The practical guide for ZARONIA-linked money market instruments

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SOUTH AFRICAN RESERVE BANK

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1. Overview

In international markets there has been a change in standards from using the interbank offered rates (IBORs) as reference rates to the use of more robust alternative reference rates (ARRs), namely overnight reference rates (ONRRs) that are near risk-free. South Africa, through the South African Reserve Bank (SARB) has proposed the use of the South African Overnight Index Average (ZARONIA) as its ONRR.

Floating rate money market instruments (FRMMIs) provide for the payment of interest for interest periods where each interest payment amount is dependent on the level of a reference rate. A margin/spread above the specified reference rate reflects the credit risk of the issuer and the structure and maturity of the instrument.

This document serves as a practical guide to applying the recommended ZARONIA conventions for FRMMIs. For a detailed technical explanation please refer to the 'Market conventions for ZARONIA-based Market Instruments (Money Market)' and the accompanying example spreadsheet.

2. Recommended conventions

The pertinent recommended conventions in the application of ZARONIA to FRMMIs are summarised below:

- The daily overnight rate is compounded over the interest period and is backward looking (i.e. the interest rate will not be known until the end of the interest period).

- To provide visibility of payment, a 1-business day lookback without an observation shift is applied using the ZAJO calendar.

- The compounded rate is expressed as simple actual/365 and is rounded to six decimal places (four decimal places if expressed as a percentage).

- The margin/spread is then added to the above compounded rate.

- Interest is calculated rounding to two decimal places.

3. Calculating interest

To calculate the interest amount one can compound the daily ZARONIA rate over the observation period and apply that to the payment period.

The following steps can be followed to calculate the rate and corresponding interest amount:

- **Step 1:** Determine all the good business days, $BusDay_i$, greater than or equal to interest start date and less than interest end date.

- **Step 2:** For each good business day look up the ZARONIA rate, r_{i-1bd}.

- **Step 3:** Create a compounding index starting at 1 and apply the rates in **Step 2** over the respective days to accrue interest.

$$CompoundingIndex = \prod_i \left(1 + r_{i-1bd} * \frac{BusDay_{i+1} - BusDay_i}{365} \right)$$

- **Step 4:** Calculate the growth in the index expressed in simple terms over the period rounded to six decimal places (four decimal places if expressed as a percentage).

$$Rate = (CompoundingIndex - 1) * \left(\frac{365}{EndDate - StartDate} \right)$$

- **Step 5:** Add the FRMMI spread to the $Rate$ in **Step 4** over the interest period to determine the interest amount.

$$InterestAmount = Nominal * (Rate + Spread) * \left(\frac{EndDate - StartDate}{365} \right)$$

- **Step 6:** Round the $InterestAmount$ to two decimal places.

4. Accrued interest

Accrued interest is determined in the same way as a conventional interest payment but is usually determined across a shorter interval as FRMMIs are often traded mid-interest period, especially in the secondary market.

Generally, FRMMIs do not have books close dates (BCDs), so when calculating interest it can be assumed that the purchaser will receive the entire coupon at the next coupon date. Accrued interest would be calculated from the interest start date to the FRMMI settlement date.

5. Worked examples

The following example will be used throughout the document to demonstrate the interest calculation and accrued interest described in the previous sections. For completeness, the date generation and adjustments will be described. These, however, are consistent with the current FRMMI conventions. Consider the following FRMMI:

Table 1: FRMMI example details.

Trade date	31-Mar-2023
Settlement date	31-Mar-2023
Tenor	1 year
Interest frequency	3-month
Index	ZARONIA
Traded spread	0.80%
Nominal	ZAR1 million

The interest payment dates are generated backward from the unadjusted maturity date, 31-Mar-2024. Since the unadjusted maturity date falls on the end of the month, each interest end date is assumed to be the end of its month. These dates are all then adjusted using a modified following convention, ensuring that the interest payment does not get paid into the following month.

Table 2: Interest dates.

Unadjusted dates	Adjusted dates
31-Mar-2023 Fri	31-Mar-2023 Fri
30-Jun-2023 Fri	30-Jun-2023 Fri
30-Sep-2023 Sat	29-Sep-2023 Fri
31-Dec-2023 Sun	29-Dec-2023 Fri
31-Mar-2024 Sun	28-Mar-2024 Thu

5.1. Compounding rate example

- **Step 1:** Determine all the good business days, $BusDay_i$, greater than or equal to interest start date and less than interest end date.

- **Step 2:** For each good business day look up the ZARONIA rate, r_{i-1bd}, seen in Table 3.

- **Step 3:** Create a compounding index starting at 1 and apply the rates in **Step 2** over the respective days to accrue interest, seen in Table 3.

- **Step 4:** Calculate the growth in the index expressed in simple terms over the period rounded to six decimal places. This is shown in the last row in Table 3.

Table 3: Interest compounded rate example.

Ref rate	Accrual period		Lookback	Rate	Year frac	ON cap factor
	Start date	End date				
	Step 1		Step 2	Step 2		Step 3
ZARONIA	31-Mar-23	03-Apr-23	30-Mar-23	7.095%	3/365	$1 + 7.095\% \times \frac{3}{365}$
ZARONIA	03-Apr-23	04-Apr-23	31-Mar-23	7.569%	1/365	$1 + 7.569\% \times \frac{1}{365}$
ZARONIA	04-Apr-23	05-Apr-23	03-Apr-23	7.586%	1/365	$1 + 7.586\% \times \frac{1}{365}$
ZARONIA	05-Apr-23	06-Apr-23	04-Apr-23	7.579%	1/365	$1 + 7.579\% \times \frac{1}{365}$
ZARONIA	06-Apr-23	11-Apr-23	05-Apr-23	7.580%	5/365	$1 + 7.580\% \times \frac{5}{365}$
ZARONIA	11-Apr-23	12-Apr-23	06-Apr-23	7.578%	1/365	$1 + 7.578\% \times \frac{1}{365}$
ZARONIA	12-Apr-23	13-Apr-23	11-Apr-23	7.574%	1/365	$1 + 7.574\% \times \frac{1}{365}$
ZARONIA	13-Apr-23	14-Apr-23	12-Apr-23	7.573%	1/365	$1 + 7.573\% \times \frac{1}{365}$
...	...	...	...	...	...	...
ZARONIA	20-Jun-23	21-Jun-23	19-Jun-23	8.070%	1/365	$1 + 8.070\% \times \frac{1}{365}$
ZARONIA	21-Jun-23	22-Jun-23	20-Jun-23	8.072%	1/365	$1 + 8.072\% \times \frac{1}{365}$
ZARONIA	22-Jun-23	23-Jun-23	21-Jun-23	8.087%	1/365	$1 + 8.087\% \times \frac{1}{365}$
ZARONIA	23-Jun-23	26-Jun-23	22-Jun-23	8.078%	3/365	$1 + 8.078\% \times \frac{3}{365}$
ZARONIA	26-Jun-23	27-Jun-23	23-Jun-23	8.105%	1/365	$1 + 8.105\% \times \frac{1}{365}$
ZARONIA	27-Jun-23	28-Jun-23	26-Jun-23	8.078%	1/365	$1 + 8.078\% \times \frac{1}{365}$
ZARONIA	28-Jun-23	29-Jun-23	27-Jun-23	8.084%	1/365	$1 + 8.084\% \times \frac{1}{365}$
ZARONIA	29-Jun-23	30-Jun-23	28-Jun-23	8.088%	1/365	$1 + 8.088\% \times \frac{1}{365}$
Observation cap factor Step 4						$1 + 7.8110\% \times \frac{91}{365}$

Source for ZARONIA: SARB - ZARONIA interest rate benchmark webpage

- **Step 5:** Add the FRMMI spread to the $Rate$ in **Step 4** over the interest period to determine the interest amount.

$$InterestAmount = 1,000,000 * (7.8110\% + 0.80\%) * \left(\frac{30Jun2023 - 31Mar2023}{365} \right) = 21,468.5205479452$$

- **Step 6:** Round the $InterestAmount$ to two decimal places, $21,468.52$.

This interest amount would be paid at the end of the interest period, 30-Jun-2023.

5.2. Accrued interest example

The accrued interest is an important factor in determining what interest has accrued on an FRMMI and is used when trading mid coupon.

Let us assume we purchase the FRMMI defined in Table 1, settling on the 28-Apr-2023.

- **Step 1:** Determine all the good business days, $BusDay_i$, greater than or equal to the interest start date and less than the settlement date.

- **Step 2:** For each good business day look up the ZARONIA rate, r_{i-1bd}, seen in Table 4.

- **Step 3:** Create a compounding index starting at 1 and apply the rates in **Step 2** over the respective days to accrue interest, seen in Table 4.

- **Step 4:** Calculate the growth in the index expressed in simple terms over the period rounded to six decimal places. This is shown in the last row in Table 4.

Table 4: Interest accrued CUM example.

Ref rate	Accrual period		Lookback	Rate	Year frac	ON cap factor
	Start date	End date				
	Step 1		Step 2	Step 2		Step 3
ZARONIA	31-Mar-23	03-Apr-23	30-Mar-23	7.095%	3/365	$1 + 7.095\% \times \frac{3}{365}$
ZARONIA	03-Apr-23	04-Apr-23	31-Mar-23	7.569%	1/365	$1 + 7.569\% \times \frac{1}{365}$
ZARONIA	04-Apr-23	05-Apr-23	03-Apr-23	7.586%	1/365	$1 + 7.586\% \times \frac{1}{365}$
ZARONIA	05-Apr-23	06-Apr-23	04-Apr-23	7.579%	1/365	$1 + 7.579\% \times \frac{1}{365}$
ZARONIA	06-Apr-23	11-Apr-23	05-Apr-23	7.580%	5/365	$1 + 7.580\% \times \frac{5}{365}$
ZARONIA	11-Apr-23	12-Apr-23	06-Apr-23	7.578%	1/365	$1 + 7.578\% \times \frac{1}{365}$
ZARONIA	12-Apr-23	13-Apr-23	11-Apr-23	7.574%	1/365	$1 + 7.574\% \times \frac{1}{365}$
ZARONIA	13-Apr-23	14-Apr-23	12-Apr-23	7.573%	1/365	$1 + 7.573\% \times \frac{1}{365}$
ZARONIA	14-Apr-23	17-Apr-23	13-Apr-23	7.582%	3/365	$1 + 7.582\% \times \frac{3}{365}$
ZARONIA	17-Apr-23	18-Apr-23	14-Apr-23	7.585%	1/365	$1 + 7.585\% \times \frac{1}{365}$
ZARONIA	18-Apr-23	19-Apr-23	17-Apr-23	7.588%	1/365	$1 + 7.588\% \times \frac{1}{365}$
ZARONIA	19-Apr-23	20-Apr-23	18-Apr-23	7.591%	1/365	$1 + 7.591\% \times \frac{1}{365}$
ZARONIA	20-Apr-23	21-Apr-23	19-Apr-23	7.590%	1/365	$1 + 7.590\% \times \frac{1}{365}$
ZARONIA	21-Apr-23	24-Apr-23	20-Apr-23	7.590%	3/365	$1 + 7.590\% \times \frac{3}{365}$
ZARONIA	24-Apr-23	25-Apr-23	21-Apr-23	7.540%	1/365	$1 + 7.540\% \times \frac{1}{365}$
ZARONIA	25-Apr-23	26-Apr-23	24-Apr-23	7.597%	1/365	$1 + 7.597\% \times \frac{1}{365}$
ZARONIA	26-Apr-23	28-Apr-23	25-Apr-23	7.591%	2/365	$1 + 7.591\% \times \frac{2}{365}$
Observation cap factor Step 4						$1 + 7.5496\% \times \frac{28}{365}$

Source for ZARONIA: [SARB - ZARONIA interest rate benchmark webpage](#)

- **Step 5:** Add the FRMMI spread to the $Rate$ in **Step 4** over the interest period to determine the interest amount.

$$InterestAmount = 1,000,000 * (7.5496\% + 0.80\%) * \left(\frac{28Apr2023 - 31Mar2023}{365} \right) = 6,405.1726027397$$

- **Step 6:** Round the $InterestAmount$ to two decimal places, $6,405.17$.

The seller of the FRMMI should be compensated for the accrued interest in the price of the instrument.

Glossary

List of acronyms

ARR   alternative reference rate. 4

BCD   books-closed date. 5

FRMMI   floating rate money market instrument. 3, 4, 5, 6, 7

IBOR   interbank offered rates. 4

ONRR   overnight reference rate. 4

SARB   South African Reserve Bank. 4

ZAJO   South African calendar - Johannesburg Financial Center. 4
ZARONIA   South African Overnight Index Average. 4, 5, 6, 7