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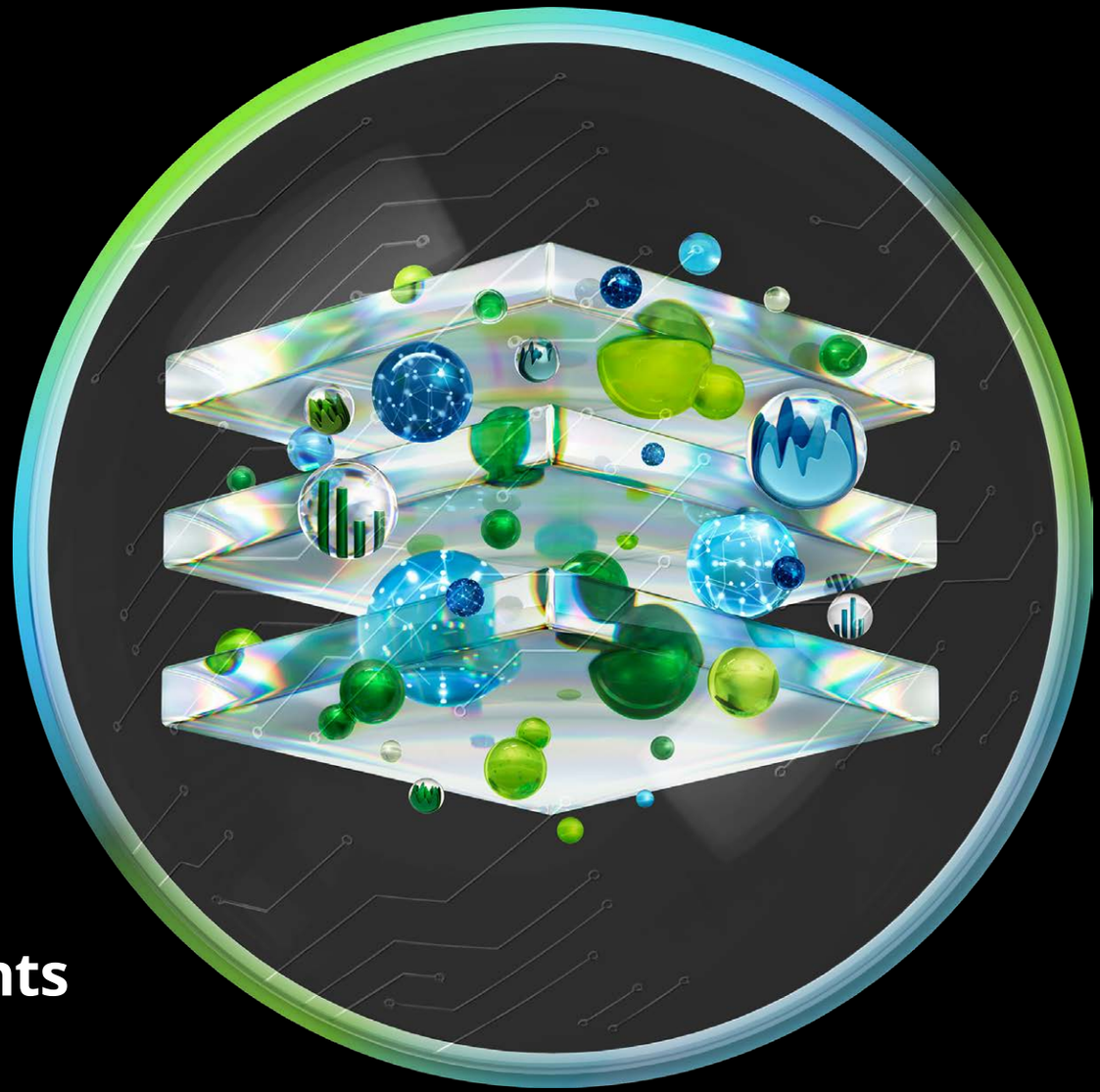

Currency Risk
Understanding the SCR Risk Components

Calibration, shortcomings and risks not considered.

April 2024

MAKING AN IMPACT THAT MATTERS since 1845

Contents

Currency Risk

In this series, we apply the magnifying glass to how the standard formulae for selected SCR sub-modules were calibrated. We investigate the history behind the calibration, the risks that were excluded from the calibration, and potential shortcomings as a result. We also investigate the impact of alternative calibrations with updated, South Africa specific data.

This article on Currency risk is PART VI of the series. *Mortality, Retrenchment, Property, Expense and Equity risks* were covered in PARTS I to V.

1 Summary

Currency Risk is a component of the Solvency Capital Requirement (SCR) for all life and non-life insurers. The calibration of the currency standard formula as per the Prudential Authority Financial Soundness Standards for Insurers (FSI) 4.1 is dependent on the data sets and assumptions as at the time of calibration. Since then, we have 10 years worth of additional data on which to base the calibration and assumptions. In this article, we investigate how the currency risk calibration would have changed allowing for the additional years of data.

This article is recommended reading for Head of Actuarial functions forming opinions on the adequacy of the SCR standard formula. In a wider sense, this article contains useful information for anyone wishing to understand the calibration, shortcomings and possible alternatives updates of the currency risk standard formula.

2 Background

Currency risk arises when the market value of assets and liabilities are sensitive to changes in currency exchange rates. The FSI 4.1 standard formula specifies that the currency risk capital is equal to the maximum of the insurer's change in basic own funds after applying either an instantaneous rise of 50% in the value of all currencies against the Rand, or after applying an instantaneous fall of 30% in the value of all currencies against the Rand. The upward (weakening of the Rand) stress is larger due to large Rand depreciations being more frequently observed (i.e. more likely) than large Rand appreciations against other currencies.

3 Calibration of the currency risk standard formula

3.1. History of the calibration

The calibration of currency risk is based on Solvency II, which is consistent with the way other submodules were derived. However, various adjustments were made to the Solvency II approach, to derive the current FSI 4.1 standard formula. The following adjustments or clarifications are pointed out in the SAM steering committee Position Paper (PP) 45:

- Currency risk from all sources is included, whether the currency risk event affects the entire industry, or only the specific insurer.
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- The size of the stress differs depending on the direction of the stress.
- The direction of exposure to different foreign currencies is assumed to be the same, i.e. all foreign currencies are expected to move in the same direction relative to the Rand.
- Allowance is made for the mitigation effect of risk mitigating contracts.
- Dual listed shares listed on the JSE and purchased on the JSE do not attract a currency risk shock; such shares are included in the equity risk calculation. (Note if dual listed shares were purchased on an offshore exchange, then it should be included in the currency risk shock calculation).

- The same percentage stress is applied to all currencies regardless of whether the currency is pegged to the Rand or e.g. to the Euro. The rationale behind this can be explained by the graph below, where at the time of the calibration, a strong correlation was observed between the movements in different foreign currencies relative to the Rand. This is still the case, as observed below from updated data.

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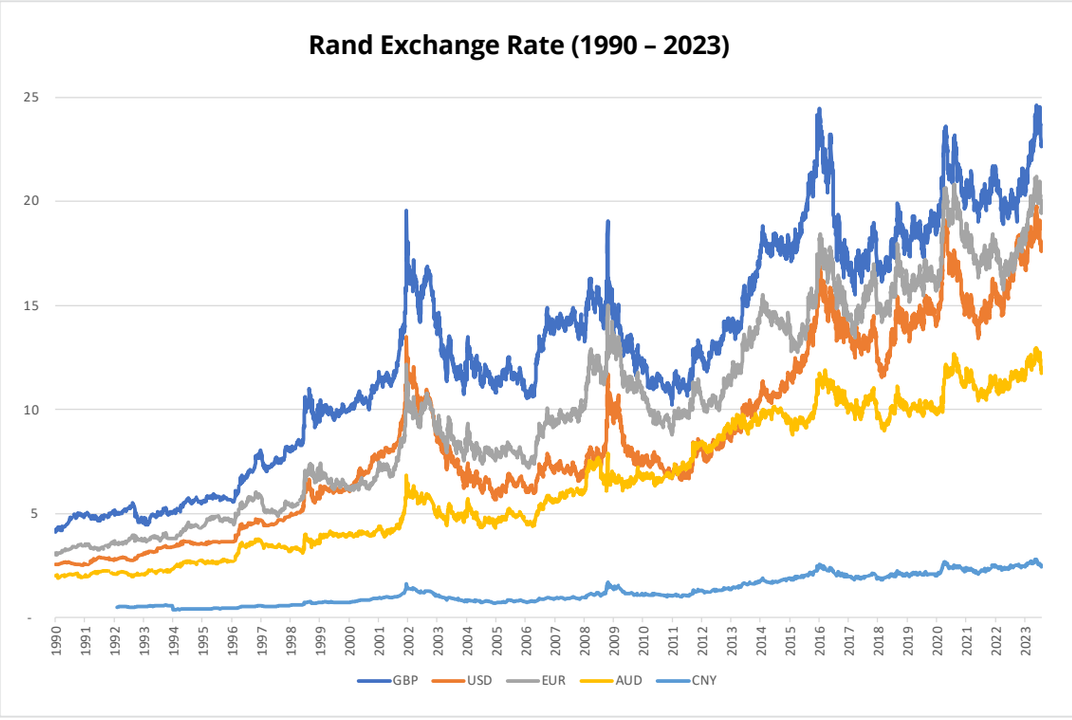


Source of data: Solvency Assessment and Management: Position Paper 451 (v 3) Currency Risk, by Steering Committee (for rates up to 2013) and Exchange Rate Database – Historical Exchange Rate Values (fx-rate.net)[1] (for rates post 2013).

In very extreme scenarios currencies may 'decouple' (where currency values are usually positively correlated, they may not move in tandem any more under extreme scenarios). An example of this was seen at the start of the 2008 financial crisis. The US Dollar initially strengthened, despite the negative macroeconomic environment, likely because investors were turning towards what is perceived to be 'safer' US Dollar investments. Currencies of countries with large US Dollar debt exposure, low foreign exchange reserves and weak current account positions, depreciated significantly more against the US Dollar[2].

The stress factor (shock percentage) itself also underwent multiple calibrations before the 50% upward shock and 30% downward shock in FSI 4.1 were concluded. Quantitative Impact Study (QIS) 3 and QIS 4 considered a 20% symmetric shock (assuming percentage changes in currency rates follow a n/ormal distribution). This 20% was derived from a portfolio made up of 35% investment in USD, 24% in GBP, 13% in Argentine Peso (representing exposure to emerging markets), 8% in JPY, 7% in SEK, 7% in CHF and 6% in AUD.

However, the 20% shock was found to be too 'light' based on a study by the Committee of European Insurance and Occupational Pensions Supervisors (CEOIPS) that used Bloomberg data. Daily returns of 14 currency pairs against the GBP, from 1971 to 2009, and 14 currency pairs against the Euro, from 1999 to 2009, indicated that for almost all currency pairs the worst year-on-year currency change was more than 20%. The analysis showed that 29% is more representative of a 1-in-200 stress scenario. In addition, this specific CEOIPS study found that the distribution of percentage changes in currency rates is in fact skewed, implying a different upward and downward shock.

Interestingly, for Solvency II, a 25% upward and downward shock was eventually settled upon, after further investigations into optimal currency weights (the CEOIPS study referred to the above being only one of the data/portfolio studies that informed the final Solvency II calibration). As further discussed in section 4 below, the calibration is very sensitive to portfolio constituents and weights, which contributed to the difference between the Solvency II and FSI currency risk stresses.

[1]https://fx-rate.net/historical/?c_input=ZAR&cp_input=EUR&date_to_input=2020-11-01&range_input=30

[2]Source: European Central Bank Working Paper Series No 1060 / June 2009: What explains the global exchange rate movements during the financial crisis. https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1060.pdf

3.2. Final calibration included in FSI 4.1

A study looking at returns of the Rand against the USD and various other currencies, over 1990 to 2013, concluded that the 1-in-200-year tails of the empirical distribution correspond roughly to a 50% upwards (weakening of the Rand) stress and 30% downwards (strengthening of the Rand) stress. The following foreign currencies were considered in the calibration: Pound Sterling (GBP), US Dollar (USD), Euro (EUR), Australian Dollar (AUD), Chinese Yuan (CNY).

The daily exchange rates of these foreign currencies to the South African Rand were converted to year-on-year annual returns for each currency. The 0.5th and 99.5th percentiles were then calculated empirically. As a result, the following stress percentages were obtained as per Position Paper 45:

Percentile	Pound	USD	Euro	AUD	Yuan	SAM shock
0.005	-28,6%	-32.1%	-22.9%	-21.4%	-32.2%	-30.0%
0.995	45.4%	53.3%	49.5%	50.6%	64.0%	50.0%

4 Potential shortcomings to consider when assessing relevance of standard formula stresses

The method followed to calibrate the standard formula results in a couple of potential shortcomings.

The main shortcoming is that the standard formula shocks were calibrated using a very specific portfolio of foreign investments. The shock percentages derived are heavily dependent on the weighting assigned to different currencies (constituencies of the foreign portfolio) in the calibration. Since the standard formula calibration does not allow for the insurer's specific asset composition, the standard shocks may not be reflective of the insurer's actual currency risk exposure. The ideal would be to determine a stress percentage per currency that the insurer is exposed to, and stressing each asset based on their weighted currency exposure, instead of assuming the single standard formula stress across all currencies.

Another shortcoming is that the calibration does not consider movements of the Rand compared to main African countries. This is not a problem for African currencies pegged to the Rand (e.g. Namibia, Lesotho, Swaziland) but may impact insurers with exposure to African countries whose currencies are not pegged to the Rand (e.g. Mozambique, Nigeria, etc). It may not be appropriate for such insurers to apply the standard formula shocks.

Diversification benefits and correlations are not fully allowed for, which may under or overstate the currency risk. Specifically, diversification benefits from exposure to multiple currencies are not considered – the same currency risk is calculated whether the insurer is invested in one currency or five different currencies. Correlations between foreign currencies are not accounted for – it is assumed that all currencies increase and decrease to the same extent compared to the Rand.

In addition, the currency risk standard formula does not allow for the risk that the liabilities and assets are both foreign, but in different currencies. This is probably unlikely to happen since assets are usually invested to match liabilities, however the risk exists.

The current calibration of the standard formula only considers data up to March 2013. In the section below we investigate whether this is a shortcoming in the calibration by considering the impact of adding 10 years of additional data.

5 Allowing for additional data

We have used open-source data to replicate the method and shocks in Position Paper 45 (refer table in section 3.2 above). We then appended additional data up to 31 July 2023, from which the following results were obtained:

Percentile	Pound	USD	Euro	AUD	Yuan
0.005	-27,9%	-30.9%	-21.3%	-20.2%	-31.6%
0.995	46.0%	51.6%	45.7%	46.7%	61.6%

Compared to the Position Paper 45 table (using data up to 2013), no significant changes in shock percentages were noted as can be seen below:

	Percentile	Pound	USD	Euro	AUD	Yuan
Position Paper	**0.005**	-28,6%	-32.1%	-22.9%	-21.4%	-32.2%
	0.995	45.4%	53.3%	49.5%	50.6%	64.0%
Allowing for updated data	**0.005**	-27.9%	-30.9%	-21.3%	-20.2%	-31.6%
	0.995	46.0%	51.6%	45.7%	46.7%	61.6%
Effect of allowing for updated data	**0.005**	0.7%	1.2%	1.6%	1.2%	0.6%
	0.995	0.6%	-1.7%	-3.8%	-3.9%	-2.5%

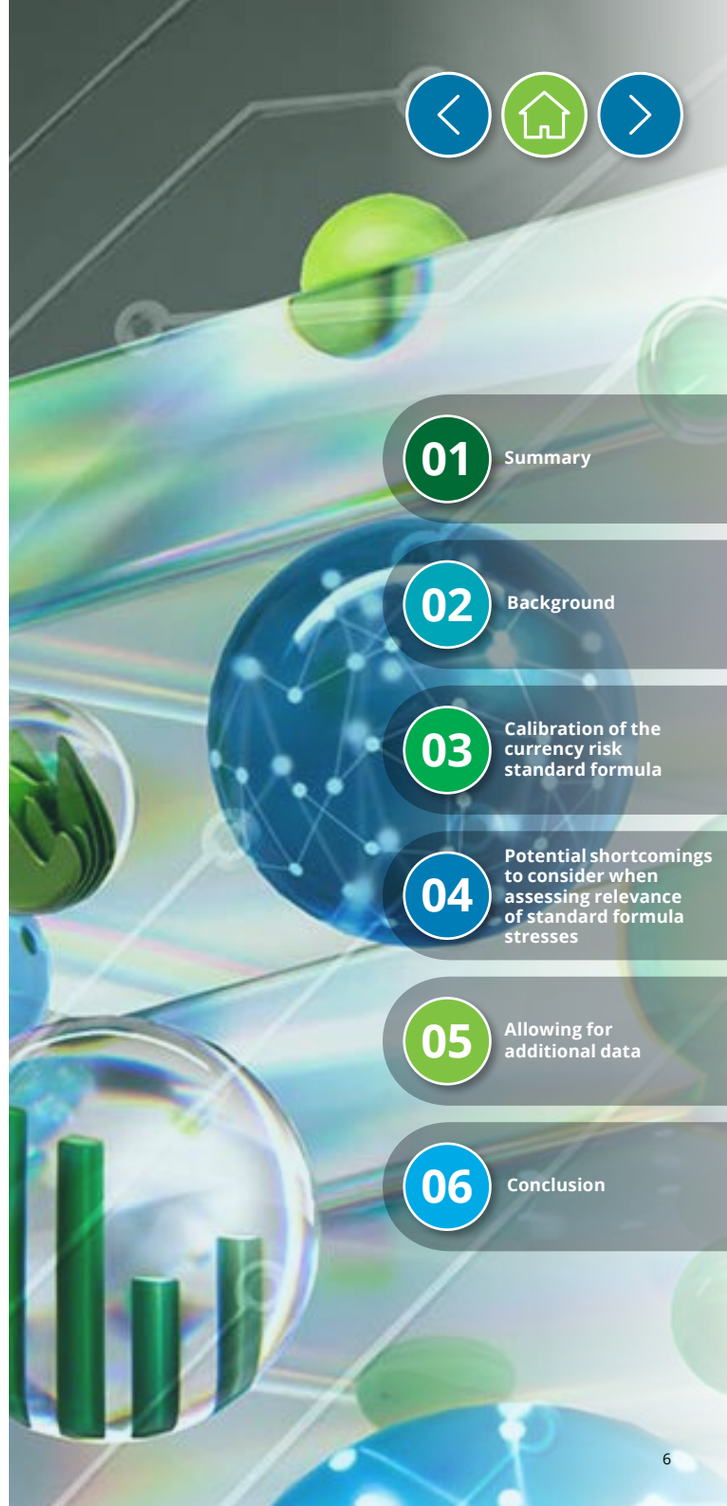
We therefore conclude that the up and down shock percentages in the standard formula, with shortcoming as mentioned in Section 4, are still up to date.

6 Conclusion

The calibration and potential shortcomings of the currency risk standard formula are useful to keep in mind for insurers with large currency risk exposures. Depending on the nature of the insurer's currency risk exposure (e.g. How many different currencies are exposed in what proportions? Does it have exposure to other African currencies?), the standard formula may under or overestimate currency risk for the specific insurer.

Allowing for additional data in the currency risk calibration, there seems to be no significant changes since the original calibration was done. Our study therefore indicates that the calibration, noting above shortcomings, is still relevant.

[3]Source: https://fx-rate.net/historical/?c_input=ZAR&cp_input=EUR&date_to_input=2020-11-01&range_input=30



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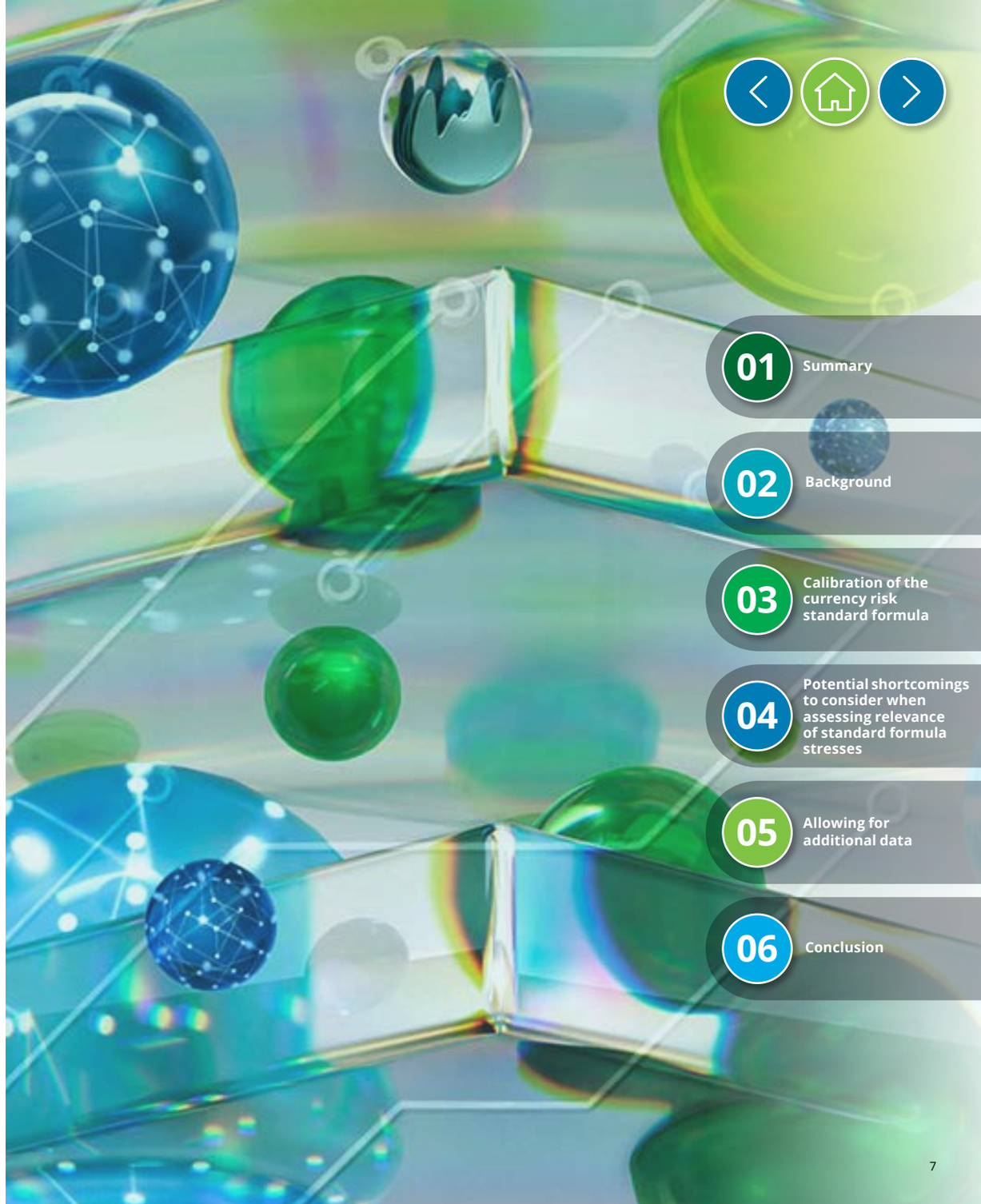

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