Educational Note

IFRS 17 Risk Adjustment for Non-Financial Risk for Life and Health Insurance Contracts

Committee on Life Insurance Financial Reporting

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The actuary should be familiar with relevant educational notes. Educational notes are not binding; rather they are intended to illustrate the application of the standards of practice. A practice that an educational note describes for a situation is not necessarily the only accepted practice for that situation nor is it necessarily accepted practice for a different situation. Responsibility for ensuring that work is in accordance with accepted actuarial practice lies with the actuary. As accepted actuarial practice evolves, an educational note may no longer appropriately illustrate the application of standards. To assist the actuary, the CIA website contains a reference of pending changes to educational notes.

MEMORANDUM

To: Members in the life insurance area

From: Steven W. Easson, Chair
Actuarial Guidance Council

Steve Bocking, Chair and Marie-Andrée Boucher, Immediate Past Chair
Committee on Life Insurance Financial Reporting

Date: June 30, 2022

Subject: **Educational Note: IFRS 17 Risk Adjustment for Non-Financial Risk for Life and Health Insurance Contracts**

The Committee on Life Insurance Financial Reporting (CLIFR) has prepared this educational note to summarize some of the methods available to calculate the risk adjustment for non-financial risk and its corresponding confidence level, in accordance with IFRS 17 requirements.

The educational note is structured into seven sections. Section 1 introduces the content presented in this report. Section 2 highlights the key similarities and differences between IFRS 4 and IFRS 17 with regards to adjustments for uncertainty in estimates of future cash flows. Section 3 presents general considerations related to the measurement and disclosure of the risk adjustment. Sections 4 through 6 present different methods for measurement of the risk adjustment: risk margins in Section 4, cost of capital in Section 5, and quantile techniques in Section 6. Section 7 concludes the note with considerations for the calculation of the confidence level associated with the risk adjustment.

This educational note is written primarily from the perspective of Canadian actuaries and is not intended to duplicate any other guidance. Further information ("guidance") can be found in International Actuarial Association (IAA) guidance and other Canadian Institute of Actuaries (CIA) documents.

A preliminary version of the draft of this educational note was shared with the following committees prior to publication:

- Property & Casualty Insurance Financial Reporting Committee
- Committee on Risk Management and Capital Requirements
- Committee on the Appointed/Valuation Actuary
- International Insurance Accounting Committee
- Committee on Workers' Compensation

A preliminary version of the draft of this educational note was also shared with the staff of the Accounting Standards Board (AcSB) to broaden consultations with the accounting community. Given that this educational note provides actuarial guidance rather than accounting guidance, the AcSB staff review was limited to citations of and any inconsistencies with IFRS 17. CIA educational notes do not go through the AcSB's due process and therefore, are not endorsed by the AcSB.

The draft of this educational note was also presented to the Actuarial Guidance Council (AGC) in the months preceding this request for approval. CLIFR satisfied itself that it had sufficiently addressed the comments received on the draft of this educational note and it was published in July 2019.

The following highlights the changes between this educational note and the draft published version:

- Updates on references and wording to the final version of the *Application of IFRS 17 Insurance Contracts* educational note (published in August 2021);
- Refreshed references to IFRS 17 materials published or edited since July 2019;
- Expanded commentary in section 7.4 about the degree of judgment required in assessing the confidence level of the RA, and caveats about inferring too much precision in the calculations, in response to feedback from several stakeholders; and
- Other minor edits for increased clarity and grammar.

Given that the changes made to the final version of this educational note relative to the draft published version were not substantial, the final version of this educational note was only subject to a limited review by the CIA committees.

The creation of this memorandum and educational note has followed the AGC's Protocol for the adoption of educational notes and other material. In accordance with the CIA's *Policy on Due Process for the Approval of Guidance Material other than Standards of Practice and Research Documents*, this educational note has been prepared by CLIFR and has received approval for distribution from the AGC on May 10, 2022.

The actuary should be familiar with relevant educational notes. Educational notes are not binding; rather they are intended to illustrate the application of the standards of practice. A practice that an educational note describes for a situation is not necessarily the only accepted practice for that situation nor is it necessarily accepted practice for a different situation. Responsibility for ensuring that work is in accordance with accepted actuarial practice lies with the actuary. As accepted actuarial practice evolves, an educational note may no longer appropriately illustrate the application of standards. To assist the actuary, the CIA website contains a reference of pending changes to educational notes.

CLIFR would like to acknowledge the contribution of its subcommittee that assisted in the development of this educational note: Andrew Ryan (Chair), Venessa Archibald, Colette Atkinson, Glenalan Cameron, Terry Chan, Eric Chuen Cheong, Simon Fortin, Marc-André Harvey, David Littleton, Qian Ma, Louis-Philippe Morin-Lessard, Pierre-Charles Paquet, Na Ta, Arthur Yuen, and Yongan Zhong.

Questions or comments regarding this educational note may be directed to the Chairs of CLIFR and this subcommittee (noted above) at guidance.feedback@cia-ica.ca.

SWE, SB, MAB

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1. Introduction

IFRS 17 establishes principles for the recognition, measurement, presentation, and disclosure of insurance contracts. This educational note provides practical application guidance on Canadian-specific issues relating to the IFRS 17 risk adjustment for non-financial risk. References to specific paragraphs of the IFRS 17 standard are denoted by IFRS 17.XX in this note, where XX represents the paragraph number.

Risk adjustment for non-financial risk (hereinafter referred to in this educational note as "risk adjustment", or RA) is a defined term in IFRS 17 Appendix A, pursuant to IFRS 17.37:

> An entity shall adjust the estimate of the present value of future cash flows to reflect the compensation that the entity requires for bearing the uncertainty about the amount and timing of the cash flows that arises [sic] from non-financial risk.

Further application guidance is provided in IFRS 17.B86–B92. Some key points in those paragraphs include:

- The RA would consider only non-financial risk, such as insurance risk, lapse risk, and expense risk; operational risks, market, and credit risks would be excluded from the RA.
- The RA measures the compensation the entity requires to make the entity indifferent between fulfilling a liability with uncertain cash flows, versus fulfilling a liability with fixed cash flows and the same present value as the liability with uncertain cash flows.
- The RA must be explicitly included in the insurance contract liabilities, and appropriately disclosed per the requirements of IFRS 17.100–107 and IFRS 17.119.
- There are no prescribed estimation techniques to determine the RA; judgment must be exercised.

Chapter 4 of the CIA educational note *Application of IFRS 17 Insurance Contracts* provides further general guidance on the IFRS 17 risk adjustment. This educational note, published in October 2021, is an adoption of the International Actuarial Note (IAN) 100, which is accompanied by a preamble. The preamble outlines a number of additional clarifications on the topics discussed in the final version of the IAN 100 that CIA members should be aware of.

As noted above, IFRS 17 does not prescribe any methodologies for calculating the RA. However, IFRS 17.B91 states that the risk adjustment would have the following characteristics:

(a) "risks with low frequency and high severity will result in higher risk adjustments for non-financial risk than risks with high frequency and low severity;

(b) for similar risks, contracts with a longer duration will result in higher risk adjustments for non-financial risk than contracts with a shorter duration;

(c) risks with a wider probability distribution will result in higher risk adjustments for non-financial risk than risks with a narrower distribution;

(d) the less that is known about the current estimate and its trend, the higher will be the risk adjustment for non-financial risk; and

(e) to the extent that emerging experience reduces uncertainty, about the amount and timing of cash flows, risk adjustments for non-financial risk will decrease and vice versa."

In discussing this guidance, the *Application of IFRS 17 Insurance Contracts* educational note states the following in Question 4.3 (emphasis added in bold):

> **"This general guidance means that there is no single correct way for an entity to set the risk adjustment**. In general, some of the important considerations that will be relevant to how an entity determines its approach to estimating the risk adjustment:
>
> - consistency with how the insurer assesses risk from a fulfilment perspective;
> - practicality of implementation and ongoing re-measurement; and
> - translation of risk adjustment for disclosure of an equivalent confidence level measure.
>
> **Therefore, a variety of methods are potentially available…"**

Any method that conforms to the requirements of IFRS 17.37 and IFRS 17.B86–92 could be used to calculate the RA. Notwithstanding the calculation methodology, the actuary would ensure that the resulting RA represents the compensation the entity requires for accepting uncertainty in the amount and timing of the cash flows arising from non-financial risk (hereinafter in this educational note referred to as "uncertainty related to non-financial risk"). Demonstration that the RA reflects the compensation the entity requires for uncertainty related to non-financial risk, such as consistency with pricing policies or internal risk appetite policies, would be part of the basic governance structure around the establishment and maintenance of the RA.

The sections that follow in this educational note provide more specific application guidance for Canadian actuaries for each of these potential methods. The guidance herein does not prescribe which method would be used, nor prescribe exactly how any given method would be applied, but rather provides additional background information to help inform Canadian actuaries when exercising judgment in applying one or more of the methodologies.

The guiding principles that the CLIFR Risk Adjustment subcommittee followed in writing this educational note were the following:

- First and foremost, consider Canadian-specific perspectives, rather than simply repeating international actuarial guidance.
- Provide application guidance that is consistent with the IFRS 17 standard and applicable Canadian actuarial standards of practice and educational notes, without unnecessarily narrowing the choices available in the IFRS 17 standard.
- Consider practical implications associated with implementation of potential methods; in particular, ensure that due consideration is given to options that do not require undue cost and effort to implement.

2. Comparison between IFRS 4 and IFRS 17

Prior to the effective date of IFRS 17, insurance contract liabilities were subject to IFRS 4, which for life and health insurance contracts in Canada was accepted as being the Canadian asset liability method (CALM) as guided by CIA Standards of Practice and educational notes. As such, references in this educational note to IFRS 4 pertain to the application of CALM in Canada.

In this educational note, emphasis is placed on the margin approach, which is most analogous to the IFRS 4 approach in Canada. This educational note provides guidance on Canadian-specific issues, and a margin approach may be commonly applied in Canada under IFRS 17 given the operational efficiencies from using a modelling framework that is similar to the IFRS 4 approach, and supported by Canadian industry-standard software. As such, translation of the IFRS4 margin for adverse deviations (MfAD) approach to an IFRS 17 risk adjustment approach is a key Canadian specific issue, should an actuary choose to maintain a margin approach. This is not meant to imply that other methods are not equally acceptable practice in Canada.

A margin approach would generally be acceptable if it satisfies the five characteristics defined in IFRS 17.B91 and noted above in Section 1 of this educational note. Canadian IFRS 4 guidance for setting margins was based on similar considerations. It is therefore reasonable to conclude that all of the required characteristics of an IFRS 17 RA are satisfied by the IFRS 4 Canadian MfADs.

If IFRS 4 MfADs are used as the starting point for calculating the IFRS 17 RA, the actuary would need to assess the questions posed in section 9.2 of the educational note *Comparison of IFRS 17 to Current CIA Standards*:

- Is the current level of PfAD consistent with the compensation the entity requires for bearing uncertainty?
- Are the diversification benefits included in current PfADs consistent with those that would be reflected in IFRS 17?
- How would the confidence level (to satisfy disclosure requirement of IFRS 17.B92) inherent in the current PfADs be determined?
- How would the PfAD appropriate to the net liability be split between the direct and ceded contracts?
- Are any adjustments needed for pass-through features?

IFRS 17.37 states that the risk adjustment would "reflect the compensation that the entity requires for bearing the uncertainty about the amount and timing of the cash flows that arises from non-financial risk". In practice, most Canadian entities are unlikely to have previously defined a specific metric or set of metrics that explicitly defines the compensation the entity requires for bearing non-financial risk. Such metrics or risk-appetite articulations, if they exist, would likely consider all risks, including financial. Therefore, the actuary would need to provide some justification for how the chosen MfADs, and/or the resulting confidence level of the RA, reflect the entity's required compensation for non-financial risk.

3. General considerations

3.1 Measurement methodology

Under IFRS 17.37, the actuary would understand the compensation required by the entity for the uncertainty related to non-financial risk, and establish a link to the risk adjustment (RA). The IFRS 17 standard does not prescribe a methodology for how the RA would be measured in practice. The compensation the entity requires is a subjective assessment of an entity's own risk appetite. There are numerous ways an entity may choose to put a price on that risk. Questions 4.9 and 4.13 in the CIA educational note *Application of IFRS 17 Insurance Contracts* provide further general guidance. It is beyond the scope of this educational note to recommend any specific method.

The answers to questions 4.9 and 4.13 refer to the entity's pricing as potential reference points for measuring the entity's risk aversion and/or compensation requirements. The actuary would consider whether the compensation the entity requires would reflect any pricing concessions due to competitive market pressure and/or price discounting in pursuit of aggressive market positioning. One view is that the actual pricing would be market-observable evidence of the compensation the entity requires. An alternative view would be that an entity could temporarily accept less than its theoretical steady-state compensation requirements, and that the RA would reflect the latter.

The approach used to determine the RA at any reporting date must satisfy the overall requirements of IFRS 17 for measurement, presentation, and disclosure of insurance contracts. Measurement requirements are based on the IFRS 17 unit of account (i.e., RA determined for a single contract or group of contracts), whereas presentation and disclosure requirements tend to be at a higher level (RA for the aggregation of portfolios of contracts, or entity-level RA). In order to assess the appropriateness of a particular approach, it is necessary to consider both the detailed accounting (measurement) requirements for the RA and the aggregated presentation and disclosure requirements.

3.1.1 Measurement requirements related to RA (unit-of-account viewpoint)

The unit of account for the IFRS 17 liability for remaining coverage (LRC) is the group of contracts, and the measurement requirements of the standard (and some presentation and disclosure requirements) must be applied at that level. This has implications for the RA, including the following:

- The RA must be determined, at each reporting date, for each group of contracts [IFRS 17.32 and .40].
- The RA for a group of contracts has an impact on the measurement of the contractual service margin (CSM) and/or loss component for the group, both at initial recognition [IFRS 17.38] and subsequently [IFRS 17.B96(d)].
- For contracts initially recognized in a period, the RA is required to satisfy the grouping requirements of IFRS 17.16 (i.e., to identify onerous contracts).

IFRS 17.24 does allow the fulfilment cash flows (of which the RA is part) to be determined at a higher level of aggregation than the group and then allocated to the relevant groups.

For the liability for incurred claims (LIC), there is no requirement to determine the RA at a group of contracts level.

3.1.2 Disclosure requirements related to RA (aggregate/entity-level viewpoint)

While the measurement requirements of IFRS 17 require an RA value for each unit of account, most of the presentation and disclosure requirements of IFRS 17.97–109 will typically be met at a more aggregate level such as reporting segment or reporting entity level.

IFRS 17.117(c)(ii) specifically requires disclosure of the approach used to determine the RA, and IFRS 17.119 requires disclosure of the confidence level corresponding to the reported RA. Depending on the approach used, this confidence level will be either an explicit input to the RA calculation or an implicit result of the calculation.

3.1.3 Selection of a measurement methodology

Some actuaries may view the aggregate entity-level perspective as being the primary basis for determining the RA (perhaps driven by disclosure requirements, or aligned at the level at which the entity thinks about compensation). Of the various approaches described in this educational note to calculating the RA, some are more directly applicable to an aggregate calculation methodology than to a calculation at the unit-of-account level (i.e., the quantile techniques noted in Section 6). An aggregate RA would need to be allocated amongst the units of account to satisfy the IFRS 17 measurement requirements (see Section 3.1.1).

On the other hand, some actuaries may develop the RA at a lower level to more directly facilitate the measurement requirements of IFRS 17. The margin approach described in Sections 4.3 and 4.4 would be potential ways to do this. The margins used to determine the RA would be developed such that they reflect diversification among the non-financial risks in the entity's various units of account, to the extent that the entity chooses to reflect the benefits of diversification in its RA (see Section 3.2.2). The sum of the risk adjustments calculated at the unit-of-account level would be the entity's aggregate risk adjustment.

3.2 Diversification, allocation, and aggregation

The entity's perspective on diversification will affect both the level of the RA and its assessment of the confidence level of the RA. The mechanics of how diversification benefits are reflected may differ depending on whether an entity-level or unit-of-account perspective is taken as the primary approach.

3.2.1 Diversification and allocation in an aggregate RA approach

To the extent that an entity-level perspective is taken as a primary approach, the aggregate risk distribution would reflect the entity's perspective of the benefits of diversification among its component risks. For example, the entity would assess the degree of diversification that it expects between its insurance contracts exposed to longevity risk versus mortality risk.

Reflection of diversification could be based upon statistical or empirical analyses, expert judgment, or causal relationship. The more uncertain the entity is with respect to the diversification benefit, the less likely it would be fully reflected in the aggregate risk distribution. Below are some common techniques that could be used:

- *Correlation matrix*

  Examples of potential correlation matrices are included in Appendix 4. In choosing the correlation factors, the entity would consider the confidence level of the risk exposure and make sure that the correlation still applies at that level of confidence. Furthermore, the correlation factors would be considered in the context of the entity's own circumstances – use of a "one-size-fits-all" correlation matrix may not be appropriate.

- *Copulas*

  The actuary could decompose the joint probability distribution of the entity's non-financial risks into marginal probability distributions. A copula is a function that combines those marginal distributions together and allows the actuary to quantify the correlations between the risks. Illustrations of copulas are beyond the scope of this educational note.

The compensation the entity requires for non-financial risk would determine the confidence level at which the entity chooses to set its RA. The benefits of diversification reflected in the aggregate RA calculation would be passed down to the unit-of-account level via the allocation process.

Allocation to groups of contracts may be done either directly (using a proportional or other method as appropriate) or indirectly (e.g., by calibrating margins such that a unit-of-account calculation, aggregated across all groups of contracts, yields the same RA as an entity-level calculation). Either way, the sum of the RA for the various units of account would equal the aggregate entity-level RA.

The IFRS 17 standard does not prescribe any aggregation or allocation techniques, and a discussion of potential methods is beyond the scope of this educational note as it is not a Canadian-specific issue. The CIA published a research paper on *Risk Aggregation and Diversification* in April 2016, and more generally, the Enterprise Risk Management section of the CIA website contains additional resources on aggregation and diversification.

3.2.2 Diversification and aggregation in a unit-of-account RA approach

When the RA is developed at the unit-of-account level, the entity's aggregate RA would be the sum of the risk adjustments for the various units of account. A risk adjustment developed independently for one particular unit of account may or may not reflect the benefits of diversification with other units of account within the entity.

To the extent that diversification between entities, or diversification between different portfolios within an entity, are considered in pricing, there would be a clear argument that reflecting similar diversification in the RA is a direct reflection of the compensation the entity requires. If pricing does not account for diversification between entities or portfolios, justification of inclusion of such diversification in the RA could be more difficult but would depend on the particular facts and circumstances of the entity. Ultimately, the level of the RA for any given group of contracts will be a matter of judgment, and the actuary would ensure that the resulting aggregate RA reflects the compensation the entity requires for uncertainty related to non-financial risk.

The quantification of the confidence level when the RA is calculated using a unit-of-account approach is described in Section 7.3. To the extent that the benefits of diversification are fully reflected in the assumed underlying probability distribution, but are not fully reflected in the calculation of the entity's RA, the resulting confidence level of the RA would be higher than had the full benefits of diversification been passed down to the unit-of-account level. Expressed another way, the more conservative view an entity takes in applying diversification at the unit-of-account level, the higher will be the resulting RA and its reported confidence level.

3.2.3 Diversification between entities

When a parent entity is comprised of subsidiary entities, the last paragraph under question 4.10 in the *Application of IFRS 17 Insurance Contracts* educational note presents two different perspectives on diversification.

One perspective is that each subsidiary entity would make an assessment of the compensation it requires for its own non-financial risks, independent of any potential diversification with risks across the collective entities. The assumed probability distribution underlying the calculation of the confidence level of the subsidiary entity's RA would not reflect between-entity diversification. The parent entity would then choose whether to apply a diversification benefit at the parent-entity level, such that the RA of the parent would be less than the sum of the risk adjustments of the subsidiaries, or to simply sum up the RA of the subsidiary entities. The confidence level of the parent RA would be higher in the latter approach versus the former.

Another perspective is that the diversification benefits of the collective organization would be reflected at the subsidiary entity level. In this approach, the assumed probability distribution underlying the calculation of the confidence level of the subsidiary entity's RA would reflect between-entity diversification, and the degree of diversification credit reflected in the subsidiary's RA calculation would affect the confidence level of the subsidiary's RA. The parent entity RA would be the sum of the subsidiary entity risk adjustments.

The methodology used would be consistent from period to period and reflect how the entity manages/considers the level of risk.

3.3 Reinsurance

Under IFRS 17, direct liabilities must be calculated separately from ceded liabilities because these contracts would never be in the same unit of account. It follows that RA must also be calculated separately for direct business and the associated ceded business. This concept is articulated in IFRS 17.64, which specifically requires an explicit risk adjustment for ceded reinsurance contracts:

- IFRS 17.64: Instead of applying paragraph 37, an entity shall determine the risk adjustment for non-financial risk so that it represents the amount of risk being transferred by the holder of the group of reinsurance contracts to the issuer of those contracts.

This separation of direct and ceded risk adjustments may not always be intuitive. This issue is addressed in question 9.10 of the *Application of IFRS 17 Insurance Contracts* educational note:

> A specific definition for the determination of the risk adjustment for reinsurance contracts held is provided that replaces the general definition in paragraph 37 used for insurance and reinsurance contracts issued in the standard. Under the definition for reinsurance held, the risk adjustment for non-financial risk represents the amount of non-financial risk being transferred by the holder of a group of reinsurance contracts to the issuer(s) of those contracts (paragraph 64).
>
> The risk adjustment for the reinsurance held can therefore conceptually be thought of as the difference in the risk position of the entity with (i.e. net position) and without (i.e. gross position) the reinsurance held. As a result, the risk adjustment for the reinsurance held could be determined based on the difference between these amounts.
>
> Another possibility to determine the risk adjustment for reinsurance held is to consider the cost of reinsurance as an indicator of the entity's view of the compensation that would be required to keep (i.e., not reinsure) the risk. Under this view, the cost of reinsurance would be an estimate of the risk adjustment for the reinsurance held.
>
> For reinsurance held, because the risk adjustment for reinsurance held is defined based on the amount of risk transferred to the reinsurer, the risk adjustment for reinsurance held will either increase the reinsurance contract asset or reduce the reinsurance contract liability. This has the opposite effect from the risk adjustment on insurance contracts issued. For example, the release of the risk adjustment on reinsurance contracts held in a reporting period will reduce reported profit rather than increase it.

The RA reflects the compensation the entity requires for uncertainty related to non-financial risk, and would be appropriately apportioned to direct and ceded contracts. Ultimately, the key concepts underlying the RA are (a) the RA for the direct contracts would represent the compensation for non-financial risk that the entity requires for writing those contracts, and (b) the RA for the ceded contracts would account for non-financial risk transferred from the entity to the reinsurer(s). Any method that respects these concepts would generally be acceptable.

Reinsurance is a hedge against the risk in the direct contract. Where the price of reinsurance is proportional to the level of risk being hedged (i.e., ceded) from the direct entity's perspective, the ceded RA would be proportional to the direct RA, and the direct RA would be unaffected by the presence of reinsurance unless the reinsurance hedge affects the level of compensation required on the direct contract. Examples A1.2 and A1.3 in Appendix 1 illustrate these situations.

When the price of reinsurance is not proportional to the level of risk being hedged, from the direct entity's perspective, then the ceded RA may not be proportional to the direct RA. For example, in Canada, reinsurers might have a more favourable view of mortality on some life products, resulting in reinsurance subsidization of some of these products. The cost of the reinsurance could be viewed as a reflection of the price the entity is willing to pay to be relieved of risk, and therefore indicative of the entity's compensation requirements related to uncertainty of the risk being ceded. Examples A1.4 and A1.5 in Appendix 1 illustrate these types of situations. In the extreme example A1.5, the market price for hedging the risk is zero, illustrating that in certain circumstances the ceded RA could in theory be reduced to zero, yet still respect the key concepts in the IFRS 17 standard.

3.4 Discount rate

IFRS 17 provides no direction regarding the discounting of the RA. IFRS 17.B90 states “the risk adjustment for non-financial risk is conceptually separate from the estimates of future cash flows and the discount rates that adjust those cash flows”. Furthermore, IFRS 17.B92 states “an entity shall apply judgement when determining an appropriate estimation technique for the risk adjustment for non-financial risk”.

Consequently, the use of discounting (or not) and the methodology to determine discount rates are at the discretion of the entity.

Many discounting methodologies are possible. Regardless of the discounting methodology chosen, the actuary would maintain a consistent methodology between different reporting periods.

Changes in discount rates will affect the current value of the RA if the RA is discounted. Under IFRS 17.81, the entity is not required to bifurcate the change in RA into its component pieces (change in undiscounted provision for non-financial risk vs. change in discounting impact). If not bifurcated, the entire change in RA would be presented as part of the insurance service result, and the entire change in RA related to future services would adjust the CSM.

3.5 Disclosure requirements

General IFRS 17 disclosure requirements are outlined in IFRS 17.93 through IFRS 17.132. Elements specific to the RA include the requirement to disclose a reconciliation of the movement in the RA from the opening balance to the closing balance (IFRS 17.101), and the requirement to disclose significant judgments and changes in judgments used in the calculation of the RA (IFRS 17.117).

Disclosure requirements for the confidence level are noted in IFRS 17.119. The full text of that paragraph is the following:

> An entity shall disclose the confidence level used to determine the risk adjustment for non-financial risk. If the entity uses a technique other than the confidence level technique for determining the risk adjustment for non-financial risk, it shall disclose the technique used and the confidence level corresponding to the results of that technique.

It is reasonable to infer that paragraph IFRS 17.119 refers to the entity’s aggregate risk adjustment, and it would be at the discretion of the entity to disclose the confidence level of risk adjustments at anything less that an entity-level.

4. Margin approach

4.1 Introduction

The actuary would define an approach that links the chosen margins to the compensation that the entity requires for uncertainty related to non-financial risk. Per the discussion in Section

3.1, this could be done using several different approaches, depending upon how the entity chooses to express the compensation it requires for uncertainty related to non-financial risk. The paragraphs that follow outline three potential approaches where margins could be used.

4.2 Aggregate/entity-level approach

Under an aggregate approach, the primary method for calculation of the aggregate RA would be a quantile technique or cost-of-capital approach. Chapters 5 and 6 discuss these approaches. The MfADs can be used as a supplemental technique to allocate the RA to the unit-of-account level.

A potentially very significant shortcoming of this method is its reliance upon the precision of the aggregate RA calculation. If the actuary uses an approximation technique (like the LICAT approach illustrated in Section 7.4) to determine the aggregate RA at a particular confidence level, there may not be sufficient precision in the approximation to reliably apply this method.

4.2.1 Aggregate approach using a quantile technique

Allocation of the aggregate RA could be accomplished by calibration of the margins, such that the sum of the risk adjustments calculated at the unit-of-account level is equal to the aggregate risk adjustment calculated via a quantile technique. Many other allocation and/or calibration methods are possible; the IFRS 17 standard does not prescribe a method. The actuary has discretion in choosing a reasonable approach, while considering operational efficiency.

For practical purposes, the margins would likely be calibrated periodically, potentially annually, and only changed outside of the periodic review cycle if the resulting confidence level corresponding to the RA drifted away from the target confidence level by more than a defined threshold.

4.2.2 Aggregate approach based on cost of capital

Another potential approach is calibration of margins to replicate an aggregate RA derived from a cost-of-capital approach. This method could be a practical alternative to a first-principles-based, cost-of-capital calculation, given that the latter may be very difficult to execute in production within typical financial reporting deadlines.

A cost-of-capital approach could be a useful input into calibration of the level of the margins by risk type. Margins could be developed to produce risk adjustments by risk type that are proportional, or approximately proportional, to the capital requirements by risk type. Actuarial judgment would dictate whether a goal of proportionality would be appropriate given the facts and circumstances particular to the entity.

To comply with presentation and disclosure requirements, the confidence level corresponding to the resulting RA would need to be calculated. Refer to section 7 for considerations on how to do this.

4.3 Unit-of-account approach

Under a pure unit-of-account approach, MfADs would be the primary method for calculating the RA. The actuary would set the MfADs at levels that explicitly represent the compensation the entity requires for bearing uncertainty for a given group of contracts. The “compensation the entity requires" would be quantified through the margin-setting process, not based on the resulting confidence level.

It may be helpful to the actuary to look to the CIA *Standards of Practice* that existed prior to IFRS 17 for guidance in setting MfADs (see Appendix 3 for a brief summary). This guidance is not binding, but could be a useful starting point for setting MfADs at the unit-of-account level.

In the margin-setting process for a given group of contracts, the actuary may look to the risk exposure of the broader entity to consider whether there are potential diversification benefits that the entity would reflect in its RA, as discussed in Section 3.2.2.

The confidence level corresponding to the resulting aggregate RA (sum of the parts) would need to be calculated for IFRS 17 disclosure purposes. The confidence level disclosure would be an output of the process, not an input to the RA calculation, except perhaps as a reasonability check on the level of the MfADs. Potential methods for quantifying the confidence level are discussed in section 7 of this educational note.

4.4 Hybrid approach

A hybrid approach could potentially take many forms, but would land somewhere between the approaches discussed in the prior sections (aggregate approach vs. unit-of-account approach). This section describes one possible hybrid approach.

Similar to the unit-of-account approach, the actuary could use MfADs established for each assumption as a starting point, adjust for diversification or other factors, and calculate the resulting aggregate RA and associated confidence level.

But unlike the pure unit-of-account approach, the entity's risk management policies could define a target range for the confidence level corresponding to the aggregate RA that represents the aggregate compensation the entity requires. The MfADs would be recalibrated in the event that the aggregate RA landed outside the defined confidence-level range, to bring the confidence level corresponding to the aggregate RA back within the range.

This type of hybrid approach would mitigate the significant potential shortcomings of the aggregate approach noted in Section 4.2, namely the dependency upon a precise identification of the confidence level associated with the RA. Calibrating the RA within a wide enough range may lessen some of the concerns with the precision of the confidence level calculation.

If using the cost-of-capital approach as a calibration point, rather than a confidence-level target, the aggregate RA could be calculated based on a range of the target cost-of-capital rates, and the MfADs would be calibrated accordingly.

4.5 Sign of the margins

The underlying intent of a margin approach is to adjust the fulfilment cash flows to create an incremental provision for non-financial risk. This would normally be done by explicitly testing the sign of the margin, or in more complex cases, such as the lapse margin for some products, by dynamically adjusting the direction of the margin within the valuation model at each duration (often referred to as the crossover logic).

For a group of direct contracts or assumed reinsurance, the RA would always be positive –i.e., the RA would increase the fulfilment cash flows (FCF) portion of the liability. For a group of ceded contracts, the RA would be negative – i.e., the ceded RA would provide an offset to the increase in the direct RA to account for the portion of the risk transferred to the reinsurer. There could be rare situations where the ceded RA is reduced to nil (see illustrative example A1.5 in Appendix 1).

In some situations, it may be necessary for the sign of the margin to differ for similar risks in order to generate a positive RA for direct contracts. This could include some instances of reinsurance, or within portfolios of direct contracts where the risk profile is not homogeneous. The following sections explore these situations.

4.5.1 Choosing margins with reinsurance

Under IFRS 4, testing of the direction of the margin would have been done on a net-of-reinsurance basis. However, because IFRS 17 requires explicit risk adjustments for both direct and ceded contracts, testing the direction of the margin on a net basis may not be sufficient. The sign of the margin may have to be different on a net basis versus on a direct basis in order to generate positive risk adjustments for the direct, ceded, and net components. For example, some Canadian life products may be death-supported on a net-of-reinsurance basis, but life-supported on a direct basis, in which case the sign of the mortality margin would be negative on a net basis but positive on a direct basis.

In this type of situation, the actuary could test the FCF liability impact of the margin with and without reinsurance, choosing the sign of the margin separately on a direct and net basis to ensure that both lead to an appropriate increase in the corresponding liability. The ceded RA would then be the difference between the gross and net risk adjustments. This would align with the guidance in Question 9.10 of the *Application of IFRS 17 Insurance Contracts* educational note.

4.5.2 Choosing margins for non-homogeneous portfolios

Some portfolios may have implicit diversification due to non-homogeneity. For example, within a given portfolio, there may be some groups of contracts that are death-supported while others are life-supported.

It would be appropriate to recognize diversification within the portfolio, and thereby reduce the overall RA on the portfolio, if diversification affects the compensation the entity requires for uncertainty related to non-financial risk. However, it would not be appropriate to do so by having positive risk adjustments on some groups and negative risk adjustments on other groups.

One approach might be to test and apply the sign of the margin at the group level, and possibly reduce the quantum of the margin such that the aggregate RA reflects the compensation the entity requires for the diversified risks within the portfolio. An alternative approach might be to test and apply the sign of the margin at the portfolio level, and allocate the RA down to the group of contracts level.

5. Cost-of-capital approach

5.1 Introduction

In a cost-of-capital approach, the RA is based on the compensation that the entity requires to meet a target return on capital. In this calculation, three elements are required:

- *Projected capital amounts*: to determine the level of non-financial risk during the duration of the contract;
- *Cost-of-capital rate(s)*: represents the relative compensation required by the entity for holding this capital; and
- *Discount rates*: to obtain the present value of future required compensation.

This approach has the benefit of being conceptually close to the definition of the RA, and allows allocation of the RA at a more granular level (depending on the entity's allocation method for capital amounts). On the other hand, it might be operationally complex, as the projection of capital requirements is an input to the liability calculation.

Whereas the general formula for this approach is simple, there are a variety of ways to determine its components. A practical approach to determine the compensation required by the entity would be the methodology used for pricing purposes (i.e., the way an entity determines compensation in its day-to-day operations). Otherwise, an entity might prefer to define the required compensation on a more theoretical basis. Both views are discussed.

5.2 General formula

The general formula for the RA based on a cost-of-capital approach is the following:

$$RA = \sum_t \frac{r_t \ x \ C_t}{(1+d_t)^\wedge t}$$

where,

- C_t is the average capital amount for the period t,
- r_t is the selected cost-of-capital rate for the period t,
- r_t x C_t is the compensation required by the entity for the period t, and
- d_t is the selected discount rate(s), reflecting a yield curve, if appropriate.

Considerations for defining C_t and r_t are discussed in the following sections.

5.3 Capital

A practical approach for a given group of contracts could be to determine the capital requirement[1] with the capital model used for pricing purposes. However, any other capital

[1] In the context of this section, "capital requirement" is defined as an amount of equity required. For example, in the context of a capital model on a total asset requirement (TAR) basis, the capital requirement is the difference between the TAR and the liability including RA and CSM. Alternatively, the actuary may choose to define the amount of capital based on risk, independent of how capital is comprised. In the latter view, the capital requirement would be the TAR less the liability excluding RA and CSM. The latter view would lead to a higher capital amount but could be simpler to implement in practice as it would eliminate the iterative element discussed later in this section.

models might be used as long as it is consistent with the view of the entity regarding compensation.

Possible capital models include the regulatory capital model of the entity (e.g., Life Insurance Capital Adequacy Testing (LICAT)) or internal capital models (e.g., economic capital models). This second type of capital model might refer to models where all components were developed by the entity. An internal capital model might also be a regulatory capital model for which a few changes were made by the entity (e.g., modified LICAT).

Capital models using a total asset requirement (TAR) approach, such as LICAT, introduce complexity into the calculation of C_t in the general formula defined in Section 5.2. The actual RA is used in the determination of C_t, potentially leading to circular calculations. For example, under LICAT, the entity's target amount of available capital could be expressed as the entity's target total ratio multiplied by base solvency buffer less the RA, CSM, and eligible deposits. In such situations, determining the RA for each period may require iterative calculations.

Furthermore, the capital requirement would be adjusted to reflect the following considerations:

- Removal of the capital component(s) related to risks other than the non-financial risks in scope of the RA.
- Diversification, if not specifically addressed in the capital model being used.
- Consideration of the various risk-sharing mechanisms (reinsurance, policyholder dividends, etc.) reflected in the estimates of future cash flows.
- Inclusion of a non-financial capital component for risks without explicit non-financial capital components in the capital model, if significant (e.g., segregated funds where the capital requirement under LICAT is determined in aggregate, including financial and non-financial risk).

An allocation method will allow the entity to allocate the capital requirement (initially determined by considering the diversification at an aggregate level) to the most granular level. At a minimum, the entity would allocate the capital requirement by group of contracts to meet IFRS 17 requirements. However, for internal needs, an entity might want to allocate the capital requirement by contract and by risk (within a contract). Literature includes a few capital allocation methods such as the pro rata, continuous/discrete marginal, or the Shapley method.

Finally, there may be no link between the confidence level corresponding to the RA required for disclosure and the confidence level of the capital model. For example, an economic capital model calibrated to cover risks at the 99th percentile over a one-year horizon is conceptually very different than a risk adjustment that covers a lifetime horizon. Thus, it may not be possible to reconcile these amounts. The quantification of the confidence level of the RA would be determined using another approach.

5.4 Cost-of-capital rate

The cost-of-capital rate is traditionally designed as the weighted average cost of capital (WACC) for an entity that considers all sources of capital, minus the rate that could be earned on surplus. Among these sources of capital, the cost of capital for common shareholders (or equivalent stakeholders) is the most complex to define.

A practical approach would be to use, by capital source, target rates of return on capital and their respective weights that are consistent with management's view (i.e., used for pricing or as corporate targets). Target rates of return on capital might vary by line of business, by product, etc. Even if these rates of return might not be supported by the theory on cost of capital, they may still represent the compensation required by the entity.

Alternatively, theoretical cost-of-capital rates might be determined by the entity. In this case, the entity might consider the following:

- The cost of capital for shareholders would depend on their risk aversion.
- The amount of capital would reflect the level of risk (i.e., uncertainty). If the entity requires different compensation for similar risks in different segments of the business, the difference would be reflected in the cost-of-capital rate rather than the amount of capital.
- The cost-of-capital rate can be defined as a rate that represents the profit required for a given quantity of risk (risk perceived by the shareholders). Then, this rate is applied to an amount of capital measured by a capital model. In theory, when the capital model used measures perfectly the risks perceived by the shareholders, the same cost-of-capital rate would apply for all lines of business, all products, all risks, etc. However, in practice, capital amounts measured by these models are generally simplified measures of the underlying risks. For this reason, different cost-of-capital rates could be justified.
- The risk-adjustment is a pre-tax item, yet cost of capital requirements are often-stated on an after-tax basis. The actuary would ensure that the calculations are internally consistent.

5.5 Reinsurance

Section 3.3 of this educational note discusses general considerations with respect to reinsurance. A specific consideration to the cost-of-capital approach would be the need to develop cost-of-capital rates on a gross basis. A practical approach would be to use the net cost-of-capital rate for this purpose. This would be consistent with the considerations articulated in Section 3.3. From a theoretical standpoint, the third bullet point in Section 5.4 suggests that it is expected that the cost-of-capital remains unchanged when there is a change in the risk profile (e.g., ignoring all reinsurance), unless the capital model inadequately captures the risk perceived by the shareholders.

6. Quantile techniques

6.1 Overview

Quantile techniques including Value at Risk (VaR) and Conditional Tail Expectation (CTE) can be used to assess the probability of the adequacy of the fulfilment cash flows, and thus help to quantify the desired magnitude of the RA. The primary advantage of a quantile technique is that it will directly satisfy the IFRS 17 disclosure requirements regarding confidence level corresponding to the RA.

Assessment of the confidence level corresponding to the RA would generally require underlying assumptions for the risk distribution to be developed. Given a risk distribution, both VAR and CTE can be calculated.

The purpose of this section is to provide a high-level overview of potential approaches to generate a risk distribution, with a focus on Monte Carlo Simulation, and how quantile techniques including VaR and CTE can be applied accordingly to determine the RA. Detailed implementation guidance for an entity choosing to apply one of these techniques is beyond the scope and purpose of this educational note; the IAA has published a monograph on risk adjustment that may be a useful supplemental reference.

6.2 Approaches to generate a risk distribution

To generate a distribution of the underlying future cash flows, a few possible approaches can be considered:

- Fit future cash flows for non-financial risks into a probability distribution; for instance, a normal distribution, or a suitably skewed probability distribution
- Monte Carlo Simulation
- Other Scenario Modelling

6.2.1 Probability distribution for present value of cash flows

IFRS 17 requires the actuary to estimate an unknown variable (the fulfilment cash flows), which conceptually is derived from an analysis of the full range of possible outcomes of the contractual cash flows. In practice, it would be extremely difficult to observe the full range of possible outcomes or the underlying probability distribution that would define the full range of possible outcomes. The actuary might therefore need to make an assumption about the shape of the underlying probability distribution. One such simplifying assumption would be the use of the normal distribution, which might be appropriate for portfolios that do not exhibit characteristics of skewed exposures, such as a high concentration of stop loss insurance. Discussion of other potential distributions is beyond the scope of this educational note.

6.2.2 Monte Carlo simulation

Non-financial risks can be modelled stochastically. This would generally involve calibration of distributions of rates of mortality, mortality improvement, morbidity, lapse, and any other key drivers of insurance risk. Cashflows would be projected for multiple scenarios based on these stochastic input parameters, enabling the actuary to observe a probability distribution of the entity's aggregate risks. This would enable the RA to be set at the target percentile level of the observed distribution.

To model insurance risks stochastically, the following risk components would be considered:

- Level: Risk of misestimating the mean
- Trend: Risk of misestimating future changes in the mean

- Volatility: Risk due to random fluctuations
- Catastrophe: Risk due to one-time large-scale events

6.2.3 Other scenario modelling

Scenario modelling is mentioned as an alternative approach in question 4.14 of the *Application of IFRS 17 Insurance Contracts* educational note, for reflecting qualitative risk characteristics, "provided suitable extreme scenarios are included". Instead of different assumptions applied to each risk, a combination of assumptions or a scenario reflecting multiple non-financial risks could be applied to the underlying insurance contracts. However, in practice, it may be difficult to calibrate the appropriate scenarios.

An example of scenario modelling is financial condition testing (FCT). FCT is a process of analyzing and projecting trends in an insurer's capital position given its current circumstances, considering adverse scenarios that are severe but plausible. As such, the materiality threshold for a FCT analysis would generally be higher than the materiality associated with a liability calculation. Therefore, the actuary would be cautious in simply applying the techniques used to complete a FCT analysis onto the determination of its RA.

6.3 Approaches to measure risk

Once a distribution is generated, both VaR and CTE can be calculated or observed.

6.3.1 Value at Risk (VaR)

The VaR approach can be summarized as follows:

- Entity determines the target confidence level at which it determines its compensation required, e.g., x^{th} percentile
- VaR is determined such that the probability of actual fulfilment cash flows being less than VaR is x%
- Risk adjustment is then determined as VaR @ x^{th} percentile less the mean of present value of probability-weighted cash flows

The VaR approach is similar to the approach frequently used for internal economic capital calculations, for instance Own Risk and Solvency Assessment (ORSA). An entity's existing VaR techniques could be applied to the calculation of RA. However, there are some important differences which are summarized below:

- **Risk profile**: Economic capital can include all risks faced by the entity, whereas the RA is only required for non-financial risk.
- **Time horizon**: Economic capital tends to be calculated over a one-year time horizon, whereas the time horizon for the calculation of the confidence level of the RA would reflect all cash flows within the contract boundaries – i.e., a lifetime horizon, where lifetime is limited by the contract boundaries. The entity could, if it so chose based on its own compensation requirements, determine the level of the RA based on one-year shocks, but the associated confidence level would be calibrated against a lifetime horizon.

- **Comparability:** Economic capital is often calibrated at a higher percentile (e.g., 99.5%) over a one-year time horizon. The confidence level of the RA would generally reflect a lower percentile over a longer time horizon. As such, the two amounts may not be directly comparable.

6.3.2 Conditional tail expectation (CTE)

The Conditional Tail Expectation (CTE) approach can be summarized as follows:

- Entity determines the target confidence level at which it determines its compensation required, e.g., x^{th} percentile.
- From the probability distribution, an entity can determine
  - A. Conditional mean of the fulfilment cash flows beyond the target percentile
  - B. Mean of present value of probability-weighted cash flows
- Risk adjustment is then determined as the difference between A and B

A standard normal probability distribution may be the simplest to apply in practice, but a suitably skewed probability distribution and/or CTE approach could be applied depending upon the facts and circumstances specific to the entity.

6.4 Aggregation and allocation

Once the aggregate percentile level and resulting aggregate RA are derived from a quantile technique, the RA needs to be allocated to the IFRS 17 group level per the requirements of paragraph 24, and perhaps to the contract level for purposes of initial grouping of contracts as per IFRS 17.16 and IFRS 17.47. IFRS 17 does not prescribe any allocation methodologies. Possible solutions could range from simple proportional allocation techniques to more sophisticated weightings based upon an analysis of the component risks.

Alternatively, instead of producing a distribution of the fulfilment cashflows for the entire entity, the VaR and CTE could be calculated for each non-financial risk and then aggregated using a correlation matrix.

7. Quantification of the confidence level

7.1 Introduction

Question 4.18 in the *Application of IFRS 17 Insurance Contracts* educational note states the following about determination of the confidence level:

> In order to determine confidence levels, only a portion of the probability distribution would be needed. If that probability distribution is not explicitly derived as part of the measurement process, some method or model might be needed to estimate the percentiles of that combined portfolio distribution of the fulfilment cash flows at the amount which includes the risk adjustment. The extent of the analysis needed for such estimation is likely to require judgement.

Potential techniques range from full stochastic modelling to a relatively simple assumption about the shape of the underlying probability distribution.

Determining the confidence level corresponding to the RA may be operationally burdensome; nevertheless, confidence level is a required disclosure under IFRS 17. The actuary therefore would need to assess the practicality, cost and effort associated with the chosen methodology. In particular, it is possible that parameterization of a full stochastic model may be wrought with assumptions that could lead to spurious accuracy in the resulting calculation of the confidence level. In many situations, a more simplified approximation technique may provide an equally reasonable estimate of the confidence level, at much less cost and effort. The degree of rigour would be an entity-specific decision subject to the judgment of the actuary and agreement of the auditor.

Regardless of the approach taken, the actuary would be aware that the quantification of the confidence level will be an estimate, given the unobservable nature of the full probability distribution of the present value of the cash flows. As is the norm with any actuarial estimate, the actuary would make users of the information aware that the quantification is based on certain methods and assumptions, and take care to apply those methods and assumptions consistently from period to period.

7.2 Quantile technique as primary method

This subsection refers to situations where a quantile technique is the primary method for determining the amount of the RA (i.e., one of the methods described in Section 6 are used to determine the RA). There is no need for a separate process to calculate the confidence level corresponding to the RA, because the confidence level is a direct input into the quantile technique. A quantile technique as the primary method for calculation of the RA therefore directly satisfies the IFRS 17 disclosure requirements in paragraph 119.

As such, the remainder of Section 7 will discuss quantification of the confidence level when the primary method for calculation of the RA is not a quantile technique.

7.3 Quantile technique as secondary method

If the primary method for determination of the RA is either the margin approach or the cost-of-capital approach, then the actuary will need a secondary method to quantify the confidence level corresponding to the RA to satisfy the disclosure requirement in IFRS 17.119. As noted in question 4.18 of the *Application of IFRS 17 Insurance Contracts* educational note, this would usually require some information about the underlying probability distribution of the present value of future cashflows. The term “future cash flows” used throughout the remainder of this section is understood to be the present value of future cash flows.

Unless there is evidence to the contrary, it might be reasonable to assume that the PV of future cash flows follows a normal distribution as noted in Section 6.2.1.

The following paragraphs illustrate how a quantile technique could be applied based on an underlying normal probability distribution assumption for the future cash flows. Quantification of the confidence level using other distributions would be theoretically possible using analogous statistical techniques. Illustrations are beyond the scope of this educational note.

A normal distribution is defined by its mean and its standard deviation. Any point on the distribution can be identified if these two variables are known.

The best estimate liability (BEL) represents the mean or central tendency of the distribution, such that there is a 50% probability that the actual unknown future cash flows will be greater than or less than the BEL. Ideally, the actuary would have a method to derive the standard deviation of the assumed distribution of future cash flows, but in practice this could be difficult.

However, if a second point on the distribution can be identified, then there are mathematical techniques to calculate the standard deviation. So, the key to this approach is being able to identify the future cash flows associated with another point on the distribution. That may be easier said than done, unless reasonable assumptions are made.

One potential reasonable approach is that a specific percentile of the distribution can be derived from the LICAT regime, as discussed below in section 7.4. However, other reasonable approaches to define the second point on the curve could be explored. In particular, it may be possible to use an entity's own economic capital models if sufficiently robust, and recalibrated beyond the typical one-year risk horizon of most economic capital models for quantification of the confidence level of the RA.

Once a second point on the assumed normal distribution is identified, the implied standard deviation of the entity's future cash flows distribution can be calculated using the formula $\sigma = (X - \mu) / Z$), where:

- **Z** can be determined by looking up the given percentile score from a Standard Normal table with mean of 0 and standard deviation of 1
- **X** is the entity's liability calculated at the given percentile
- **μ** is the entity's best estimate liability

Once the standard deviation of the entity's future cash flows is calculated, then the standard normal formula can be re-arranged to solve for the implied confidence level corresponding to the RA:

- Solve for Z, using the formula $Z = (X - \mu) / \sigma$
  - **Z** is the unknown to be solved for
  - **X** = is the entity's risk-adjusted liability (i.e., $RA = X - \mu$)
  - **μ** is the entity's best-estimate liability
  - **σ** is the standard deviation of the entity's liability distribution
- Look up the Z score in a standard normal distribution table to determine the confidence level

This method can be illustrated with simple examples. See Appendix 2.

7.4 Calibration using LICAT

For simplicity, this section refers to OSFI's Life Insurance Capital Adequacy Test (LICAT) framework, but it is also applicable to the Capital Adequacy Requirements for Life and Health Insurance (CARLI) of the Autorité des marchés financiers (AMF).

A practical advantage of using LICAT as a calibration point is that it could be operationally efficient to leverage existing processes in the quantification of the confidence level. A potential disadvantage is that the LICAT calibration may not be a reasonable point of reference for a particular entity.

LICAT includes a combination of one-year shocks and lifetime shocks, meaning that it would not be possible to translate the aggregate LICAT base solvency buffer to a lifetime confidence level analogous to the confidence level corresponding to the RA. However, it may be possible to leverage portions of the LICAT framework as a calibration benchmark for the confidence level corresponding to the RA. In particular, the LICAT level and trend shocks represent a lifetime horizon, whereas the LICAT volatility and catastrophe shocks reflect a one-year horizon.

Use of the LICAT shock as the second point on the distribution would require the following considerations, which are discussed in more detail later in this section:

- Reflect an appropriate level of diversification when aggregating multiple shocks. Proper consideration would be given to the entity's mix and volume of business.
- Appropriate credit for the pass-through features of participating and adjustable products.
- Appropriate consideration of the discounting approach.

The following approach represents a rough approximation of a lifetime 85th percentile based on the LICAT for products other than segregated funds. It represents an approximation in a context where an entity has no better information on how to derive a second percentile point on the distribution of the present value of future cash flows over a lifetime horizon. However, note that the calibration of the LICAT level and trend shocks reflected a particular discount rate, diversification and LICAT credits. To the extent that these parameters are different in an entity's estimate of future cash flows, the LICAT benchmark may not necessarily correspond to a confidence level at or around 85%. Significant differences are possible.

LICAT conceptually includes within the base solvency buffer a terminal provision that would represent a confidence level between CTE60 and CTE80. By assuming that level and trend solvency buffers represent the termination provision, they could be assumed to reflect a confidence level between CTE60 and CTE80. As a simplifying assumption, it could be assumed that the midpoint of this range, CTE70, is approximately equal to VAR85, or the 85th percentile of the distribution. More sophisticated approximations are possible, bearing in mind the underlying assumptions.

Additional judgment would be required when applying diversification within the LICAT approximation framework. For example, judgment should be used to assess whether the level and trend shocks represent the 85^{th} percentile before or after reflecting diversification and/or the diversification caps in the LICAT framework. Other nuances of diversification calculations may require judgment as well, depending upon the circumstances specific to the entity. This educational note cannot prescribe specific guidance at this level of granularity, but the actuary is advised to apply consistent judgment from period to period.

The actuary would take care to check the reasonability of the LICAT benchmark approach based on the facts and circumstances of the entity and the prevailing interest rate environment, and adjust the methodology and assumptions accordingly.

One possible approach to mitigate volatility in the confidence level due to changes in interest rates would be to develop a scaling factor that adjusts the LICAT benchmark as interest rates change. This might involve testing the sensitivity of the fulfilment cash flows to changes in interest rates, and attributing a similar sensitivity to the LICAT benchmark. The LICAT benchmark could then be scaled to reflect the magnitude of the interest rate change since the point at which the benchmark was originally calibrated. Actuarial judgment would be required in setting the initial calibration point; one possible simplifying assumption could be that the LICAT benchmark represents the x^{th} percentile at the IFRS 17 transition date, with application of the scaling factor based on interest rate movement from that point onwards.

Given the relatively high degree of judgment in the assumptions underlying the calculation of the confidence level, users of the financial statements would be cautious in inferring too much precision in the reported confidence level. Comparability of confidence levels between entities would be directional rather than exact measures of differences. Consistency in the application of judgment from period to period is important, even if precision in the end result is not expected.

With the above caveats, an 85th percentile of the fulfilment cash flows can be determined as the sum of the present value of the best-estimate future cash flows and a modified LICAT base solvency buffer as defined below:

- **Credit, market and operational risks.** These risk components would be set to zero as they are not part of the RA.
- **Mortality, longevity, morbidity and lapse risks.** The sum of the level risk and trend risk could reasonably be assumed to represent a lifetime 85th percentile shock. Best estimate and shocked cash flows would be:
    - projected consistently with the disclosure of the entity’s confidence level (i.e., net of reinsurance, both registered and unregistered, if calculating and disclosing the confidence level on a net-of-reinsurance basis; otherwise with and without reinsurance if calculating and disclosing confidence levels of the gross and ceded risk adjustments separately).
    - where calculations are done on a net-of-reinsurance basis, projections would include all reinsurance (registered and unregistered).
    - discounted at LICAT’s prescribed rates.
- **Expense risk.** An increase of 10% in all policy years could reasonably be assumed to represent a lifetime 85th percentile shock. Best estimate and shocked cash flows would be:
    - projected consistently with the disclosure of the entity’s confidence level; and
    - discounted at LICAT’s prescribed rates.

- **Within-risk diversification.** Within-risk diversification as defined in LICAT would be considered.
- **Between-risk diversification.** Under the assumption of a standard normal distribution, there is mathematical equivalence between a set of LICAT shocks individually calibrated at the 85th percentile, and the between-risk post-diversification aggregate requirement at the 85th percentile from all the shocks combined in the modified LICAT base solvency buffer. Example A2.2 in Appendix 2 contains an illustration.
- **Par, adjustable, and other credits.** These credits would be determined consistently with the diversified insurance risks calculated as described above. The credits would not exceed the diversified risks, and consideration would be given as to the level of caps on the credits, if any, that the entity would apply. The level of sophistication of the approach used to estimate these credits would depend upon the materiality of the credits for the given entity.
- **Scalar.** It would be reasonable to exclude the scalar from the calculation for consistency over time. The scalar is a regulatory tool used to adjust the level of capital in the industry.

See Appendix 2 for simple numerical examples.

As noted above, the LICAT approach can be assumed to represent a rough approximation of a lifetime 85th percentile based on the LICAT for products other than segregated funds. In most cases, the vast majority of risk from segregated fund products would be financial risk. It would be reasonable to add the entity's IFRS 17 RA for segregated funds to the modified LICAT base solvency buffer when non-financial risk related to segregated fund guarantees is not a significant part of the entity's overall risk profile. This would assume that IFRS 17 RA represents an 85th percentile confidence level. A more sophisticated approach may be required if segregated fund guarantees represent a material portion of the entity's non-financial risk profile.

Appendix 1: Illustration of Reinsurance Impact on RA

In the tables that follow, cash inflows are shown as negative numbers, and cash outflows are shown as positive numbers.

Base case: no reinsurance

Illustrative example A1.1: Assume that there is a group of direct contracts that has a PV of benefit payments with a probability-weighted mean of $100. The benefit payments are assumed to be normally distributed with a standard deviation of $20. The entity prices this risk such that there is an 80% probability that the premium, less a profit charge of $10, will exceed the actual claims. In this case, it can be shown mathematically that the resulting premium is $126.83, and the RA would be $16.83.

- Solve for X, using the formula $Z = (X - \mu) / \sigma$
  - **Z** can be determined by looking up the 80th percentile score from a standard normal table with mean of 0 and standard deviation of 1 (i.e., 0.84162)
  - **X** = is the entity's risk-adjusted liability to be solved for (note that $RA = X- \mu = \sigma*Z$)
  - **μ** is the company's best-estimate claim cost (i.e., $100)
  - **σ** is the standard deviation of the company's liability distribution (i.e., $20)
- Solve for the RA and the premium to charge:
  - Known values from the assumptions: $\mu = 100$, $\sigma = 20$, $Z = 0.84162$
  - $RA = \sigma*Z = 20*0.84162 = \$16.83$
  - $Premium = X + 10 = (\mu + \sigma*Z) + 10 = \$100 + \$16.83 + \$10 = \$126.83$

The results of the analysis can be summarized in Table A1.1:

	Direct	Ceded	Net
PV Premium	($126.83)	n/a	n/a
PV Claims	$100.00	n/a	n/a
BEL	($26.83)	n/a	n/a
RA	$16.83	n/a	n/a
CSM	$10.00	n/a	n/a

Reinsurance scenario 1: cost of reinsurance proportional to the level of risk being ceded

Illustrative example A1.2: Now assume that the entity layers 50% coinsurance into the mix for the direct contracts considered in example A1.1, and the price of the reinsurance is 50% of the direct premium. The entity prices such that there is an 80% probability that the premium, less a profit charge of $10 (half of which is ceded to the reinsurer), will exceed the actual claims on a net-of-reinsurance basis.

- Solve for X, using the formula $Z = (X - \mu) / \sigma$

- **Z** can be determined by looking up the 80th percentile score from a standard normal table with μ = 0 and σ = 1 (i.e., 0.84162)
- **X** = is the entity's net risk-adjusted claim cost to be solved for (note that RA = X-μ = σ*Z)
- **μ** is the company's best-estimate claim cost on a net basis (i.e., $50, half of the original $100)
- **σ** is the standard deviation of the company's liability distribution on a net basis (i.e., $10, half of the original $20)

- Solve for implied net RA:
  - Known values from the assumptions: μ = 50, σ = 10, Z = 0.84162
  - Net RA = σ*Z = 10*0.84162 = $8.416

If an entity makes its pricing decisions on a net-of-reinsurance basis, it is reasonable to infer that the gross contracts would be priced using similar compensation requirements. In this case, the net of reinsurance RA would be determined as above in example A1.2, and the RA attributable to the direct contract would be calculated as in example A1.1.

The results of the analysis can be summarized in Table A1.2:

	Direct	Ceded	Net
PV Premium	($126.83)	$63.42	($63.42)
PV Claims	$100.00	($50.00)	$50.00
BEL	($26.83)	$13.42	($13.42)
RA	$16.83	($8.42)	$8.42
CSM	$10.00	($5.00)	$5.00

In practice, for coinsurance, it may be simpler to calculate the RA on a direct basis, and attribute a percentage of the direct RA to the ceded RA, based on the coinsurance percentage.

The key observation here is that the presence of reinsurance does reduce the entity's net RA, but does <u>not</u> affect the RA associated with the direct contract because the compensation the entity requires for non-financial risk when writing the direct contract is the same with or without reinsurance in this example.

100

Illustrative example A1.3: Now assume that the assumptions are the same as in example A1.2, but the entity chooses to price with a 70% probability that the premium less a profit charge of $10 (half of which is ceded to the reinsurer), will exceed claims (rather than 80%), and the reinsurer accepts this lower confidence level. The calculations would change as follows:

- Solve for the RA and the premium to charge (direct basis):
  - Known values from the assumptions: μ = 100, σ = 20, Z = 0.52440
  - RA = σ*Z = 20*0.52440 = $10.49

  - Premium = X + 10 = (μ + σ*Z) + 10 = $100 + $10.49 + $10 = $120.49
- Solve for the implied net RA:
  - Known values from the assumptions: μ = 50, σ = 10, Z = 0.52440
  - Net RA = σ*Z = 10*0.52440 = $5.244

The results of the analysis can be summarized in Table A1.3:

	Direct	Ceded	Net
PV Premium	($120.49)	$60.24	($60.24)
PV Claims	$100.00	($50.00)	$50.00
BEL	($20.49)	$10.24	($10.24)
RA	$10.49	($5.24)	$5.24
CSM	$10.00	($5.00)	$5.00

The key observation here is that the presence of reinsurance reduces the entity's direct RA relative to examples A1.1 and A1.2, only because the presence of reinsurance changed the compensation the entity requires for accepting the risk of the direct contract, not because the entity ceded part of the risk to the reinsurer.

Reinsurance scenario 2: cost of reinsurance not proportional to the level of risk being ceded

In the examples that follow, it is assumed that the savings from the lower reinsurance premium are passed on to the direct contract owner in the form of lower direct premiums. Two different views are presented, showing potentially different interpretations of the RA.

Similar to example A1.2, assume that the entity layers 50% coinsurance into the mix for the direct contracts considered in example A1.1, but the price of the reinsurance is $50. The entity prices such that there is an 80% probability, that the premium, less a profit charge of $5, will exceed the actual claims on a net-of-reinsurance basis.

The lower price of the reinsurance is used to reduce the direct premium from $126.83 in example A1.2 to $113.42, a reduction of $13.42, derived from the reduction in the reinsurance premium from $63.42 to $50.

Illustrative example A1.4: In one potential approach, the net RA is calculated and apportioned between the direct and ceded contracts on the basis of the amount insured, ignoring the price of the reinsurance.

- Solve for implied net RA:
  - Known values from the assumptions: μ = 50, σ = 10, Z = 0.84162
  - Net RA = σ*Z = 10*0.84162 = $8.42 (same as example A1.2)

The results of the analysis can be summarized in Table A1.4:

	Direct	Ceded	Net
PV Premium	($113.42)	$50.00	($63.42)
PV Claims	$100.00	($50.00)	$50.00
BEL	($13.42)	$0.00	($13.42)
RA	$16.83	($8.42)	$8.42
CSM before reinsurance offset	($3.42)	$8.42	$5.00
Reinsurance Offset	$1.71	($1.71)	$0.00
CSM after reinsurance offset	($1.71)	$6.71	$5.00
CSM after zero floor	$0	$6.71	$6.71

Under this approach, before applying the zero CSM floor on direct contracts, the net CSM is the same as example A1.2, as are the direct, ceded, and net risk adjustments. But the profit in the direct contract is reduced by $13.42 and the profit in the ceded contract is increased by $13.42 due to the offsetting changes in the premiums.

However, a reinsurance offset and zero floor are applied to the direct CSM. After applying both, the entity would recognize an initial loss of $1.71 on the direct contract, and maintain the $6.71 CSM on the ceded contract. The expected net profit is still $5.00, but the timing of recognition differs. The application of the reinsurance offset and zero floor on the CSM does not affect the RA.

Illustrative example A1.5: In an alternative approach, the RA for the ceded contract could be defined by the observable market price of the hedge – i.e., the difference between the reinsurance premiums paid and the PV of claims, which in this example is zero.

- Solve for the implied net RA:
    - Known values from the assumptions: $\mu = 50$, $\sigma = 10$, $Z = 0.84162$
    - Net RA = σ*Z = 10*0.84162 = $8.42 (same as example A1.4)
- Solve for the implied ceded RA: PV premium less PV claims = $0
- Solve for the direct RA: Net RA – Ceded RA = $8.42

The results of the analysis can be summarized in Table A1.5:

	Direct	Ceded	Net
PV Premium	($113.42)	$50.00	($63.42)
PV Claims	$100.00	($50.00)	$50.00
BEL	($13.42)	$0.00	($13.42)
RA	$8.42	$0.00	$8.42
CSM	$5.00	$0.00	$5.00

This approach aligns with the IASB staff example re issue S118 in April 2019 Transition Resource Group Agenda Paper 02.

Appendix 2: Confidence Level Quantification – Examples Using Normal Distribution and LICAT

In this appendix, the term "modified LICAT liability" is used to represent the entity's PV of shocked cash flows calculated using the modified LICAT approach, as described in section 7.4 of this educational note. It is assumed that the modified LICAT liability has been calibrated to a confidence level of 85% over a lifetime horizon.

As noted in question 4.10 of the *Application of IFRS 17 Insurance Contracts* educational note, IFRS 17 does not specify whether the confidence level disclosure is intended to be on a gross or net basis, but the confidence level of the net RA is likely to provide the most meaningful information. These examples illustrate the confidence level calculations net of reinsurance. The implied confidence levels of the gross and ceded pieces may or may not be relevant on their own, but could be calculated using a similar approach if necessary for certain IFRS 17 disclosures. While the confidence level of the ceded RA could theoretically be calculated, it does not have a clear conceptual meaning.

Illustrative example A2.1: Assume that Entity A has a best-estimate liability of 100 and a modified LICAT liability of 125. Further assume that Entity A's portfolio is comprised entirely of mortality risk (i.e., there is no diversification to consider). The net RA calculated via another method is 15.

- Solve for the implied volatility of Entity A's liability profile:
  - Known values from the assumptions: $\mu = 100$, $X = 125$, $Z = 1.03643$ (i.e., the standard normal value for an 85% confidence level)
  - Solve for σ: $\sigma = (X - \mu)/Z = (125-100)/1.03643 = 24.121$
- Determine the confidence level corresponding to the calculated risk-adjustment of 15
  - Solve for Z: $Z = (X - \mu) / \sigma = 15/24.121 = 0.622$
  - Looking up 0.622 in a standard normal table yields a confidence level of 73%

In this example, the risk-adjusted liability of 115 (BEL of 100 plus RA of 15) would be greater than the true unknown value of the net fulfilment cash flows 73% of the time.

Illustrative example A2.2: Assume that Entity B has a best-estimate liability of 100 and a modified LICAT liability of 125 before diversification, similar to Entity A in the previous example. However, assume that Entity B has two diversifiable risks: mortality and longevity. Pre-diversification risk adjustments are 9 and 6 for mortality and longevity respectively, and the respective pre-diversification modified base solvency buffers are 13 and 12 respectively. These results and the entity's assumed correlation matrix (based on LICAT for illustrative purposes in this example) are summarized as follows:

	RA	BSB
Mortality	9	13
Longevity	6	12
Pre-Diversification	15	25

Correlation Matrix		
	Mortality	Longevity
Mortality	100%	-25%
Longevity	-25%	100%

The entity determines its diversification adjustments as follows, using the formula $\sigma_{tot}^2 = \sigma_M^2 + \sigma_L^2 + 2 * cor(M,L) * \sigma_M * \sigma_L$

- Diversified RA = $[9^2 + 6^2 + 2*(-0.25)*9*6]^{0.5} = 9.5$
- Diversified base solvency buffer = $[13^2 + 12^2 + 2*(-0.25)*13*12]^{0.5} = 15.33$

There are two possible approaches to determining the confidence level of the RA, both of which lead to the same result.

Approach 1: assume that the LICAT post-diversification BSB represents the 85th percentile.

- Solve for the implied volatility of Entity B's liability profile:
  - Known values from the assumptions: $\mu = 100$, $X = 100+15.33$, $Z = 1.03643$
  - Solve for σ_{tot}: $\sigma_{tot} = (X-\mu)/Z = (115.33-100)/1.03643 = 14.791$
- Determine the confidence level for the calculated risk-adjustment of 9.5
  - Solve for Z: $Z = (X - \mu) / \sigma = 9.5/14.791 = 0.641$
  - Looking up 0.641 in a standard normal table yields a confidence level of 74%

Approach 2: assume that each of the LICAT mortality and longevity shocks, pre-diversification, each are individually calibrated to represent an 85th percentile shock.

- Solve for the implied volatility of Entity B's mortality liability:
  - Known values from the assumptions: $\mu = 100$, $X = 100+13$, $Z = 1.03643$
  - Solve for σ_M: $\sigma_M = (X-\mu)/Z = (113-100)/1.03643 = 12.543$
- Solve for the implied volatility of Entity B's longevity liability:
  - Known values from the assumptions: $\mu = 100$, $X = 100+12$, $Z = 1.03643$
  - Solve for σ_L: $\sigma_L = (X-\mu)/Z = (112-100)/1.03643 = 11.578$
- Solve for the implied volatility of Entity B's combined mortality and longevity liability:
  - Solve for σ_{tot}: $\sigma_{tot} = [\sigma_M^2 + \sigma_L^2 + 2 * cor(M,L) * \sigma_M * \sigma_L]^{0.5}$
    $= [(12.543)^2 + (11.578)^2 + 2(-0.25)*12.543*11.578]^{0.5} = 14.791$
- Determine the confidence level for the calculated risk-adjustment of 9.5
  - Solve for Z: $Z = (X - \mu) / \sigma = 9.5/14.791 = 0.641$
  - Looking up 0.641 in a standard normal table yields a confidence level of 74%

In this example, the risk-adjusted liability of 109.5 (BEL of 100 plus RA of 9.5) would be greater than the true unknown value of the fulfilment cash flows 74% of the time.

Appendix 3: Margins – Brief Summary of IFRS 4 CIA Standards of Practice

Subsection 2350 of the IFRS 4 CIA Standards of Practice provided guidance to actuaries in setting margins for adverse deviation prior to the effective date of IFRS 17. While no longer binding after the effective date of IFRS 17, this guidance might be helpful to actuaries in quantifying the degree of uncertainty in non-financial assumptions, and by extension quantifying the compensation for non-financial risk that the entity might require.

The range of margins for most non-economic assumptions was generally between 5% and 20% of the best-estimate assumption. Exceptions included:

- Life insurance mortality rates per 1000: addition or subtraction of between 3.75 and 15 divided by the curtate expectation of life.
- Annuity mortality rates per 1000: subtraction of between 2% and 8% from the best-estimate assumption.
- Mortality improvement assumptions not restricted to the 5–20% range.
- Expense: between 2.5% and 10% of the best-estimate assumption including inflation.

Considerations for placement in the ranges would have been similar to those noted in IFRS 17.B91.

Appendix 4: Sample Correlation Matrices

LICAT/CARLI as of 2022

	Mortality	Longevity	Morbidity incidence and claims	Morbidity termination	Lapse sensitive	Lapse supported	Expense
Mortality	100%						
Longevity	-25%	100%					
Morbidity incidence and claims	50%	-25%	100%				
Morbidity termination	-25%	50%	25%	100%			
Lapse sensitive	25%	25%	50%	50%	100%		
Lapse supported	0%	-25%	0%	-25%	-50%	100%	
Expense	50%	25%	50%	50%	50%	-25%	100%

Solvency II (Article 136)

	Mortality	Longevity	Disability	Lapse	Expenses	Revision	CAT
Mortality	100%						
Longevity	-25%	100%					
Disability	25%	0%	100%				
Lapse	0%	25%	0%	100%			
Expenses	25%	25%	50%	50%	100%		
Revision	0%	25%	0%	0%	50%	100%	
CAT	25%	0%	25%	25%	25%	0%	100%

IAIS, *Public 2021 Field Testing Technical Specifications*

	Mortality	Longevity	Morbidity/Disability	Lapse	Expense
Mortality	100%				
Longevity	-25%	100%			
Morbidity/Disability	25%	0%	100%		
Lapse	0%	25%	0%	100%	
Expense	25%	25%	50%	50%	100%

Note that these matrices are all used for capital purposes at high confidence levels. Internal correlation matrices would also be acceptable.