to use an accrual day count convention Actual/365 Fixed, consistent with current rate quotations.

7.5. Floating rate reference

The MPG has designated ZARONIA as the preferred successor rate that will most likely replace Jibar, which currently underpins a significant number of loan agreements.

The floating reference rate is an ONRR which has a tenor of one business day. One of the main differences between Jibar and the ONRR is that the former is based on forward-looking quoted rates, while the latter is based on transacted rates.

7.6. Publication time

Extracted from section 9 and 11 of [SARB, 2020].

'Benchmarks will be published, on the SARB's website (www.resbank.co.za), every South African business day at 10:00.'

'In the event that an error is discovered after the publication of a benchmark rate at 10:00, and if such an error pertains to the calculation process or to the transaction data supplied to the SARB, the benchmark rate may be republished at any time before 12:00 in South African time.'

7.7. Publication/Calculation lag

Publication lag: While the arbitrary ONRR, has an interest accrual period that starts on a day, the *benchmark administrator*, the SARB, will only be able to observe relevant transactions during the day and therefore, the earliest that the administrator could calculate the relevant ONRR will be at the end of day. This means that the rate will be available for use on the following day. However, operational issues and inefficiencies (potential or otherwise) may preclude the benchmark administrator from publishing the ONRR on the following day consistently. The benchmark administrator may therefore choose to be prudent and specify a publication lag that is greater than one business day after the following day.

Calculation lag: A user of the arbitrary ONRR may prefer to be more prudent than the benchmark administrator for their own operational reasons and add a lag of their own when using the ONRR for interest accrual calculation purposes.

Recommendations

- **Publication and calculation lag:** The publishing and calculation of ZARONIA is determined by the SARB. ZARONIA is published each business date on a T+1 basis.

7.8. Cumulative compounded rate calculation

The method for calculating the cumulative compounded rate (CCR) should be based on the International Swaps and Derivatives Association's (ISDA) formula for compound RFRs. The detailed formula can be found in Appendix A.

Compound interest recognises that interest is not paid daily and interest is calculated on the accumulated unpaid interest. Compounded ZARONIA is more aligned to the behaviour of the deposits that underpin the rate. The cumulative compounded rate uses this logic and applies the compounding to the rate, only on business days using the ZAJO calendar, as opposed to the amounts therefore negating the necessity to apply compounding to the amount. The recommendation is to have a lookback of five business days without observation shift to allow for the calculation of the interest amount due prior to the payment date. This aligns with international

market conventions. Lookback and observation shift are described further below.

This does not preclude parties from having a different lookback or applying a different methodology should they wish to do so (although parties should be aware of any potential systems limitations).

Lookback. In contrast to Jibar which is fixed in advance for a set period (e.g. 3 months), compounding in arrears involves aggregating the overnight ZARONIA rates over a period to derive term interest payable (i.e. longer than overnight). As compounding in arrears does not give parties visibility of the rate until the end of the period, the international cash markets have adopted the concept of a lookback (or lag) period when referencing the ONRR rates in arrears; this means the final interest payment is known a few days before it is due to be paid at the end of the interest period.

The international cash markets have also adopted a 5-business day lookback, although the lookback period can vary depending on the needs of the parties.

Without observation shift (lag method). Only the observation of the rate itself is shifted but not the number of calendar days to which the rate applies (i.e. the number of calendar days relates to the calendar days in the interest period). This is usually one except for public holidays and weekends. A lookback period of five business days reduces the effect in the weighting of calendar days. In Appendix C an example of 'lookback without observation shift' can be found.

Market convention considerations

Recommendations

- **CCR with a 5-bd lookback without observation shift:** The recommendation is a cumulative compounded rate with a lookback of five business days without an observation shift to allow for the calculation of the interest prior to payment.
- The use of the CCR may be more appropriate for loans with limited prepayments or secondary trading (see NCCR below).

7.9. Non-cumulative compounded rate

The non-cumulative compounded rate (NCCR) is the implied rate between any two cumulative compounded rates. This is required when loans are prepaid or are transferred in the secondary loan market. The NCCR would allow you to utilise the daily rate on the principal amount for the day to get to an interest amount. By design, the NCCRs add up to the CCR (if the correct rounding approach is used). If there were no events during the interest period, the CCR can be calculated on the principal amount for the entire period. See Appendix B for a detailed formula on the NCCR compounding calculation.

Market convention considerations

Recommendations

- **Use of NCCR:** The recommendation is to use the NCCR for syndicated loans and other loans where there are frequent mid-interest period events, such as principal prepayment and secondary trading.

7.10. CCR/NCCR convention

CCR is expressed as a simple rate with a rounding convention of six decimal places or four decimal places when expressed as a percentage. NCCR should not be rounded.

Market convention considerations

Recommendations

- **CCR rounding:** The recommendation is to use the six decimal places (or four decimals when expressed as a percentage) to ensure consistency in calculation methodologies.
- **NCCR rounding:** The recommendation is not to round NCCR to ensure consistency in calculation methodologies.

7.11. Margin

The margin is a rate above the floating rate, reflecting client credit, liquidity and costs negotiated between the lender and borrower. It is expressed as a simple rate that is added to the CCR. It is not compounded.

Market convention considerations

Recommendations

- **Margin:** The recommendation is to quote the margin as simple and add it to the CCR or NCCR.

7.12. Cash flow rounding

The cashflow (i.e. the interest amount plus margin plus any applicable CAS (see Section 7.15.)) calculated is rounded to two decimal places (rounded to the nearest ZAc).

Market convention considerations

Recommendations

- **Cash flow rounding:** The recommendation is to round the total accrued interest amount (inclusive of margin and CAS) calculated to two decimal places.

7.13. Floors

Agreements may contain floors. The floor is a lower bound which determines the lowest rate that will be charged (often zero, but it could be set higher). Should the rate, ZARONIA, drop lower than the floor, the floor will be charged.

The margin will then be added to that, and the interest calculation performed.

If an interest rate floor is included in a loan agreement, it is recommended that the floor be calculated daily (rather than at the end of an interest period). This is because loans accrue interest daily and due to the recommendation for the use of the NCCR above. The floor can then be applied to the applicable daily ZARONIA for the relevant interest period.

The application of a floor will be different for legacy deals transitioning from Jibar to ZARONIA – see Section 7.15. below.

Market convention considerations

Recommendations

- **Floor:** If the parties have agreed to the use of a floor in their agreements, it is recommended that the floor be calculated daily rather than at the end of the interest period. The floor on a new ZARONIA loan will be applied to the daily ZARONIA rate.

7.14. Alternative calculation methods

In the US, the working group also proposed as an alternative to compounding the ONRR, applying a simple interest methodology. Although not the recommendation, below is a description of the method.

Simple interest is calculated by applying the daily rate, only on business days using the ZAJO calendar, to the principal amount of the loan. The interest payment is the sum of the above-said interest amounts without any compounding. Alternatively, it can be calculated by weighting (by days) the ZARONIA rates and applying this over the interest period.

The daily accrual is based on a daily ZARONIA rate and not an average of rates; if principal is constant, calculation via daily simple ZARONIA will be the same as a simple average of ZARONIA in arrears at the end of the interest period. However, if principal changes, it will not be possible to apply the simple average of ZARONIA to the fixed principal at the end of the interest period.

Lockout. An alternative to the lookback is a lockout; this means the final interest payment is known a few days before it is due to be paid by repeating one daily ZARONIA rate for a number of days at the end of the interest period.

This methodology was not chosen in the international cash markets as having a lockout excludes a meaningful number of days during the life of the loan from the interest calculation and it could be material to the extent that the rates locked in are unusually high or low.

Payment lag. Delaying the payment by n number of business days to allow for interest calculation, payment notification and ultimately payment after the interest period.

While payment lag may facilitate alignment with hedging, this methodology was not chosen in the international cash markets as it involves the lenders being paid a few days after each interest period ends. This can cause operational complexity for facility agents and considerations in respect of impact on documentation to facilitate the late payment of interest.

With observation shift (shift method). The observation of the rate itself and the number of calendar days the rate applies is shifted (i.e. both are taken from the observation period). This version allows for a better hedge as it aligns with the ISDA conventions and in case a time lag of less than five days is used. In Appendix D an example of 'lookback with observation shift' can be found.

7.15. Credit adjustment spread

ZARONIA is an overnight near risk-free rate while Jibar is a forward-looking term rate. As such, Jibar contains an element of bank credit, liquidity risk as well as a term premium. Existing deals quoted at a spread to Jibar



require an adjustment, the credit adjustment spread (CAS), to be added to the new ZARONIA rate to ensure an equitable transition.

Transition agreements, where the original agreement included a **floor**, require the addition of both ZARONIA + CAS to be floored to facilitate the floor being applied to the equivalent of Jibar. Where there is no CAS, the floor is applied directly to the base rate or RFR.

Commitment fees are often agreed as a percentage of the margin. When there is a CAS, the margin remains the same as it was under the original agreement. In the absence of a CAS, for new transactions the margin may be a bit higher to account for the credit element that is lacking in the reference rate or RFR. Commitment fees may need to be adjusted as a result of this for new agreements.

Market convention considerations

Recommendations

- **CAS for transition agreements:** The recommendation is to use a CAS only in agreements that are being transitioned. Any floor should be applied to ZARONIA + CAS.
- This does not preclude market participants from using a CAS in new agreements, but the implications of doing so need to be understood.

7.16. Prepayments

A prepayment is a reduction in the principal amount. If a prepayment occurs on a non-interest payment date, then interest would be proportionally calculated using the NCCR and accrued interest paid on the amount prepaid at the time of the reduction in the principal amount.

Market convention considerations

Recommendations

- **Prepayments:** Use the NCCR to calculate interest should a principal prepayment be made.
- **Interest accrued** should be settled to avoid unnecessary complexity in compounding calculations.

7.17. Secondary market settlement delays

Delayed compensation entitles the buyer of a loan to compensation regardless of the root cause of the delay.

The **cost of carry** represents the financing cost of the loan over the delay and represents the cost incurred by the seller of the loan.

The seller typically pays the buyer the delayed compensation less the cost of carry; this is intended to put both parties economically in the same position had the trade settled in the predetermined time.

Market convention considerations

Recommendations

The following conventions are recommended:

- **Delayed compensation:** The recommendation is for the seller to pay the buyer the all-in rate (i.e. ZARONIA compounded plus margin plus any CAS, if applicable).
- **Cost of carry:** The recommendation is for the buyer to pay the seller ZARONIA compounded plus any CAS, if applicable.

7.18. Hedging

When hedging ZARONIA loans, any lag/leads or any other conventions need to be matched in the derivative hedge to ensure hedge effectiveness and minimise basis risk.

8. Use of formulae and examples

To demonstrate the recommended conventions for ZARONIA-linked loans, Microsoft Excel workbooks have been created with specific examples, scenarios, actual market data and supporting calculations. A compressed file, ZARONIA_Loan_Examples.zip, can be found as an accompanying document.

The Excel workbook 'ZARONIA_Loan_Examples.xlsx' contains a worked example that demonstrates the calculation of the CCR, NCCR and different prepayment examples.

Please note that, in general, the provided examples and scenarios highlight features and nuances of the specific conventions that are recommended rather than an exhaustive presentation of all possible conventions.

A further practical guide is included as an accompanying document: ZARONIA_Linked_Loans_Practical_Guide.zip.

Appendix A CCR calculation (lookback without observation shift)

The CCR method is intended for application throughout an interest period for a compounded rate loan. This rate represents the annual percentage rate (with efforts to minimise rounding) and is favoured for its straightforward computation. While it may not accommodate intra-period events like trading activity, it offers a reliable and efficient approach, and is recommended without an observation shift. The calculation method is as follows:

Step 1: Final cumulative compounded RFR_{d_b} (FCR_{d_b})

$$FCR_{d_b} = \left[\prod_{i=1}^{d_b} \left(1 + \frac{r_{i-LP} \times n_i}{365} \right) - 1 \right] \times \frac{365}{tn_i}$$

Where :

d_b = number of business days in the interest period.

r_{i-LP} = interest rate applicable on business day i minus lookback period (LP) in the observation period, as published on the business day immediately after business day i .

n_i = 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 business day before a holiday).

tn_i = total number of n_i as of the relevant business day within the interest period.

i = series of whole numbers from one to d_b , each representing the relevant business day in chronological order from, and including, the first business day in the relevant interest period.

Step 2: Interest amount

$$\text{InterestAmount} = \left(\frac{\text{Principal} \times [FCR_{d_b} + CAS + Margin] \times tn_i}{365} \right)$$

*Interest amount should be rounded to two decimal places at the end of the period only.

Where :

CAS = credit adjustment spread (if applicable).

$Margin$ = margin (if applicable).

Appendix B Daily NCCR calculation (lookback without observation shift)

The daily NCCR without observation shift method is designed for use on each RFR business day 'i' during an interest period for a compounded rate loan. This rate reflects the annual percentage rate (with efforts to minimise rounding) and is recommended due to its ability to accommodate intra-period events, including trading activity. The calculation method is as follows:

Step 1: Annualised cumulative compounded RFR_i (ACR_i)

$$ACR_i = \left[\prod_{i=1}^{d_b} \left(1 + \frac{r_{i-LP} \times n_i}{365} \right) - 1 \right] \times \frac{365}{tn_i} \quad (1)$$

Where :

d_b = number of business days in the interest period.

r_{i-LP} = interest rate applicable on business day i minus lookback period (LP) in the observation period, as published on the business day immediately after business day i .

n_i = 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 business day before a holiday).

tn_i = total number of n_i as of the relevant business day within the interest period.

i = series of whole numbers from one to d_b , each representing the relevant business day in chronological order from, and including, the first business day in the relevant interest period.

Step 2: Unannualised cumulative compounded RFR_i (UCR_i)

$$UCR_i = ACR_i \times \frac{tn_i}{365} \quad (2)$$

Step 3: Non-cumulative compounded RFR_i (NCR_i)

$$NCR_i = (UCR_i - UCR_{i-1BD}) \times \frac{365}{n_i} \quad (3)$$

*NCR_i should not be rounded.

Where :

BD = business day for the specific currency only.

Step 4: Interest amount

$$\text{InterestAmount}_i = \left[\sum_{i=1}^{d_b} \left(\frac{\text{Principal}_i \times [NCR_i + CAS + Margin] \times n_i}{365} \right) \right] \quad (4)$$

Where :

CAS = credit adjustment spread (if applicable).

$Margin$ = margin (if applicable).


Appendix C Lookback without observation shift

In the context of calculating compounded interest rates based on an ARR, the 'lookback without observation shift' method involves using historical ARR rates.

This approach ensures precise interest computations and captures real-time market conditions and intra-period events. By relying on authentic published rates, it promotes transparency, consistency and adherence to market practices and regulatory standards, making it a preferred and credible choice in various financial agreements.

Find below, in Table 3, an illustrative example of rate determination under the 'lookback without observation shift' method applying a 5-business day lookback:

Table 3: Lookback without observation shift example.



Rate date	Mon 17 Apr	Tue 18 Apr	Wed 19 Apr	Thu 20 Apr	Fri 21 Apr	Sat 22 Apr	Sun 23 Apr	Mon 24 Apr	Tue 25 Apr	Wed 26 Apr	Thu 27 Apr ²	Fri 28 Apr
Rate (%)	7.588	7.591	7.59	7.59	7.54	-	-	7.597	7.591	7.594	-	7.594

In the above table, it can be seen that the interest period starting from 28-Apr-2023 to 2-May-2023 (four days), would utilise a rate of 7.59% (Thu 20-Apr-2023) under a 5-business day lookback, utilising the 'lookback without observation shift' method.²

²27-Apr-2023 and 1-May-2023 are declared public holidays.


Appendix D Lookback with observation shift

An alternative calculation method which can be agreed upon, is the 'lookback with observation shift' method. In the context of calculating compounded interest rates based on an ARR, it involves using historical ARR rates with an observation shift applied.

The concept of an 'observation shift' involves factoring in the time lapse between rate calculation and its practical implementation (i.e. the rate and the observation are shifted by the applicable number of days). It enhances the accuracy and consistency of interest calculations, effectively addressing any inconsistencies arising from delays in the rate publication.

Below, in Table 4, is an illustrative example of rate determination under the 'lookback with observation shift' method applying a 5-business day lookback, for the interest period starting on 8-May-2023:

Table 4: Lookback with observation shift example.



Observation date (T-5)	Fri 28 Apr	Sat 29 Apr	Sun 30 Apr	Mon 01 May ⁴	Tue 02 May	Wed 03 May	Thu 04 May	Fri 05 May	Sat 06 May	Sun 07 May	Mon 08 May
Rate publication (T-4)	Tue 02 May				Wed 03 May	Thu 04 May	Fri 05 May	Mon 08 May			Tue 09 May
Calendar days in observation period	4				1	1	1	3			1
Rate (%)	7.594				7.589	7.594	7.582	7.594			7.58

It can be observed from Table 4, that the interest period from 8-May-2023 to 09-May-2023 constitutes an interest period of one calendar day, and the rate referenced was observed for four calendar days.³

To determine the CCR under the 'lookback with observation shift' convention, the following formula would be applied:

Step 1: Final cumulative compounded RFR_{d_b} (FCR_{d_b})

$$FCR_{d_b} = \left[\prod_{i=1}^{d_b} \left(1 + \frac{r_i \times n_i}{365} \right) - 1 \right] \times \frac{365}{tn_i}$$

Where :

d_b = number of business days in the observation period.

r_i = interest rate applicable on business day i in the observation period, as published on the business day immediately after business day i .

n_i = 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 business day before a holiday).

tn_i = total number of n_i as of the relevant business day within the observation period.

i = series of whole numbers from one to d_b , each representing the relevant business day in chronological order from, and including, the first business day in the relevant observation period.

³1-May-2023 is a declared public holiday.

Step 2: Interest amount

$$\text{InterestAmount} = \left(\frac{\text{Principal} \times [FCR_{db} + CAS + \text{Margin}] \times tcn_i}{365} \right)$$

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

Where :

CAS = Credit Adjustment Spread (if applicable).

Margin = Margin (if applicable).

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 business day within the interest period.

Appendix E International market conventions

The table below summarises the key market conventions for vanilla corporate loans that were developed in the international markets: United States (US) (US Dollar (USD) denominated), United Kingdom (UK) (British pound (GBP) denominated) and the European Union (EU) (euro (EUR) denominated). Please note that in the UK (GBP-denominated) and US (USD-denominated) intercompany loans may have different conventions. In addition, trade finance loans in all three currency regions may make use of forward-looking term rates.⁴

Table 5: Market conventions for USD-, GBP- and EUR-denominated loans.

Feature	US	UK	EU
Business day calendar	USGS	GBLO	EUTA
Payment lag	0 bd, USNY	0 bd, GBLO	0 bd, EUTA
Accrual period date generation	ACT/360	ACT/365 Fixed	ACT/360
Floating reference rate (ARR)	SOFR	SONIA	€STR
Publication time	08:00 ET	08:00 GMT	08:00 ECT
CCR convention	Simple, 7dp (5dp in percentage terms)	Simple, 6dp (4dp in percentage terms)	Simple, 7dp (5dp in percentage terms)
Business day convention	Modified Following		
Publication / Calculation lag	1bd		
Cumulative compounded rate (CCR)	Compounded, 5 bd lookback.		
Non-cumulative compounded rate (NCCR)	Derived from or function of CCR		
Observation shift	With or without observation shift		
Margin	Simple average of the margin.		
Cash flow rounding	2 decimal places (dp)		
Floors	Daily floor if applicable. Legacy IBOR had a floor the equivalent is to floor ARR + CAS		
Prepayments	Proportional interest accrued on sums prepaid, paid at the point of principal prepayment.		
Credit adjustment spread (CAS)	Market-related rate or ISDA 5-year historical spread, designed to minimise value transfer when transitioning legacy agreements.		

⁴Forward-looking term ZARONIA rates are not covered in this paper and will be considered elsewhere.



Glossary

List of acronyms

ACR	annualised cumulative compounded rate. 7
ARR	alternative reference rate. 4, 17, 18, 19
bd	business day(s). 7, 10, 19
CAS	credit adjustment spread. 7, 11, 13, 14, 19
CCR	cumulative compounded rate. 2, 7, 9, 10, 11, 14, 15, 18, 19
CMW	Cash Market Workstream. 5, 6
DMTN	domestic medium-term note. 5
dp	decimal places. 19
€STR	Euro short-term rate. 19
EUTA	Europe TARGET Calendar - TARGET Financial Center. 19
FSCA	Financial Sector Conduct Authority. 4
GBLO	London banking calendar - London Financial Center. 19
IBOR	interbank offered rates. 4, 19
ISDA	International Swaps and Derivatives Association. 9, 12, 19
Jibar	Johannesburg Interbank Average Rate. 4, 5, 7, 9, 10, 12, 13
MPG	Market Practitioners Group. 4, 5, 7, 9
NCCR	non-cumulative compounded rate. 2, 10, 11, 13, 14, 16, 19
ONRR	overnight reference rate. 4, 9, 10, 12
RFR	risk-free rate. 5, 9, 13, 16
RFRWS	Risk-Free Reference Rate Workstream. 3, 4
SAFEX ON	South African Futures Exchange overnight rate. 4
SARB	South African Reserve Bank. 4, 7, 9
SOFR	secured overnight financing rate. 19
SONIA	Sterling Overnight Index Average. 19
USGS	United States Government Securities business days. 19
USNY	United States banking calendar - New York Financial Center. 19
ZAJO	South African calendar - Johannesburg Financial Centre. 7, 8, 9, 12
ZAR	South African rand. 4
ZARONIA	South African Overnight Index Average. 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 19

References

- Hou, D. and D.R. Skeie (2014). *LIBOR: Origins, economics, crisis, scandal, and reform*. In: *FRB of New York Staff Report* 667 (cited on page 4).
- RSA (1994). *Public Holidays Act 36*. In: URL: <https://www.gov.za/documents/public-holidays-act#:~:text=The%20Public%20Holidays%20Act%2036,for%20matters%20incidental%20thereto>. (cited on pages 7, 8).
- SARB (2018). *Consultation paper on selected interest rate benchmarks in South Africa*. In: URL: https://www.resbank.co.za/content/dam/sarb/what-we-do/financial-markets/committees-and-working-groups/mpg/Consultation_Paper_Aug_2018.pdf (cited on page 4).
- (2020). *Draft Statement of methodology and the policies governing the South African Reserve Bank - administered interest rate benchmarks*. In: URL: <https://www.resbank.co.za/content/dam/sarb/publications/markets-consultation-paper/2020/10021/Draft-Statement-of-methodology-and-policies-for-benchmarks.pdf> (cited on pages 4, 9).
- (2021). *Feedback on the statement of methodology and policies governing the SARB-administered interest rate benchmarks*. In: URL: <https://www.resbank.co.za/content/dam/sarb/publications/media-releases/2021/fmd-admin-benchmarks/Feedback%20on%20the%20statement%20of%20methodology%20and%20policies%20governing%20the%20SARB%20administered%20benchmarks.pdf> (cited on page 4).
- SARB-MMRR (2021). *JIBAR: Code of Conduct, Governance Process and Operating Rules*. In: URL: https://www.resbank.co.za/content/dam/sarb/publications/jibar/2021/Jibar_Revised%20Code_of_Conduct-April2021.pdf (cited on page 4).
- SARB-RFRWS (2020). *Risk-Free Reference Rate Work Stream - August 2020*. In: URL: <https://www.resbank.co.za/en/home/publications/publication-detail-pages/mpg-related-documents/2020/10187> (cited on page 4).