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RISK-FREE RATE TERM STRUCTURES APPLICABLE FOR THE VALUATION OF TECHNICAL PROVISIONS OF THE NEPALESE INSURANCE SECTOR UNDER A RISK-BASED FRAMEWORK

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Confidential. Draft

Introduction and baseline

1. This paper provides an objective, robust and fully transparent methodology for the derivation of the risk-free interest rate term structures applicable for the valuation of the technical provisions of the Nepalese insurance sector under a risk-based framework (hereinafter, *the Nepalese RFR curves*).
2. At the end of October 2023 NIA opened a 3-week public consultation period on a discussion paper containing an initial proposal of the referred methodology and raising a set of questions to gather feedback from insurers and reinsurers.
3. Furthermore, on Mangshir 10, 2080 (November 26, 2023) insurance and reinsurance industry representatives held a meeting on the methodology for the Nepalese risk-free interest rate curve with NIA and the World Bank team supporting Nepal in the implementation of a risk-based framework in the Nepalese insurance sector and its supervision. During the meeting the industry was informed of how their feedback during the consultation process had been taken on board to improve the methodology. The comments of the industry during that meeting have also enriched this document, in particular the item reflecting additional remarks.
4. This document has benefited from the comments received both when obtaining a strong support for the proposals subject to consultation, and where stakeholders raised alternative approaches.
5. Furthermore, it is expected that an appropriately designed field test (impact study), will help to improve the methodology described in this document.
6. As part of the preparation of the methodology to derive *the Nepalese RFR curves* an online meeting was held on July 31st with representatives of the NRB, banking sector, NIA and the World Bank. The main conclusions of that meeting are summarized as follows:
 - There is no generally accepted methodology in the Nepalese financial sector for determining the fair value of fixed-income bonds,
 - The trading of fixed-income bonds, including government bonds, after issuance is exceptional and most government and corporate bonds are in the held-to-maturity portfolios of banks or NRB. Therefore, it is not expected in the short-medium term that a deep, liquid and transparent fixed-income secondary market will be developed, nor will a methodology be developed that could be usable as an initial reference for the derivation of *the Nepalese RFR curves*.

- The pricing of scarce secondary transactions of fixed-income bonds seems to be materially conditioned by entity specific features or even subjective judgement, which are not relevant for the derivation of *the Nepalese RFR curves*.
7. Considering this context, the only option seems to be the development of a methodology based, to the extent possible, on financially robust foundations. For solvency purposes, the methodology should deliver a valuation of technical provisions that is adequate to ascertain the transfer of the insurance portfolios if needed¹.
 8. Once the methodology is agreed, user-friendly IT tools should be deployed to make the calculation process fully transparent.
 9. In developing the methodology of *the Nepalese RFR curves*, the following properties are considered relevant, though some trade-off among the properties is unavoidable:
 - To the extent possible, the calculation should be based on financial information derived from deep, liquid and transparent markets for the relevant fixed-income instruments. This does not exclude the application of appropriate adjustments where relevant for the purpose expressed above;
 - The RFR curve should reflect the yield that can be earned on a risk-free basis. Therefore, appropriate adjustments to the observed market interest rates are possible;
 - The methodology should be reliable and financially robust, including the quality of the sources of the inputs and assumptions. This feature does not exclude the application of sensible approximations for the sake of simplicity and pragmatic reasons;
 - The methodology should avoid the artificial volatility of financial markets, especially in longer terms where extrapolation methods are necessary;
 - The methodology should remain stable, with no expected changes in the short-medium term, though keeping a continuous monitoring of its appropriate functioning especially in exceptional circumstances;
 - Easy operation (e.g. continuity, smoothness of spot and forward rates, etc.);

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¹ Note that for the financial statement reporting the use of discounting based on the appropriate market interest rates existing at each point in time is also required.

- Full transparency for interested stakeholders;
 - Replicable and pragmatic, which among other conditions requires access to the inputs of the methodology with adequate frequency;
 - The methodology should provide incentives for those insurers and reinsurers applying a good risk management, therefore promoting a level playing field, transparency and appropriate risk management behaviours;
 - The methodology does not interfere or create unjustified inconsistencies with sound risk management practices regarding interest rate risks;
 - The methodology should prevent procyclical behaviour, protecting the policy holders' interests and the financial stability of Nepal; and
 - Where decisions or components of the methodology should be made or applied under material uncertainty, the methodology shall deliver an adequate level of prudence while providing an economic picture of the solvency position of the insurer or reinsurer based on a total balance sheet approach.
10. To better illustrate the methodology described below, this document elaborates on how that methodology would have worked for the Nepalese fiscal year-end 2079/2080 (hereinafter NP – Nepali Patro).

Methodology to derive the Nepalese risk-free interest rates curves.

11. Neither the information of the Nepalese financial markets nor the financial practices of the Nepalese financial institutions will be usable to derive the Nepalese risk-free interest rates curves until a deep, liquid and transparent secondary market for (almost) risk-free fixed-income instruments is in place.
12. Nevertheless, there are examples of deriving the risk-free interest rate curves of currencies that are pegged to another currency (the base reference currency). That practice starts from the risk-free interest rate curves of the base reference currency and adjustments are applied appropriate to the pegged currency².
13. The pegging mechanism of the Nepalese rupee to the Indian rupee has been in place for decades and the experience shows the capacity of the Central Bank of Nepal (NRB) to monitor and manage the development of exchange rates among both currencies. Furthermore, there are no reasons to question such mechanism.
14. Therefore, this document proposes a methodology to derive the *Nepalese RFR curves* based on three steps:
 - firstly, to consider the liquid part of an internationally accepted source providing the risk-free interest rate term structures for India that are easily available with adequate frequency (at least quarterly),
 - secondly, to assess the relevant adjustment considering the differences among the Indian and the Nepalese economies,
 - thirdly, to extrapolate the adjusted Nepalese risk-free interest rates beyond the last tenor of the liquid part.
15. The purpose of this approach is to:
 - Produce a valuation of the technical provisions that is adequate to ensure with a high degree of confidence the transfer of the portfolio of insurance contracts of the (re)insurer to another reinsurer, considering that the buyer might be in any of the countries of the regional area with a sufficient relationship with Nepal; and
 - Satisfy the desirable properties listed above, though having in mind the limitations described and that some trade-off among the properties is unavoidable.

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This is the methodology applied in the European Union to derive the risk-free curves for the Danish Krona and Bulgarian Lev, which are both pegged to the Euro.

16. Although the methodology integrates mechanisms to avoid overreliance on a single reference, impact of outliers and short-term volatility, NIA is fully aware that it is necessary to carry out a timely monitoring of the appropriateness of the methodology in case of material changes in the economic environment (for example, a material departure of the Nepalese features regarding interest rates from the Indian interest rates, compared to the current situation, and to the extent such departure is not neutralised by the mechanism mentioned above).

Disclaimer.

None of the external sources of information mentioned in this methodology has assured or assumes responsibility about the appropriateness of the data mentioned in this document or used for the purpose of deriving the Nepalese risk-free interest rate term structure.

The disclaimer also applies to the numeric examples reflected in this document.

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Step 1. Base reference. The Indian risk-free interest rates curves.

17. Regarding the first step, the main internationally accepted and free source for monthly access to risk-free interest rate term structures for a wide set of currencies (Indian rupee included) is currently the European Insurance and Occupational Pensions Authority (hereinafter, EIOPA). Its methodology and process of calculation are fully transparent at the following website: https://www.eiopa.europa.eu/tools-and-data/risk-free-interest-rate-term-structures_en.³
18. Note that the monthly publication of EIOPA risk-free interest rates curves refers to the end of each month according to the Gregorian calendar. This means that there is a mismatch of 17 days with the yearend according to the Nepalese financial calendar (Ashad-end in Nepali Patro).

For the sake of simplicity, as a general rule NIA shall apply the methodology of this document to the last EIOPA RFR curves published before the reference date.

This assumes that the calendar mismatch referred above has a negligible impact.

For example, in the case of the financial yearend, the EIOPA RFR curves referred to June 30 (GC) will be used as inputs to the methodology.

And similarly for any other date, such as the case of quarterly calculations or any other date in case of portfolio transfers or acquisitions.

Note that to remove artificial volatility, the general rule set out above will have an exception in the scenario 2.2 envisaged in step 3 below.

19. According to item 6.3 of the technical documentation of EIOPA, available at <https://www.eiopa.europa.eu/system/files/2022-12/eiopa-bos-2022-547-new-rfr-technical-documentation.pdf>, from January 2024 (GC) onwards the Indian RFR

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The last version of the EIOPA RFR Technical documentation is available at <https://www.eiopa.europa.eu/system/files/2023-10/EIOPA-BoS-2023-359%20-RFR%20Technical%20Documentation.pdf>.

curve will be based on Overnight Index Swaps (OIS) and the liquid part of the curve will be limited to tenors from 1 to 5 years⁴.

20. The illustrative examples of this document consider the expected changes from January 2024 (GC) onwards in the EIOPA methodology for the EIOPA India RFR curves, having in mind that some points may need to be reassessed once the first curve with the new methodology is published (early February 2024 (GC))⁵.
21. Referring to fiscal year-end 2079/2080 NP, the liquid part of the EIOPA Indian risk-free interest rate curve provides the following OIS spot **zero-coupon** rates:

Zero-coupon	1	2	3	4	5
31-05-2023	6.358%	6.107%	5.986%	5.937%	5.932%
30-06-2023	6.523%	6.353%	6.262%	6.200%	6.204%
31-07-2023	6.639%	6.515%	6.437%	6.397%	6.404%
31-08-2023	6.728%	6.550%	6.506%	6.454%	6.445%
30-09-2023	6.840%	6.742%	6.712%	6.683%	6.692%
31-10-2023	6.705%	6.561%	6.551%	6.548%	6.567%

22. As explained above, EIOPA is not currently publishing these interest rates (the publication will start from January 2024 GC onwards). The interest rate figures for the dates shown in the table can be obtained from the most widely known financial service providers. It is expected that any eventual difference among all sources will be immaterial.
23. NIA has explored the adjustment of the base reference (the EIOPA Indian risk-free interest rates curve) using the inflation spread of India and Nepal under three approaches: annual spread, long-term inflation and statistics based on long term series of data.

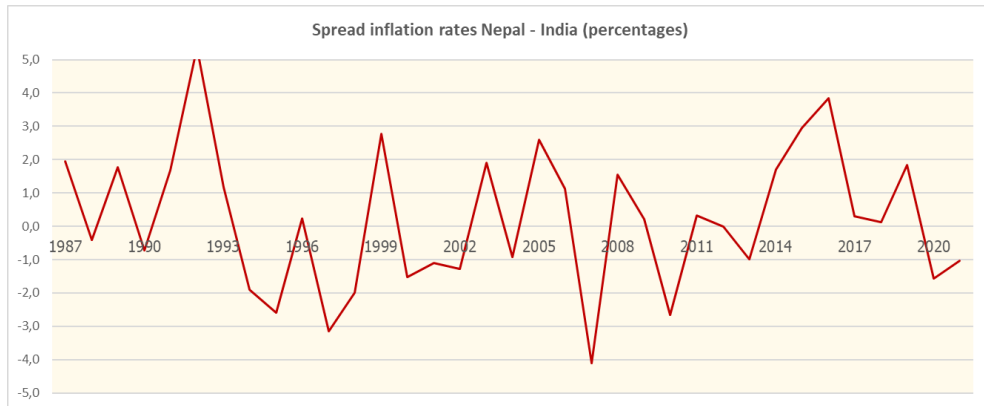
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⁴ Until end-December 2023 (GC), the last observable term (LOT) of the Indian RFR curve is 10 years. In addition, the financial instrument used to construct the curve is the Indian government bond, considering all tenors from 1 to 10 years.

Furthermore, as per paragraph 7.2.4 of the EIOPA RFR Technical documentation, '*In the case of risk-free interest rate term structures based on overnight indexed swaps (OIS), no CRA (credit risk adjustment) is applied due to negligible credit risk.*'

⁵ On October 2, 2023 (Gregorian Calendar, hereinafter GC) EIOPA announced that the methodology to calculate the liquid part of the risk-free interest rate curve for the Indian rupee (hereinafter, Indian RFR curve) will change from January 2024 (GC) onwards. Below this document refers to the main elements of that change.

Figure 1. Inflation spreads v/ Interest rates spreads. Baseline: India.



24. The conclusion is that such adjustment is not currently appropriate.

Firstly, the use of adjustments based on spreads of short-term inflation rates does not seem relevant to derive medium-long term interest rates, both considering financial literacy and the factual behaviour of those spreads.

Secondly, the available long-term inflation rates (whose main source are the long-term inflation targets of Central Banks) may be materially influenced by factors not sufficiently related to the cost of transferring a portfolio of insurance obligations in case necessary. Therefore, this reference would likely expose the Nepalese insurance sector to undesired and unjustified volatility.

Finally, as the following chart shows, using averages or correlations of long series data of inflation spreads is not appropriate since the high correlation among the two inflation rates considered (Nepalese and Indian inflation) would make the adjustment almost insensitive to market movements (which is against the economic approach intended with a risk-based framework).

25. The conclusion set out above does not preclude to reassess the issue if the inflation spread experiences sustain material changes in the future.

Step 2. Adjustment of the base reference to the Nepalese economy.

26. There are several considerations that may question whether the methodology for determining *the Nepalese RFR curves* should be based **only** on the Indian RFR curve without any adjustments.
27. As mentioned above, adjusting the Indian RFR curve would be consistent with other international examples of deriving the risk-free interest rate curves of pegged currencies⁶. This document will consider two components for that adjustment:
- material differences between the Nepalese and the Indian economies that might result in differences in the risk-free curves for the respective currencies,
 - the cost of hedging against the exchange rate risk, considering the band of fluctuation allowed within the pegging mechanism.
28. Therefore, the adjustments do not question the appropriateness of the Indian RFR curve as a base reference, but rather the adjustments intend to adapt that curve to reflect the features of the Nepalese economy and currency that differ from India.
29. In this line, the following considerations are relevant:
- Firstly, the Debt-to-GDP ratio for India reached almost 90% in 2022⁷, compared to 41.4% for Nepal in 2022-2023. Therefore, it is relevant to consider whether the Indian RFR curve reflects some country-specific increase of interest rates due to the liquidity needs of public financing.
 - Secondly, on a rather continuous basis the Indian RFR curve shows interest rates that are materially higher than those of the regional economies whose risk-free rates curves are publicly available.

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⁶ Item 8 of the technical documentation of EIOPA, available at <https://www.eiopa.europa.eu/system/files/2022-12/eiopa-bos-2022-547-new-rfr-technical-documentation.pdf>

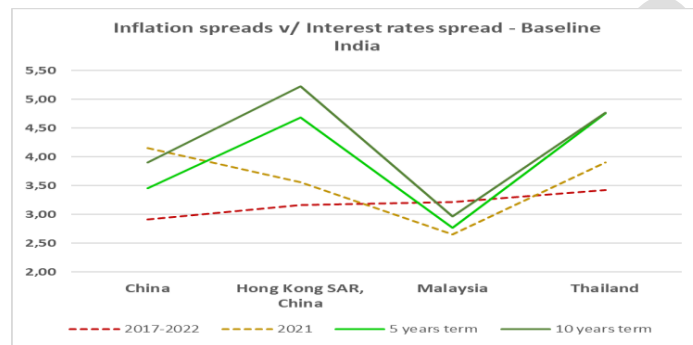
⁷ [India Government Debt to GDP - 2023 Data - 2024 Forecast - 1980-2022 Historical \(tradingeconomics.com\)](https://tradingeconomics.com/india/government-debt-to-gdp)

To assess these material spreads, the following chart shows a comparison of the Indian features with the regional economies considered relevant for the purpose⁸.

The dotted lines show the average inflation spreads versus India for the last five years and for 2021 (GC).

The continuous lines show the interest rates spreads for tenors 5 and 10 years as of 31-12-2021 (GC) according to EIOPA information.

Figure 2. Inflation spreads v/ Interest rates spreads. Baseline: India.



Sources: <https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?locations=NP> for inflation rates. EIOPA website for information of spreads of interest rates

- Additionally, it makes sense to consider that the target to achieve, (a valuation of the technical provisions adequate to ensure the transfer of the insurance portfolios if needed), may refer not only to other (re)insurers in India, but also to other financial groups of the region. Adopting the Indian RFR curve, which is the higher one (all interest rate spreads in the chart were positive and above 200 basis points), might narrow the possibility of transferring the Nepalese insurance portfolios to (re)insurers of another regional country (unless the forecast of the exchange rates offsets the impact of lower third-country interest rates than those of the RFR Indian curve).

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EIOPA currently provides on a monthly basis the following Asian risk-free curves: China, Hong-Kong SAR, India, Malaysia, Japan, Singapore, South Korea, Taiwan, Thailand and Turkey.

For the purposes of this document the risk-free curves for China, Hong Kong, Malaysia and Thailand will be considered as secondary references. USA risk-free curve is added to the basket of secondary references because after the Indian rupee, export/import Nepalese trading is mostly made with US dollars.

30. Summing up it seems prudent to introduce an objective adjustment to avoid basing the Nepal RFR only on the economy with the highest interest rates in the region. Furthermore, an algorithm involving several jurisdictions, rather than relying on a single jurisdiction, avoids a *'single point of failure'* (that is, a situation where the single jurisdiction considered experiences artificial movements not relevant for *the Nepalese RFR curves*).
31. The adoption of this methodology for the calculation of the adjustment referred above is coupled with a continuous monitoring of its functioning and dialogue with stakeholders. One of the challenges is the lack of deep, liquid and transparent Nepalese medium- and long-term interest rates. This then requires the use of indirect inputs and application of a level of prudence in the estimation of the adjustment.
32. Under this methodology, initially tenors 1 to 5 of the Indian OIS zero coupon interest rates are adjusted with a portion of the average difference (spread) between the Indian RFR curve and each of the EIOPA risk-free interest rates curves for the five currencies (China, Hong Kong, Malaysia, Thailand and USA) used as secondary references (footnote 8 above)⁹.
33. Given the purpose of the secondary references (to adjust the base reference curve), NIA will consider the EIOPA risk-free interest curve with volatility adjustment (VA). Note that such volatility adjustment currently means an increase of the interest rates¹⁰, and hence a reduction of the adjustment.
34. Furthermore, currently EIOPA calculates the volatility adjustment for China and USA but not for the other currencies integrated in the basket.

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⁹ Certainly, there are other regional economies more similar to the Nepal economy, but all of them lack any reliable source to derive their national risk-free rates, and therefore are not usable for the purpose of this document.

If these more similar economies would develop in the future robust references for sufficient medium-term risk-free interest rates, it will make sense to consider whether it is relevant to include them as secondary references of the methodology. This is expected to be part of the continuous monitoring of its functioning referred above.

The methodology below keeps in mind that the secondary references above correspond with economies with material divergences compared to the Nepalese economy and among them. This means that where the use of plausibility is unavoidable the methodology opts for a prudent approach avoiding jeopardizing the chances of the Nepalese insurers and reinsurers to move towards a risk-based framework, while keeping a prudent approach.

¹⁰ Though it might be negative under certain scenarios.

35. To maintain stability of this adjustment and avoid that outliers have an excessive influence on the average (i.e., to avoid outliers providing unjustified volatility to the adjustment), the maximum spread in absolute value is removed for each tenor.
36. In mathematical terms the calculations might be expressed as

$$RFR_{Nepal}(t) = RFR_{India}^{EIOPA}(t) + P * \frac{\sum Spread_{India}^k(t)}{4}$$

where

- (t) means tenors 1 to 5,
- (k) refers to the magnitudes of China, Hong Kong, Malaysia, Thailand and USA, excluding in each tenor the country with the highest absolute spread,
- P means the portion of the average spread to adjust. It is considered that $P = 0,20$ provides a plausible estimation of the adjustment. Nevertheless, the value of parameter P will be reassessed in February 2024 (GC) once EIOPA publishes the Indian RFR curve as of end-January 2024 and in light of the outcomes of the quantitative impact study mentioned below,
- $Spread_{India}^k(t)$ means for each tenor (t) the five spreads of each of the five currencies used as secondary reference compared to the Indian OIS zero coupon interest rates. For each tenor the country with the highest absolute spread will be excluded. For example, for the 5 years term and China,

$$Spread_{India}^{China}(5y) = RFR_{China}^{EIOPA}(5y) - RFR_{India}^{EIOPA}(5y).$$

37. The following table shows the outcome at the Nepal fiscal year-end 2079/2080 NP and three months later (Aswhin 13, 2080 – NP / September 30, 2023 – GC):
- Columns 3 to 6 show the differences for each tenor and currency compared to the EIOPA risk-free interest rates curve for India,
 - Column 'Average spread' shows the average of spreads for each tenor, excluding the maximum spread in absolute value for each row (i.e. the excluded observation may correspond to different currencies in each tenor),
 - The last column, green filled cells, shows *the Nepalese RFR curve* resulting from the adjustment (e.g., for tenor 1, $5.846 = 6.523 - 0.677$).

	RFR curve	Spread OIS Indian rates - EIOPA RFR curves for each country							Nepal RFR curve
	India	China	Hong Kong	Malaysia	Thailand	USA	Average spread	Adjustment	
20230630	AR	AO	AQ	AT	BA	BC			
1	6,523	4,569	1,680	3,288	4,566	0,614	2,537	-0,507	6,016
2	6,353	4,296	1,801	3,011	4,268	1,035	2,529	-0,506	5,847
3	6,262	4,071	1,950	2,822	4,112	1,375	2,555	-0,511	5,751
4	6,200	3,894	2,043	2,682	4,007	1,601	2,555	-0,511	5,689
5	6,204	3,803	2,165	2,613	3,972	1,792	2,593	-0,519	5,685

	RFR curve	Spread OIS Indian rates - EIOPA RFR curves for each country						0,2	Nepal RFR curve
30/09/2023	India	China	Hong Kong	Malaysia	Thailand	USA	Average spread	Adjustment	
20230930	AR	AO	AQ	AT	BA	BC			
1	6,840	4,886	1,748	3,594	4,441	0,873	2,664	-0,533	6,307
2	6,742	4,695	1,943	3,356	4,290	1,256	2,711	-0,542	6,200
3	6,712	4,552	2,132	3,182	4,179	1,560	2,763	-0,553	6,159
4	6,683	4,397	2,209	3,036	4,071	1,704	2,755	-0,551	6,132
5	6,692	4,290	2,236	2,948	4,001	1,806	2,748	-0,550	6,142

It is relevant to consider the behaviour of the adjustment under different scenarios:

- It might happen a material increasing of spreads of the risk-free interest rates of the currencies used as secondary references to the Indian risk-free interest rates. This might lead to a situation where the distance between the Indian and the Nepalese risk-free interest rates curves becomes non-plausible. To prevent this situation, it makes sense to introduce a cap to the adjustment. Among the different alternatives to overcome this drawback, the simplest approach, but still sensible, seems to set an absolute cap. *NIA deems that under current market conditions it is appropriate to set a cap of 75 basis points in absolute terms*¹¹.
- It might also occur that all the five currencies involved in the calculation materially move in the same direction (either upwards or downwards), while keeping the respective spreads without material changes. This will result in material changes of opposite sign in the valuation of the mathematical provisions. This situation is considered in the additional remarks developed at the end of this document.

38. After the introduction of the cap proposed above, the formula to calculate the Nepalese RFR curve becomes as follows for each term (t) = {1...5}:

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At international level there are some precedents setting caps, floors or corridors for the adjustments to the risk-free curve used as reference. For example, in the case of the European Union the credit risk adjustment has a corridor of 10-35 basis points. In the case of the adjustment considered in this document it lacks sense to set a floor.

when $\frac{\sum Spread_{India}^k(t)}{4} > 0$

$$RFR_{Nepal}(t) = RFR_{India}^{EIOPA}(t) + \min (75bp ; P * \frac{\sum Spread_{India}^k(t)}{4})$$

otherwise

$$RFR_{Nepal}(t) = RFR_{India}^{EIOPA}(t) + \max (-75bp ; P * \frac{\sum Spread_{India}^k(t)}{4})$$

39. Note that the derived curves will not necessarily be around the 6 per cent flat rate that is currently used to discount technical reserves as per the Nepalese insurance regime in force before the introduction of the RBC framework. At a future point in time the curve may be materially above or below the 6 per cent, depending on how the different inputs to the methodology evolve.
40. Therefore, the valuation of technical provisions would be materially lower (or higher) than the valuation with the current flat 6 per cent discount rate. This feature is inherent in a risk-based framework, as it is intended to reflect market movements and developments.
41. Note that the adjustment formulated above is understood to include a prudent currency risk adjustment (second bullet point mentioned in paragraph 25). Thus, it is not necessary to add any explicit adjustment for this reason. The explicit insertion of such adjustment, further than increasing the complexity of the method, would trigger a calibration challenge difficult to solve under current market conditions.¹²
42. NIA is conscious that this approach has room for evolution when the extreme limitations currently existing in the Nepalese financial markets for fixed-income instruments fade away. In the meantime, the approach of this document is considered to satisfy to a sufficient degree the goal and properties elaborated at the beginning of this document.

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¹² Refer to item 8 of the EIOPA methodology on risk-free interest rates (https://www.eiopa.europa.eu/tools-and-data/risk-free-interest-rate-term-structures_en) as an evidence of the complexity that may have an estimation of the currency risk adjustment.

Step 3. Prevention of short-term volatility.

43. The goal of this step is to remove or mitigate to the extent possible the influence of short-term volatility on the Nepalese risk-free interest rates.
44. For the sake of clarity, the illustrative examples of this step refer to the financial yearend. The methodology applies *mutatis mutandis* to any other reference date.
45. For the sake of simplicity, the analysis is carried out separately for each concrete tenor (t-years). This assumes that any difference between tenors will not generate material disruptions in the curve.
46. To preserve the objectivity of the methodology, NIA shall consider that there *might* be a short-term volatility where the last interest rate observed before the reference date presents an absolute variation above 20 basis points the previous observation for the same tenor. In formulaic expression:

$$\text{Abs}(\text{Nepal_RFR}_{\text{tenor}_t}^{30-6} - \text{Nepal_RFR}_{\text{tenor}_t}^{31-5}) > 20 \text{ bp}$$

47. The calibration of the threshold at 20 basis points is based on the experience of the observations for the period 30-5-2023 to 31-10-2023 (GC), as described below. The adopted level avoids situations where there is short-term volatility in a major part of the observations, while avoiding the situation that there is short-term volatility in a very limited number of cases.
48. Absolute variations below the referred 20 bp threshold shall be considered as ordinary market fluctuations and hence:

$$\text{Nepal_RFR}_{\text{tenor}_t}^{\text{Ashad}^{\text{end}}} = \text{Nepal_RFR}_{\text{tenor}_t}^{30-6}$$

49. NIA is of the view that the following decision tree achieves an appropriate balance between simplicity and adequacy.

Scenario 1.- Where $\text{Abs}(\text{Nepal_RFR}_{\text{tenor}_t}^{30-6} - \text{Nepal_RFR}_{\text{tenor}_t}^{31-5}) \leq 20 \text{ bp}$

$$\text{Nepal_RFR}_{\text{tenor}_t}^{\text{Ashad}^{\text{end}}} = \text{Nepal_RFR}_{\text{tenor}_t}^{30-6}$$

Scenario 2.- Where $\text{Abs}(\text{Nepal_RFR}_{\text{tenor}_t}^{30-6} - \text{Nepal_RFR}_{\text{tenor}_t}^{31-5}) > 20 \text{ bp}$

Scenario 2.1.- The first observed variation after the reference date (Ashad-end) is nil or has the same sign as compared to the last observed variation before the reference date.

$$(Nepal_RFR_{tenor_t}^{31-7} - Nepal_RFR_{tenor_t}^{30-6}) \text{ is nil or have the same sign as } (Nepal_RFR_{tenor_t}^{30-6} - Nepal_RFR_{tenor_t}^{31-5})$$

This means that the last observed variation before the reference date (Ashad-end) is not reversed.

$$\text{In this case } Nepal_RFR_{tenor_t}^{Ashad\ end} = Nepal_RFR_{tenor_t}^{30-6}$$

Scenario 2.2.- The first observed variation after the reference date (Ashad-end) has the opposite sign to the last observed variation before the reference date.

$$(Nepal_RFR_{tenor_t}^{31-7} - Nepal_RFR_{tenor_t}^{30-6}) \text{ has a different sign than } (Nepal_RFR_{tenor_t}^{30-6} - Nepal_RFR_{tenor_t}^{31-5})$$

This means that the last observed variation before the reference date (Ashad-end) is partially or totally reversed. In this scenario, it is suggested:

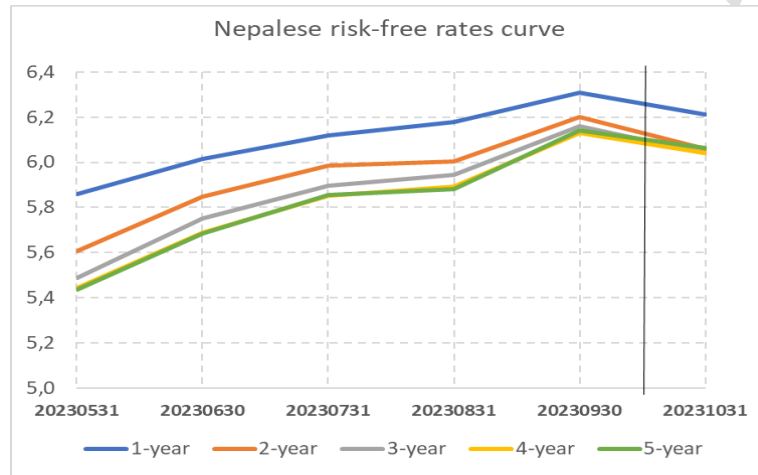
$$Nepal_RFR_{tenor_t}^{Ashad\ end} = (Nepal_RFR_{tenor_t}^{31-5} + Nepal_RFR_{tenor_t}^{30-6} + Nepal_RFR_{tenor_t}^{31-7}) / 3$$

50. NIA is aware that using the EIOPA RFR curves of the first publication after the reference date (July 31 in the case of the financial year-end) means an operational delay for insurers and reinsurers of approximately 20 days. For the time being, NIA considers that such delay is acceptable in light of the benefits of avoiding that a material artificial volatility may jeopardize the representativeness of the information used for risk management, provided to stakeholders and reported to NIA.
51. The following table reflects how this mechanism would have worked for the six EIOPA RFR curves published from 31-5-2023 to 31-10-2023 (GC). The cells with 1 identify those cases where the two conditions of scenario 2.2 are met.

	20230531	20230630	20230731	20230831	20230930	20231031
1-year		0	0	0	0	
2-year		0	0	0	0	
3-year		0	0	0	1	
4-year		0	0	0	1	
5-year		0	0	0	1	

52. In case the reference date for the valuation of technical provisions would be somewhere in October, the application of scenario 2.2 means that the interests rates derived for tenors 3, 4 and 5 before applying the mechanism to remove the short-term volatility (6.159, 6.132 and 6.142 respectively) would change to 6.048, 6.022 and 6.029. Unavoidably there is a discontinuity between the 2-year rate (obtained from 30-6 observations) and the 3, 4 and 5-year rates (obtained as the average considered in scenario 2.2).

Figure 3. Nepalese risk-free interest rates before the application of the mechanism to remove short-term volatility



53. For the five curves (tenors) considered from 31-5-2023 to 31-10-2023 (GC) the 25 annual variations of interest rates distributed as follows: 7 were above 20 basis points (30-6-2023 and 30-9-2023) while the remaining 18 were below such threshold.

Step 4. Extrapolation.

54. Beyond a methodology for the liquid part of the RFR curves, it is necessary to extrapolate the interest rates for longer terms. In this regard, it makes sense that the extrapolation of *the Nepalese RFR curve* be as consistent as possible with the one that EIOPA applies for the Indian RFR curve, though maintaining flexibility for specific considerations where relevant.
55. Since one of the desirable features of the RFR curves is stability in the long term, it is suggested to use the Smith-Wilson extrapolation method because it is based on a constant long-term forward rate/ultimate forward rate (LTFR/UFR in the terminology of the IAIS and EIOPA, respectively) and the method may deliver a rather quick convergence to the LTFR/UFR. This means a higher stability of the extrapolated part of the RFR curve compared to other extrapolation methods. Furthermore, this method has a lower number of parameters than other methods also generally applied for the extrapolation of interest rates curves¹³. This property is relevant when the methodology should apply in conditions of rather high uncertainty (principle of parsimony).
56. The main inputs of this algorithm for extrapolation are:
- the last observed term (LOT) of the liquid part (i.e., tenor previous to the starting point of the extrapolation),
 - the level of the LTFR/UFR, and
 - the term at which the 1-year forward rates of the extrapolated interest rates should be sufficiently near¹⁴ the targeted LTFR/UFR.
57. Regarding the first input - the last observed term of the liquid part of the curve- it makes sense to apply the extrapolation of *the Nepalese RFR curve* from tenor 6 onwards, having in mind that from January 2024 (GC) onwards, EIOPA will only consider tenors 1 to 5 as the liquid part of the Indian RFR curve.
58. Regarding the second input - the level of the LTFR/UFR for 2024 - according to the EIOPA document accessible at <https://www.eiopa.europa.eu/system/files/2023->

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¹³ Such as for example, Nelson-Siegel or Svensson methods.

¹⁴ With the Smith-Wilson method, the convergence to the targeted 1-year forward rate is reached at infinity. For the sake of simplicity, it is a common practice to consider that the convergence has been reached when the difference between the targeted LTFR/UFR and the extrapolated 1-year forward rate falls below a small amount (e.g., below 1 basis point).

[04/EIOPA-BoS-23-127-Report-on-the-Calculation-of-the-UFR-for-2024.pdf](#), the LTFR/UFR for the Indian rupee is currently estimated at 5.25 per cent for 2024 (GC). Furthermore, the EIOPA methodology shows during last years a steady decrease of the LTFR/UFR for several currencies (India rupee included) which is expected to continue in the coming years.

59. For *the Nepalese RFR curves* the following LTFR/UFR to the Smith-Wilson extrapolation method is adopted having in mind the 6 per cent flat discount rate that was compulsory before the transition to a Risk-Based Capital framework:
- An UFR of 5.50 per cent at fiscal year-end 2080/2081 (first application of the Risk-Based Capital and Solvency Directive),
 - The initial level of the LTFR/UFR will be reduced annually by 10 basis points during the period 2081/82 to 2084/85 NP, until it reaches 5.00 per cent at financial year-end 2085/86 NP. The intention of this progressive reduction of the LTFR/UFR is, further than considering the forecasts according to EIOPA methodology, to keep the estimate of the LTFR/UFR at a plausible level having in mind the possibility of a future decreasing of the inflation rates and therefore interest rates in Nepal as well.
60. Regarding the third input of the Smith-Wilson methodology (the so-called '*convergence point*'), it is important to note that the length of the convergence period has an impact on the level of prudence of the *Nepalese risk-free interest rate curve*¹⁵.
61. According to item 9.2 of the EIOPA technical documentation, the term of convergence for the EIOPA Indian RFR curve is 60 years. At the same time, it is relevant to note that EIOPA provides flexibility for a different convergence point when appropriately justified, as was the case of the Swedish krona, whose point of convergence to its LTFR/UFR is the 20-year tenor.
62. Since cash flows beyond 30 years are almost immaterial in the Nepalese insurance market, a convergence point of 60 years would have a limited impact compared to a shorter convergence point, such as a 30-year tenor.

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¹⁵ Where the forward interest rates of the liquid part of the curve (1 to 5 tenors) are expected to remain higher than the targeted UFR, an extrapolation to a longer convergence period provides higher discounting rates than an extrapolation targeting a shorter convergence period (and inversely where the forward interest rates of the liquid part of the curve are expected to remain lower than the targeted UFR).

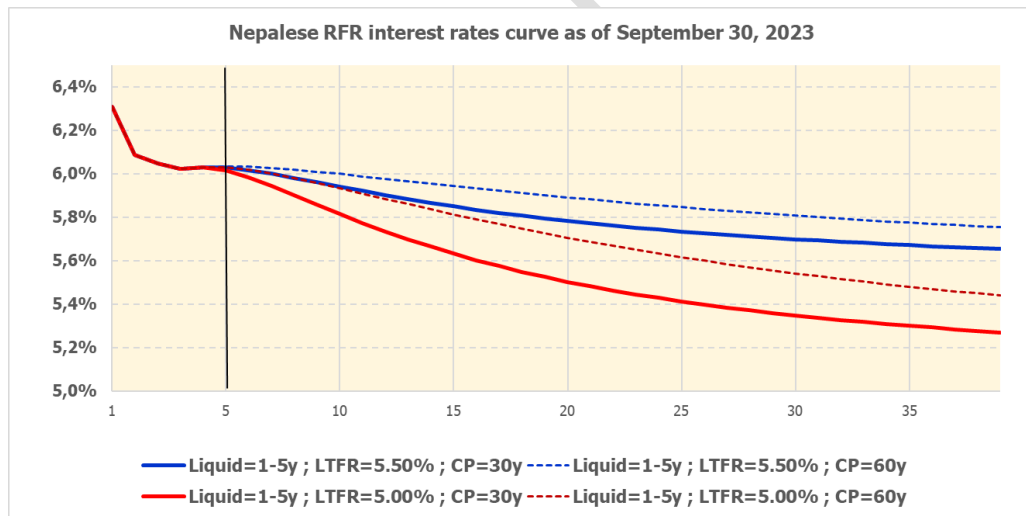
63. Therefore, to ascertain that all inputs and components of the methodology of extrapolation have real effect, NIA sets the convergence point at 30 years.

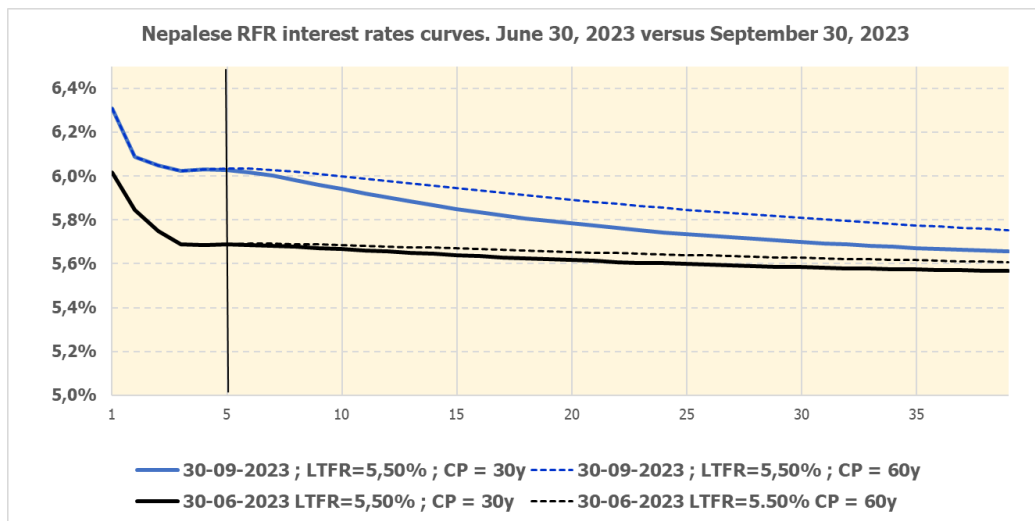
A well-informed decision on whether the convergence point should be 30-years will be done in February 2024 (GC), once EIOPA publishes the first Indian RFR interest rates curve based on OIS rates.

64. EIOPA has released an Excel file with an open macro that allows end users to calculate the extrapolation without needing specific IT capabilities (available at [smith-wilson risk-free interest rate extrapolation tool v1.2.xlsb \(live.com\)](https://www.smith-wilson.com/insights/risk-free-interest-rate-extrapolation-tool-v1.2.xlsb)).

65. The outcome of the extrapolation according to this preliminary methodology is shown in the chart below, where tenors 1 to 5 (the curves left of the thin black vertical line) are the outcomes of the liquid part of the Nepalese RFR curve derived according to step 2 above.

Figures 4 and 5. Nepalese risk-free interest rates curves, including extrapolation.





Note that the **spot** rates are decreasing beyond the convergence term because Smith-Wilson is based on a constant ultimate *forward* rate. The *spot* rate at a given maturity 'm-years' may be viewed as the geometric average of the 1-year forward rates for all maturities from tenor 1-year to tenor 'm-years'. Therefore, the spot rates beyond the convergence point retain information of the forward rates for maturities below such convergence point (though the weight of such information decreases as the term increases). This explains that spot rates in the longest terms are above the targeted LTFR/UFR. Theoretically, at the infinity end the extrapolated spot rate would equal the LTFR/UFR.

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Additional remarks.

66. The lack of market information and usable fair valuation practices in the Nepalese financial sector makes necessary to develop a specific methodology to derive *the Nepalese risk-free interest rate curve*.
67. The methodology described in this document seeks to satisfy the desirable properties for a risk-free interest rate term structure applicable to the valuation of technical provisions of insurance obligations in the Nepalese insurance market. For this purpose, the methodology uses different components which benefit from both international and academic recognition.
68. Nevertheless, a continuing open and intensive dialogue between NIA and the industry, especially life insurers, followed by adequate field tests (impact studies), are necessary to assess that the methodology remains appropriate.
69. A key issue to consider is the likely economic context expected at the first day of application of the methodology, in particular the inflationary environment and its derivative consequence of exceptionally high interest rates. In fact, the increase of interest rates in inflationary situations tends to amplify in India and Nepal compared to other countries in the regional area with advanced financial markets and lower inflation rates.
70. As noted above, the valuation of technical provisions with the methodology may result in either materially lower or higher values compared to the valuation using the flat 6 per cent discount rate currently established in the Nepalese legislation.
71. In case of a reduction of the valuation of technical provisions, though paragraph (68) of the Risk-Based Capital Directive sets that... "*Future profits embedded in the valuation of technical provisions (reserves) shall be considered as capital resources with a limit of 15% of the RBC*", it is unclear whether the reduction of technical provisions due to higher discount rates will correspond to a great extent to future profits embedded in the valuation of the technical provisions (and therefore the aforementioned prudential limit will act as safeguard) or rather to prudential cushions that would be transformed in Available Capital Resources without being capped by the limit of paragraph (68).
72. In the case of interest rates returning in the future to a situation like the one at year-end 2079/2080 NP, there will be a material increase of technical provisions.

73. This increase would not create major issues for those insurers holding appropriate assets with a duration like the duration of its insurance liabilities. In that case, the increase in technical provisions due to a reduction of interest rates would be mirrored to certain extent by an increase of the market value of assets.
74. However, this is not the current situation of the Nepalese insurance market. Material changes in the Nepalese risk-free curve, even being those changes a fair reflection of market information, would result in material changes in Available Capital Resources, which would introduce volatility in the solvency position of insurers.
75. Furthermore, experience shows that the yield of new investments may materially change during the year due to the concentration of the financial entities supplying short and medium-term assets.
76. Certainly, in the medium and long term it is expected that the risk-based capital framework will incentivize an improvement of Asset and Liability Management (ALM) practices in the Nepalese insurance market. But such evolution does not seem feasible in the short-term. Furthermore, for the sake of financial stability it would be sensible to avoid a sudden change in the composition of the asset portfolio of insurers and reinsurers.
77. Keeping in mind the importance of the features mentioned above, this document considers that it is relevant to stick to a risk-free interest rate methodology that:
 - provides a reliable picture of the interest rate risks that the insurer or reinsurer is exposed due to the asset-liability timing mismatch,
 - bears in mind that risk managers and supervisors need to base their decisions on real world,
 - keeps in mind that artificial mechanisms in the methodology would likely be incompatible with the ORSA goals,
 - preserves the risk-free interest rate methodology stable and traceable, therefore providing certainty on this aspect to the risk management of insurers and reinsurers, and
 - meets to the possible extent the other properties listed in the introduction.
78. All these features highlight the need of carrying out in the short-term a holistic impact assessment, where the effect of the new risk-free interest rate methodology is analysed both in isolation and in connection with the other changes derived from the new risk-based framework.

79. NIA intends to carry out a careful assessment in light of the outcomes of the field test and considering paragraphs (93) to (97) of the RBC Directive.
80. The considerations above reveal the macroeconomic consequences of the introduction of a risk-based capital framework and the need to adopt appropriate supervisory measures in that regard that facilitate to the extent possible the adaptation of the Nepalese insurers and reinsurers.
81. Furthermore, to the extent that the derivation the Nepalese risk-free interest rates curve cannot rely on direct observations of interest rates in deep, liquid and transparent Nepalese financial markets, such calculation needs to rely on external references.
82. Therefore, further than having a prudent approach, it makes sense to achieve a sensible trade off that avoids, on the one hand, interest rates that are too low that they create an unaffordable pressure on the level of solvency and financing needs of the insurance sector. On the other hand, it is relevant to avoid interest rates that are too high that they may underestimate the level of the technical provisions and put at risk the solvency position of the insurers and reinsurers.
83. From a market behaviour perspective, stakeholders highlight the impact on the design of new insurance contracts that will have the volatility of a market-based risk-free interest rate methodology (even excluding the short-term volatility). This change in the insurance products marketed has been already experienced by all or almost all jurisdictions moving towards a risk-based framework.
84. One might consider that in this way policy holders' rights will be better protected because although new insurance products will cover less risks, the coverage provided by the insurer will be much more reliable (based on sound assumptions).
85. Furthermore, a situation where the capacity of the insurers to honour their yield commitments towards policy holders heavily depends on the yield of future reinvestments, exposes the whole Nepalese insurance sector to a systemic risk in case of a material decrease of interest rates (which by the way is a constant target of all inflationary economies and is not a very unlikely scenario).
86. Finally, it is necessary to clarify the relevant approach to the implementation of the three buckets of life insurance portfolios envisaged in paragraph (10) of Annexure II of the Risk Based Capital and Solvency Directive (2078), in accordance with the international practices (top, middle and general bucket).

- In short, the top bucket allows for higher discounting rates when the insurer has matched the timing of the cash inflows of their assets (once de-risked such cash flows) with the timing of the estimated cash outflows of its insurance liabilities, provided the insurer is not exposed to material liquidity risks,
 - The middle bucket does not require a strict cash flow matching but also allows for higher discount rates when specific requirements on ALM are met to ascertain that it is likely that such additional yield will be earned on risk-free basis,
 - The general bucket includes the remaining life insurance contracts.
87. The current ALM practices of the Nepalese life insurance market leads to qualify all the medium- and long-term insurance portfolios in the general bucket. Therefore, for the sake of simplicity, NIA deems relevant to start the application of the new framework having in force only that general bucket. This approach has benefited from the support of stakeholders.
88. At the same time, it makes sense to retain an open door to develop in the future the middle and the top buckets, in such a way that insurers improving its ALM (improving the matching of the duration and cash flows of the assets and long-term insurance liabilities) may benefit from the recognition in the discounting rates of their capacity to earn a high yield on a risk-free basis. This has also been supported by the stakeholders.
89. Therefore, NIA will not need to amend the Risk Based Capital and Solvency Directive (2078) to remove the middle and top buckets. Both buckets will remain in the legal text as a placeholder to be activated in the future as market ALM improves.
90. NIA does not consider it appropriate to hard code strict triggering indicators for development of the middle and top buckets. Rather, NIA will monitor markets practices mainly through the quantitative regulatory reporting templates (QRRT RBC). In these templates NIA intends to include specific requests for information regarding the detailed composition and features of investments and the cash flow pattern of all life insurance obligations.