# Draft Educational Note

# IFRS 17 Discount Rates for Life and Health Insurance Contracts

Document 220079

This document was replaced by document 222097

**This document was archived April 11, 2023**

Canadian Institute of Actuaries · Institut canadien des actuaires

*Draft Educational Note*

# IFRS 17 Discount Rates for Life and Health Insurance Contracts

## Committee on Life Insurance Financial Reporting

**June 2020**

Document 220079

*Ce document est disponible en français*



*The actuary should be familiar with relevant educational notes. They do not constitute standards of practice and are, therefore, not binding. They are, however, intended to illustrate the application of the Standards of Practice, so there should be no conflict between them. The actuary should note however that a practice that the educational notes describe for a situation is not necessarily the only accepted practice for that situation and is not necessarily accepted actuarial practice for a different situation. Responsibility for the manner of application of standards of practice in specific circumstances remains that of the members. As standards of practice evolve, an educational note may not reference the most current version of the Standards of Practice; and as such, the actuary should cross-reference with current Standards. To assist the actuary, the CIA website contains an up-to-date reference document of impending changes to update educational notes.*

# MEMORANDUM

**To:** Members in the life insurance area

**From:** Steven W. Easson, Chair
Actuarial Guidance Council

Marie-Andrée Boucher, Chair
Committee on Life Insurance Financial Reporting

**Date:** June 8, 2020

**Subject:** **Draft Educational Note: IFRS 17 Discount Rates for Life and Health Insurance Contracts**

The Committee on Life Insurance Financial Reporting (CLIFR) has prepared this draft educational note to provide guidance related to setting the discount rates for the purpose of calculating the present value of estimates of future cash flows under IFRS 17.

This draft educational note is structured in two chapters. The first Chapter is intended to illustrate various considerations in developing an entity's IFRS 17 discount curve, without narrowing the choices available to the entity under the IFRS 17 Standard. The chapter focuses on aspects of setting the discount rates that are specific to the Canadian market. The second Chapter presents reference curves for insurance contracts that are deemed to be liquid and illiquid. It outlines how these curves are constructed in the observable period and beyond the observable period. It also outlines specific requirements with respect to the parameters used beyond the observable period. In addition, guidance is provided for recommended disclosures in the Appointed Actuary's Report (AAR) filed with the insurance regulator, to support practitioners and reviewers in assessing the reasonableness of the discount curves used versus the reference curves defined in this draft educational note. Additional details related to the content of the different chapters can be found in the introduction. An Excel tool is also available to illustrate the reference curves discussed in this paper.

This draft educational note is focused on the Canadian market, economic environment and products. Similar considerations and approaches could be used for setting the discount rates for other currencies. It is written from the perspective of Canadian actuaries and is not intended to duplicate any other guidance. Additional information that provides more details can be found in IAA guidance or other CIA documents. The draft educational note *Compliance with IFRS 17 Applicable Guidance* provides guidance to actuaries when assessing compliance with IFRS 17. It is applicable to all educational notes pertaining to IFRS 17 and members are encouraged to review it prior to reading any educational note related to IFRS 17.

A preliminary version of the draft educational note was shared with the following committees:

- Property and Casualty Financial Reporting Committee (PCFRC)
- Committee on Risk Management and Capital Requirements (CRMCR)

- Appointed Actuary (AA) Committee
- International Insurance Accounting Committee (IIAC)
- Worker's Compensation Committee
- ASB's Designated Group on IFRS 17.

It was also shared with the Accounting Standards Board (AcSB). The draft educational note was also presented several times at the Actuarial Guidance Council (AGC) in the months preceding this request for approval. The subcommittee feels that it has addressed the material comments received by the various committees.

As this draft educational note covers such a vital IFRS 17 issue, CLIFR and the AGC wish to emphasize the substantial amount of ongoing professional judgment that is necessary in setting discount rates in the unobservable period. There were rigorous debates amongst many practice committees within the CIA on the methodologies and data used to set the ultimate risk-free rate. Potential approaches included: (i) providing guidance on specific rate(s) based on a selected methodology; (ii) providing guidance on specific rate(s) based on a basket of methodologies; (iii) providing no guidance on specific rate(s) and instead only provide historical data for individual company determination. On balance, CLIFR and the AGC have preliminarily concluded the best approach, including for purposes of fulfilling the IASB® objective of comparability, is approach (ii) which uses various methodologies and historical data periods.

CLIFR and AGC are committed to closely monitoring the continued appropriateness of this guidance so that it can be updated in a timely manner.

The creation of this cover letter and draft educational note has followed the Actuarial Guidance Council's Protocol for the Adoption of Educational Notes. In accordance with the Institute's *Policy on Due Process for the Approval of Guidance Material other than Standards of Practice and Research Documents*, this draft educational note has been prepared by CLIFR and has received approval for distribution from the AGC on June 1, 2020.

The actuary should be familiar with relevant educational notes. They do not constitute standards of practice and are, therefore, not binding. They are, however, intended to illustrate the application of the Standards of Practice, so there should be no conflict between them. The actuary should note however that a practice that the educational notes describe for a situation is not necessarily the only accepted practice for that situation and is not necessarily accepted actuarial practice for a different situation. Responsibility for the manner of application of standards of practice in specific circumstances remains that of the members. As standards of practice evolve, an educational note may not reference the most current version of the Standards of Practice; and as such, the actuary should cross-reference with current Standards. To assist the actuary, the CIA website contains an up-to-date reference document of impending changes to update educational notes.

CLIFR would like to acknowledge the contribution of its subcommittee that assisted in the development of this draft educational note: Stéphanie Fadous (Chair), Wesley Foerster, Emmanuel Hamel, Étienne Morin, Denis Cantin, Saul Gercowsky, Benoît-Pierre Blais, Gwen Yun Weng, Ivy Lee, Junyu Chen, Shaonan Fang, Matthew Garnier, Abid Kazmi, and Ling Cen.

Questions or comments regarding this draft educational note may be directed to Marie-Andrée Boucher at mboucher@eckler.ca, Stéphanie Fadous at stephanie_fadous@manulife.com, and Steve Bocking at steve.bocking@canadalife.com.

**Table of Contents**

## Introduction

IFRS 17 establishes principles for the recognition, measurement, presentation, and disclosure of insurance contracts. The purpose of this draft educational note is to provide practical application guidance on Canadian-specific issues relating to setting the discount rates for calculating the present value of estimates of future cash flows under IFRS 17 and disclosure requirements in the Appointed Actuary's Report (AAR) filed with the insurance regulator; additional guidance is also available in the draft educational note *Application of IFRS 17 insurance contracts*. References to specific paragraphs of the IFRS 17 Standards are denoted by IFRS 17.XX in this note, where XX represents the paragraph number.

The discount rates applied to the estimates of future cash flows are described in IFRS 17.36 and shall:

*(a) reflect the time value of money, the characteristics of the cash flows and the liquidity characteristics of the insurance contracts;*

*(b) be consistent with observable current market prices (if any) for financial instruments with cash flows whose characteristics are consistent with those of the insurance contracts, in terms of, for example, timing, currency and liquidity; and*

*(c) exclude the effect of factors that influence such observable market prices but do not affect the future cash flows of the insurance contracts.*

IFRS 17.B74 provides further guidance when cash flows vary based on the returns on any financial underlying items:

*Estimates of discount rates shall be consistent with other estimates used to measure insurance contracts to avoid double counting or omissions; for example:*

*(a) cash flows that do not vary based on the returns on any underlying items shall be discounted at rates that do not reflect any such variability;*

*(b) cash flows that vary based on the returns on any financial underlying items shall be:*

*(i) discounted using rates that reflect that variability; or*

*(ii) adjusted for the effect of that variability and discounted at a rate that reflects the adjustment made…*

Further considerations are provided in IFRS 17. B72-B85. Those paragraphs outline two approaches to set the discount rate, bottom-up and top-down. The bottom-up approach is based on adjusting a liquid risk-free yield curve to reflect the differences between the liquidity characteristics of the financial instruments that underlie the risk-free rates observed in the market and the liquidity characteristics of the insurance contracts. The top-down approach is based on a yield curve that reflects the current market rates of return implicit in a fair value measurement of a reference portfolio of assets and adjusted to eliminate any factors that are not relevant to the insurance contracts.

IFRS 17.B82 describes how the inputs to the yield curve in a top-down approach would be identified where there are observable market prices and where no such data are available:

(a) *if there are observable market prices in active markets for assets in the reference portfolio, an entity shall use those prices (consistent with paragraph 69 of IFRS 13).*

(b) *if a market is not active, an entity shall adjust observable market prices for similar assets to make them comparable to market prices for the assets being measured (consistent with paragraph 83 of IFRS 13).*

(c) *if there is no market for assets in the reference portfolio, an entity shall apply an estimation technique. For such assets (consistent with paragraph 89 of IFRS 13) an entity shall:*

(i) *develop unobservable inputs using the best information available in the circumstances. Such inputs might include the entity's own data and, in the context of IFRS 17, the entity might place more weight on long-term estimates than on short-term fluctuations; and*

(ii) *adjust those data to reflect all information about market participant assumptions that is reasonably available.*

Chapter 3 of the draft educational note *Application of IFRS 17 Insurance Contracts* provides further general guidance on setting IFRS 17 discount rates. This draft educational note, published in February 2019, is an adoption without modification of the exposure draft of International Actuarial Note (IAN) 100. Another exposure draft of the IAN 100 is expected to be published which will address the comments made by the different bodies in addition to providing additional guidance related to the proposed amendments to the Standard.

This draft educational note provides more specific application guidance for Canadian actuaries and is comprised of two chapters. The first Chapter is intended to illustrate various considerations in developing an entity's IFRS 17 discount curve, without narrowing the choices available to the entity under the IFRS 17 Standard. The chapter focuses on aspects of setting the discount rates that are specific to the Canadian market:

a. Establishing the last observable point on the yield curve in Canada: Consistent with IFRS 17.B82, observable market prices would be used where available in active markets.
b. Setting the ultimate risk-free rate: Consistent with IFRS 17.B82, an actuary shall develop unobservable inputs using the best information available, and might place more weight on long-term estimates than on short-term fluctuations.
c. Setting the liquidity premium for products sold in Canada and in Canadian currency: Consistent with IFRS 17.36, the discount rates would reflect the characteristics of the insurance contracts, including liquidity.
d. Setting the discount rates for Canadian products that contain cash flows that vary with an underlying item.

In addition to the guidance above, this chapter will discuss different approaches to setting the discount curve such as using spot rates versus forward rates, methodologies to interpolate between the last observable point and ultimate rates, and the period over which the discount curve would converge to an ultimate rate.

The second Chapter presents reference curves for insurance contracts that are deemed to be liquid and illiquid. It outlines how these curves are constructed in the observable period and beyond the observable period. It also outlines specific requirements with respect to the parameters used beyond the observable period. In addition, guidance is provided for recommended disclosures in the AAR filed with the insurance regulator, to support practitioners and reviewers in assessing the reasonableness of the discount curves used versus the reference curves defined in this draft educational note.

The guiding principles that the CLIFR Discount Rate Subcommittee followed in writing this draft 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 and manage.

**Terminology**

The following terminology is used in this draft educational note:

- **Discount rate**: Rate used to discount estimates of future cash flows which is consistent with the timing, liquidity and currency of the insurance contract cash flows.
- **Spot rate**: The spot yield to maturity (YTM) is the estimated annual rate of return for a bond assuming that the investor holds the bond until its maturity date. The zero spot YTM is the estimated annual rate of return of a zero-coupon bond assuming that the investor holds the latter until its maturity date. In this document, the spot rates are defined as the zero spot YTM.
- **Forward rate**: The interest rate implied by the yield curve over a given future period. Mathematically, the forward rate over time [n-1, n] is

  $$f_n = \frac{(1+y_n)^n}{(1+y_{n-1})^{n-1}} - 1 \,,$$

  where $y_n$ denotes the spot rate for maturity *n*. The forward rate over time [n-1, n] can be conceptualized as the interest rate that equates the strategies of

  - investing in the n-year spot rate; and
  - investing in the (n-1)-year spot rate and then in the [1-Year] forward rate.

- **Estimates of future cash flows**: Future undiscounted cash flows arising from the insurance contracts or reinsurance held contracts.
- **Insurance finance income or expense**: The change in the carrying amount of the group of insurance contracts arising from the effect of the time value of money and changes in the time value of money.
- **Liquidity premium**: Adjustment made to a liquid risk-free yield curve to reflect differences between the liquidity characteristics of the financial instruments that underlie the (risk-free) rates observed in the market and the liquidity characteristics of the insurance contracts. The term “liquidity premium” in this draft educational note has the same meaning as the term “illiquidity premium” in the IFRS 17 Application EN.
- **Reference portfolio**: A portfolio of assets used to derive discount rates based on current market rates of return, adjusted to remove any premium related to risk characteristics embedded in the portfolio that are not inherent in insurance contracts. For cash flows of insurance contracts that do not vary based on the returns on the assets in the reference portfolio, such adjustments include:
    - adjustments for differences between the portfolio and the insurance contract cash flows in respect of the amount, timing and uncertainty of cash flows; and
    - excluding market risk premiums for credit risk which are relevant only to the assets included in the reference portfolio.

# Chapter 1 – Developing the Discount Curve

## 1. Establishing the last observable point on the yield curve in Canada

This section aims to provide guidance on how to establish the observable period in Canada for risk-free assets given the information that is directly observable in the market. Beyond this point, an actuary would estimate risk-free rates as described in Section 2.

To the extent an actuary is using a top-down approach and a reference portfolio that is composed of shorter-term fixed income assets, the actuary would consider the information available for risk-free assets to the last observable point when setting the discount rate.

### 1.1 Key principles

IFRS 17 recognizes that discount rates for instruments with the same characteristics as insurance contracts may not be directly observable in the market. IFRS 17 does not require a particular estimation technique for determining the discount rates. However, it does establish principles that a company would follow (IFRS 17.B78, B80–B82, and B44). These principles are consistent with some of the requirements of fair value measurement set out in IFRS 13 (IFRS 13.69, 79, 83, 89, and Appendix A).

These key principles may be summarized as follows:

1. Maximise the use of observable market inputs.
2. Observable market prices from active markets would be used without adjustment.
3. Observable market prices from non-active markets would be adjusted to make them comparable with market prices from active markets.

The considerations for assessing the end of the observable period in Canada are the same for entities applying the ‘top-down’ or the ‘bottom-up’ approach for developing discount rates.

### 1.2 Setting the last observable point

The last observable point for risk-free discount rates would correspond to the term of the asset with the longest maturity for which there is a quoted price from an active market (i.e., a Level 1 input under IFRS 13). IFRS 13 defines an active market as a market in which transactions for an asset take place with sufficient frequency and volume to provide pricing information on an ongoing basis. This section illustrates how the principles of IFRS 13 could be applied in Canada in order to determine the last observable point for risk-free assets.

To assess the volume of risk-free assets in Canada, either Government of Canada bonds (GoC) or Canadian-dollar interest rate swaps would be considered. GoC debt securities[1] were used to assess the terms of risk-free assets available in the Canadian market (see Section 1.2.1). GoC bonds were chosen because it is a large and liquid market in Canada.

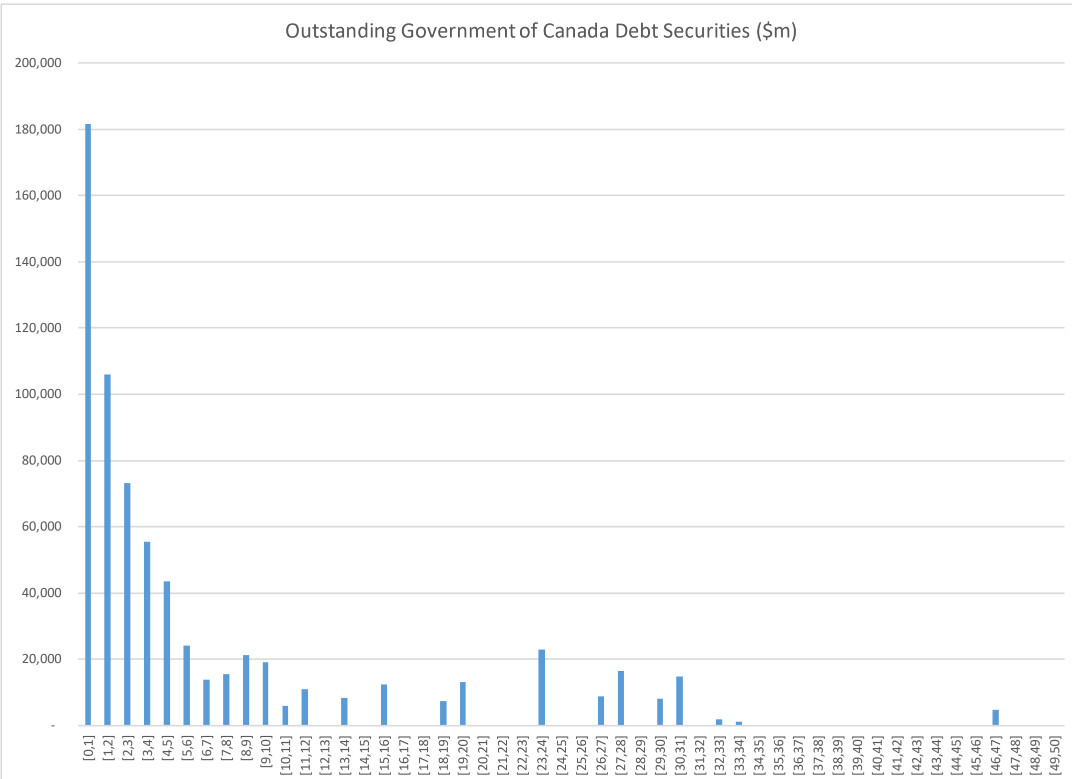
[1] GoC debt securities include both treasury bills (up to 1-year term) and bonds (over 1-year term). The terms “debt securities” and “bonds” are used interchangeably in this draft educational note since the focus is on longer-term rates and the impact of treasury bills is limited.

To assess whether there is a sufficient frequency of transactions for risk-free assets in the market, factors such as bid-ask spread, trading volume, trade size, and the impact of trades (see Appendix 1) were considered.

Based on the analysis outlined in this section, it would be reasonable to set the last observable point for GoC bonds at 30 years.

### 1.2.1 Volume of Outstanding Government of Canada Debt Securities

***Chart 1***




Source data are available at https://www.bankofcanada.ca/stats/goc/results/en-goc_tbill_bond_os_2017_12_31.html.

Chart 1 shows the par value of outstanding GoC debt securities as of December 31, 2017. This represents the universe of potential terms that would be considered in establishing the last observable point.

The longest-term GoC bonds have a maturity of December 1, 2064. These bonds are part of the GoC's tactical issuance of 'ultra-long' bonds. The government has issued these bonds in five tranches over the period 2014 – 2017.

In developing risk-free rates for Solvency II application for Euro denominated rates, European Insurance and Occupational Pensions Authority (EIOPA)[2] used a residual value criterion to assess whether there was a deep and liquid market (or active market) for debt securities. Under this methodology the amount of assets in excess of a certain term is compared to the total

[2] EIOPA is one of the three European supervisory authorities responsible for microprudential oversight at the European Union level, being part of the European System of Financial Supervision.

outstanding amount of assets. When the ratio of these two amounts falls below a certain level, the market is considered not to be deep, liquid, and transparent. EIOPA used a 6% criterion. When developing risk-free rates for Solvency II application for other currencies, EIOPA used the depth, liquidity, and transparency assessment which provided a non-exhaustive list of criteria that would be considered when setting the last liquid point[3]. This resulted in setting the last observable point at 30 years in Canada.

The data in Chart 1 has the following distribution of assets:

- 67% of GoC debt securities mature between 0 to 5 years.
- 14% of GoC debt securities mature between 5 to 10 years.
- 8% of GoC debt securities mature between 10 to 20 years.
- 8% of GoC debt securities mature between 20 to 30 years.
- 3% of GoC debt securities mature in over 30 years.

While there is significant judgment involved in the residual volume approach, it is noted that only 3% of outstanding GoC debt securities outstanding having a term in excess of 30 years. In addition, due to the fact that the GoC has only issued ultra-long bonds five times, there may not be a sufficient amount of bonds that trade in the over 30-year market to be considered an active and relevant market.

**Based on this analysis, it would be reasonable to set the last observable point for GoC bonds at 30 years. Estimates for risk-free discount rates beyond 30 years would be estimated per the requirements of IFRS 17.**

A second set of considerations for assessing the last observable point includes factors such as bid-ask spread, trading volume, trade size, and the impact of trades. Please see Appendix 1 which illustrates how these factors would be used in determining the observable period for GoC bonds.

### 1.3 Government of Canada bonds data from non-active markets

As noted above, GoC bonds with a maturity date longer than 30 years infrequently trade in the market. Given the lack of an active market for these assets, they are usually priced with reference to the nearest benchmark GoC bond (i.e., at a premium or discount to the 30-year bond).

When interpolating the risk-free discount curve beyond 30 years, IFRS 17 requires observable data from non-active markets to be considered. For terms along the yield curve where prices from non-active markets exist for GoC bonds, an actuary would assess if the interpolated rate at the same term is reasonable.

Given the current limited supply of longer than 30-year GoC bonds, it requires significant judgment to make this assessment. Due to the high demand for these bonds, their yields may be artificially depressed and would need to be adjusted for the purpose of setting the discount

[3] https://eiopa.europa.eu/regulation-supervision/insurance/solvency-ii-technical-information/risk-free-interest-rate-term-structures

curve. The results of an interpolation method that grades to an ultimate rate, such as described in Section 2, could be viewed as an acceptable set of adjusted yields.

**1.4 Assessing the last observable point for assets other than Government of Canada bonds**

The factors and analysis prepared in Section 1.2 for GoC bonds would be considered in establishing the last observable point for other fixed income securities, such as corporate bonds. If it is concluded that the last observable point is earlier for a class of assets other than GoC bonds, then the observable market prices of GoC bonds would be considered when interpolating the yield curve for such assets beyond their last observable point.

## 2. Setting the long-term risk-free rate (unobservable ultimate rate)

This section provides guidance on how to derive long-term risk-free rates in Canada when such rates are not directly observable in the Canadian market. Risk-free rates in Canada are typically observable and relevant over a period of 30 years, as discussed in Section 1. Beyond this point, an actuary would estimate an ultimate risk-free rate and derive an interpolation technique to grade from the last observable rate to the ultimate rate.

This section also provides guidance on methodologies to interpolate from the last observable rate to the ultimate risk-free rate.

**2.1 Key principles**

IFRS 17 does not require a particular estimation technique for determining the long-term rates. However, IFRS 17.B78 and B82 highlight the key principles to follow when performing such estimation:

1. Maximise the use of observable inputs. (Discount rates shall not contradict any available and relevant market data, and any non-market variables shall not contradict observable market variables.)
2. Reflect current market conditions from the perspective of a market participant.
3. Develop unobservable inputs using the best information available in the circumstances.
4. Might place more weight on long-term estimates than on short-term fluctuations.

On this basis, listed below are some characteristics that may be desirable when setting the discount curve beyond the last observable point:

1. Stability: The ultimate interest rate would be more stable over time. That is, on average, one might expect the variability of long-term interest rates to be lower than short-term rates.
2. Smoothness: Interpolated rates would follow a smooth path from the last observable point to the ultimate long-term rate.
3. Simplicity: The approach would be easy to understand and implement.

**2.2 Setting the ultimate risk-free rate**

In developing long-term estimates of interest rates, market participants may take into consideration multiple observable inputs (e.g., historical information, forward-looking expectations, economic environment and cycle, etc.). Multiple approaches to set the ultimate risk-free rate are discussed in this section and the actuary would consider the available information when developing the estimate. Numerical examples related to these techniques may be found in Appendix 2. Based on these examples, it is expected that an ultimate long-term risk-free rate of 3.5% to 5% would be reasonable in Canada.

### 2.2.1 Historical nominal rate

Historical data of select GoC bonds across various terms can be used as a potential data source for calibrating long-term risk-free rates under IFRS 17. The underlying data could be used to construct a historical average of the long-term risk-free rates; this approach implies that interest rates will revert to their historical mean or median.

Source of the underlying data can be found on the Bank of Canada (BoC) website[4]. This is based on mid-market closing yields over time based on pricing observed in financial markets typically through bond auction.

The key areas of judgment in applying this approach are the:

- length of the historical period;
- adjustments for the high-inflation period;
- adjustments to remove outliers that do not fit long-term view or match current or expected future market conditions; and
- use of par rates as an approximation to spot and forward rates. (Given the yield curve has historically been upward sloping on average, this approximation leads to lower spot and forward rates than otherwise.)[5]

Advantages and disadvantages related to this method are as follows:

| Advantages | Disadvantages |
|---|---|
| Fairly Stable (if averaging period long enough) | |
| Covers multiple market cycles | Limited (or little) weight to current market conditions with no forward-looking inputs |
| Data easily available, on all terms | Does not consider any structural change (i.e., is past inflation in line with future expectation) |
| Predictable | |
| Simple to understand and implement | |

### 2.2.2 Historical real interest rate + inflation target approach

The ultimate nominal interest rate expectation can be decomposed into two parts: the ultimate real interest rate and the ultimate inflation expectation. This method implies independence of real interest rates and inflation.

[4] https://www.bankofcanada.ca/rates/interest-rates/lookup-bond-yields/

[5] Par rates include semi-annual coupons; as such the bond that corresponds to the 30-year par rate will have a duration that is less than 30 years. Assuming the yield curve is upward sloping, the 30-year spot rate would therefore be higher than the 30-year par rate.

Ultimate real interest rates could be approximated using historical data as was done in Section 2.2.1. Regarding inflation, a reasonable indicator would be the inflation-control target that was adopted by the BoC and the GoC in 1991 and that has been renewed several times since then. The target aims to keep total Consumer Price Index (CPI) inflation at the 2% midpoint of a target range of 1% to 3% over the medium term. The BoC raises or lowers its policy interest rate, as appropriate, in order to achieve the target within a certain time horizon.

The historical real interest rate + inflation target methodology is also the one that was proposed and endorsed by EIOPA and is used in Solvency II[6]. It is also the method currently proposed by the International Association of Insurance Supervisors (IAIS) for the Insurance Capital Standard (ICS).

The key areas of judgment in applying this approach are the:

- length of the historical period (for real rates) and adjustments for outliers;
- recognition period of any inflation-control target change (instant recognition versus gradual recognition). Year over year changes could be limited to achieve stability, as is done in Solvency II; and
- Use of par rates as an approximation to spot and forward rates.

Advantages and disadvantages related to this method are:

| Advantages | Disadvantages |
|---|---|
| Expected to be stable | |
| Considers historical as well as forward-looking information (market expectations about future rates) | Relies on BoC production (less predictable, some judgment potentially applied) |
| Partly relies on current market conditions and reflects some structural changes | Real rates are not publicly available for a long historical period (must be derived using the difference between historical nominal rates and inflation rates) |
| Consistent with techniques used in other countries (i.e., Europe) | |
| Relatively simple to understand and implement | |

### 2.2.3 Real GDP growth expectation + inflation target approach

Economic theory suggests that there is a strong relationship between real interest rates and real GDP growth. This is consistent with the fact that the rate at which businesses are willing to borrow (i.e., long-term rate) would equal to the expected marginal return on investments (which, on a macro scale, corresponds to the GDP growth rate).

One way to derive real GDP Growth expectation could be to look, as for the real interest rate expectation, at historical GDP Growth rate. This method would share the key areas of judgment as well as advantages/disadvantages discussed previously. The main advantage of historical real

[6] https://www.eiopa.europa.eu/content/eiopa-publishes-calculation-ultimate-forward-rate-2020_en

GDP growth rate over historical real interest rates is that the information is more readily available, with few adjustments.

Another way to derive real GDP growth expectation would be to rely on studies and forecasts readily available. For example, the forecast from the Organisation for Economic Co-operation and Development (OECD) could be used. The OECD publishes real GDP growth forecasts up to 40 years. The real GDP growth expectation is closely related to the growth rate of available workers and the growth rate of labour productivity. The main advantage of such a technique would be to embed forward-looking information and reflect current market expectations of future interest rates. The drawback is that it heavily relies on the availability of these studies and might be adjusted from time to time. As for the inflation-control target, any change in expectation may need to be recognized over an appropriate period, to make sure that the stability principle is maintained. A key area of judgment will be the recognition period of any OECD GDP growth forecast change (instant recognition versus gradual recognition). Year-over-year changes could be limited to achieve stability.

As market participants do not necessarily rely solely on one aspect to build long-term expectations, any other hybrid approach, considering historical information, and future expectations could be considered.

Advantages and disadvantages related to these methods are:

| Advantages | Disadvantages |
|---|---|
| Relatively simple to understand and implement | Range of method/model is large |
| Consistent with economic theory (and thus, can include multiple additional considerations such as demography, consumption, etc.) | Forward-looking inputs might rely on external production (e.g., BoC, OECD, etc.) |
| Can consider historical as well as forward-looking information | Historical inputs might give limited (or little) weight to current market conditions |

### 2.3 Interpolation Methodologies

#### 2.3.1 Ultimate spot versus ultimate forward rate and convergence period

Once the long-term rate level is set, the actuary would determine the construct to interpolate to the ultimate long-term rate from the last observable point. One important aspect is to determine if the ultimate interest rate derived previously corresponds to a forward or a spot rate.

Forward rates represent future implicit market rate expectations. They correspond to future period estimated interest rates. To calculate the current price of cash flows beyond the last observable point, one needs to discount using current interest rates (during the observable period) and future expectations. As it might be difficult to derive future market expectations beyond the last observable point, it is expected that the convergence period between the last observable point and the ultimate rate would be quite short.

Spot rates represent current rates used to derive today's market price of a future cash flow. To calculate the current price of a cash flow beyond the last observable point, only one spot rate is needed. As ultimate spot rates encompass the observable (current market interest rate information) and unobservable (future interest rate expectations) period, one would be cautious to make sure that the assumption used does not contradict observable inputs. For this reason, it is expected that the convergence period between the last observable market data and the ultimate duration would be longer than for the forward rate construct.

IFRS 17 is silent on how to express the ultimate rate, as a result both methods are deemed acceptable. In both cases, expert judgment is required and the resulting curve (expressed as a forward curve and a spot curve) would not contradict observable and relevant inputs. The convergence period and the interpolation techniques are key inputs to make sure that the choice of how to express the rate will not materially impact the value of the estimates of future cash flows[7]. A convergence period as short as one year could be reasonable when using an ultimate forward, while a convergence period of 30 or more years could be reasonable when using an ultimate spot rate. The length of the convergence period would depend on the differential between the forward rate of the last observable point and the ultimate forward rate under the forward rate methodology (a short period would be reasonable with a small differential and vice versa) and on the reasonableness of the underlying forward rate progression under the spot rate methodology.

### 2.3.2 Techniques

Once the long-term rate level, the construct of the curve and the convergence period are set, the actuary would determine the method to interpolate from the last observable input to the long-term rate. Multiple interpolation methods exist for curve construction. The methodology chosen impacts the speed of grading to the ultimate rate and as a result impacts the value of the estimates of future cash flows.

In their June 2006 paper, Hagan and West explored a variety of techniques and also the characteristics of a good interpolation approach, these can be summarized as:

- easy to understand and implement; and
- the continuity, positivity, and stability of forward rates.

The paper also highlights the pros and cons related to each technique explored. Some of these techniques are discussed below:

1. **Linear interpolation**

   The linear interpolation is a straight-line interpolation from the last observable rate to the ultimate rate. It only requires two rates as well as an interpolation period. Linear interpolation can be applied on the rates themselves (spot or forward), on the log of the rates, on the discount factors, or on the log of the discount factors.

[7] Forward and spot curves can be quite different. However, if the two are based on consistent underlying assumptions, the resulting present values will be similar.

| | |
|---|---|
| Ease of understanding and implementation | ✔ |
| Continuity of forwards | ✗ |
| Positivity/stability of forwards | ✗ |
| Sensitivity to changes in observable rates* | Medium |

*Relative to the Cubic-Spline interpolation and the Monotone Convex splines

**2. Cubic-spline interpolation**

Cubic-spline interpolation is a special case of spline interpolation. A spline is a piecewise polynomial in which the coefficients of each polynomial are fixed between joints. Then, the coefficients are chosen to match the function and its first and second derivatives at each joint. Though more complicated than linear, this method gives an interpolating polynomial that is smoother (continuity of first and second derivative) and has smaller error than various other interpolating polynomials. However, even if the spline is supposed to alleviate the problem of oscillation seen when fitting using a single polynomial, significant oscillatory behaviour can still be present, strongly depending on the number and the relative value of each joint.

| | |
|---|---|
| Ease of understanding and implementation | ✗ |
| Continuity of forwards | ✔ |
| Positivity/stability of forwards | ✗ |
| Sensitivity to changes in observable rates* | High and unpredictable |

*Relative to the Linear interpolation and the Monotone Convex splines

**3. Monotone Convex Splines**

The possibility of finding a spline interpolant which is monotone (or convex) is considered with this technique. The investigation is carried out by constructing an auxiliary set of points and using monotonicity and convexity preserving properties. Using such a method, the forward curve is typically continuous and guaranteed to be positive. Moreover, the forward rates are more stable as inputs change (i.e., they change more or less proportionately).

| | |
|---|---|
| Ease of understanding and implementation | ✗ |
| Continuity of forwards | ✔ |
| Positivity/stability of forwards | ✔ |
| Sensitivity to changes in observable rates* | Medium |

*Relative to the Linear and Cubic-Spline interpolation

Other common approaches, as described below, could also be used:

**4. Smith & Wilson**

Smith & Wilson (2000) also published a model for bond prices using linear combinations of spline functions with long-term yield constraints. The pricing function is set up as the sum of a term representing the long-term behaviour of the discount factor (ultimate rate) and a linear combination of N kernel functions. This model is well known since it is used to derive the discount curve under Solvency II. It is attractive from a calibration perspective (good fit to observed market data) as well as generating a smooth and reasonable yield curve. As with any other techniques, it requires some expert judgment (e.g., setting the speed of convergence parameter).

**5. Nelson and Siegel**

Nelson and Siegel (1987) introduced a parametrical model for yield curves that can represent the shapes generally associated with various yield curves. It is widely used in practice for fitting the term structure of interest rates. The model requires four parameters: a long-term component, a short-term component, a medium-term component, and a decay factor. Parameters are fitted via a least squares or similar algorithm. The model generally behaves well at long maturities and parameters can be set to virtually fit any yield curve.

All the approaches described above could be appropriate methodologies to use to interpolate between the last observable market data and the ultimate rate.

## 3. Liquidity characteristics of insurance contracts

This section provides guidance on how to qualitatively assess the liquidity characteristics of insurance contracts for the purpose of constructing discount rates. For practical purposes, entities could assign groups of insurance contracts to a number of liquidity categories, and construct discount curves for each liquidity categories rather than for each group. This note does not limit or prescribe an exact number of liquidity category, as it is difficult to generalize all product features in the Canadian market to fit into a specific number of liquidity categories. Actuaries would apply judgment when they set up the number of categories, and then assign groups of contracts to these categories.

Observable inputs and current market conditions would not impact the qualitative assessment of insurance contract liquidity, as the liquidity characteristics are based on the product designs and features. The current market information will be reflected in the quantitative development of the liquidity premium.

### 3.1 Key principles

1. The liquidity characteristics of an insurance contract can be qualitatively assessed by considering product features that could produce an exit value, along with other considerations such as inherent value and exit cost criteria introduced by the draft educational note on *Application of IFRS 17 Insurance Contracts*[8].

[8] Contracts with low inherent value could be considered liquid even though they have no exit value. Alternatively, contracts with high inherent value and exit costs could be illiquid even if they have an exit value.

2. Contracts with similar characteristics would have similar liquidity premiums.

**3.2 Liquidity characteristics based on exit value**

The standard provides guidance on how to assess the liquidity of an insurance contract in paragraph B79:

> *Yield curves reflect assets traded in active markets that the holder can typically sell readily at any time without incurring significant costs. In contrast, under some insurance contracts the entity cannot be forced to make payments earlier than the occurrence of insured events, or dates specified in the contracts.*

Accordingly, the liquidity characteristics of a group of insurance contracts can be assessed by looking at features that could force the entity to make payments earlier than the occurrence of insured events, or dates specified in the contracts. This criterion is termed by the draft educational note *Application of IFRS 17 Insurance Contracts* as the "exit value".

Below are some features of typical Canadian products that could create an exit value. An exit value is an important feature to consider when assessing liquidity, but the additional criteria in Section 3.3 would also need to be considered.

When building discount curves for cash flows that do not vary based on the returns of underlying items, any existing underlying items would not be considered in the assessment of liquidity. For example, the fact that an underlying item exists for a universal life contract (the fund value) would not impact the discount curve used for the cash flows that do not vary with the underlying item. If a group contains contracts that cover multiple products with different liquidity characteristics, the actuary would apply judgment and consider materiality when assigning them to the liquidity categories.

The table below lists typical Canadian products and provides a liquidity consideration based on the exit value present in the contract.

| **Product type** | **Product features that could create an exit value (increase liquidity)** |
|---|---|
| Traditional Whole Life Insurance/Endowment | Cash surrender value (CSV) |
| Term Life Insurance | None |
| Universal Life Insurance | CSV |
| Critical Illness Insurance | Return of premium (ROP) on surrender rider |
| Long-term Care | None |
| Deferred (Accumulation) Fixed Annuity | Most policies have voluntary withdrawal rights, some can withdraw on a book value basis or the lesser of book and market value. |
| Segregated Funds Guarantee | Account value |
| Group Life and Health Insurance (including Group Disability Income) | None |
| Individual Disability Income | ROP on surrender or maturity rider |

| Product type | Product features that could create an exit value (increase liquidity) |
|---|---|
| Liabilities for Incurred Claims (e.g., Group/Individual LTD claims) | None; claimants do not receive any value upon termination. |
| Payout Annuity | None; annuitants do not receive any value on termination. |
| Creditor Insurance | ROP on surrender rider without restrictions |
| Stop Loss, Catastrophe Reinsurance | None |
| YRT reinsurance (mortality or morbidity risk only) -reinsurance held | None |
| Coinsurance<br>Modified Coinsurance with and without Funds Withheld – reinsurance held | The reinsurance contract would be evaluated separately from the direct contract. For coinsurance, the liquidity characteristics could be the same as the underlying contracts. However, this could vary based on the specific provisions in the reinsurance contract, including recapture provisions contained in the reinsurance contracts. |

### 3.3 Liquidity characteristics based on inherent value and exit cost

The draft educational note on *Application of IFRS 17 Insurance Contracts* recommends that entities consider "inherent value" and "exit cost" criteria when assessing liquidity characteristics of insurance contracts. Although IFRS 17 does not explicitly cover these criteria, the actuary is encouraged to take these factors into consideration. The table below lists typical Canadian products and the product features that will have an influence on liquidity characteristics based on inherent value and exit cost.

| Product type | Product features that could build up the contract's inherent value (decrease liquidity) | Product features that could create an exit cost (decrease liquidity) |
|---|---|---|
| Traditional Whole Life Insurance / Endowment | •Level premium payments<br>•Long contract boundary<br>•Waiver of Premiums | •Surrender charges, typically short term and decreasing over time |
| Participating Life Insurance | •Level premium payments<br>•Long contract boundary<br>•Policyholder dividend features, especially the paid-up addition (PUA) option<br>•Product guarantees | •Surrender charges, typically short term and decreasing over time |
| Term Life Insurance | •Level premium payments<br>•Long contract boundary (T75/T100 less liquid than T10/T20) could be | |

| Product type | Product features that could build up the contract's inherent value (decrease liquidity) | Product features that could create an exit cost (decrease liquidity) |
|---|---|---|
| | correlated with higher inherent value<br>•Convertible features – convertible to a permanent product without underwriting<br>•Renewable features – no underwriting at renewal | |
| Universal Life Insurance | •Minimum interest rate guarantee on GIC-type investment accounts<br>•Long contract boundary<br>•Level Cost of Insurance<br>•Limited Pay features | •Surrender charges, typically short term and decreasing over time<br>•Market value adjustments |
| Critical Illness Insurance | •Medium to long contract boundary<br>•Optional riders such as ROP on expiry, waiver of premium (maintains coverage if the owner of the policy becomes totally disabled and/or dies depending on the option chosen)<br>•Long-term care conversion option | |
| Long-term Care | •Medium to long contract boundary<br>•Riders such as waiver of premiums, restoration of original benefits, and inflation protection benefit | |
| Deferred (Accumulation) Fixed Annuity | •Minimum interest rate guarantee | •Withdrawal basis; lesser of book and market value |
| Segregated Funds Guarantee | •Death, maturity, withdrawal, income, or other guarantees | •Surrender charges, typically short term and decreasing over time |
| Group Life and Health (including Group Disability Income) | •Pooled risks and profit-sharing arrangements | |

| Product type | Product features that could build up the contract's inherent value (decrease liquidity) | Product features that could create an exit cost (decrease liquidity) |
|---|---|---|
| Individual Disability Income | • Optional riders such as ROP when little or no claims have occurred, and inflation protection benefit<br>• Benefit continues for life rather than a shorter benefit period (typically to age 65 or 71). | |
| Adjustable Life and Health Insurance | • Adjustability does not change liquidity from the policyholder's perspective | |
| Reinsurance | • Facultative submission (involves excess capacity, underwriting assistance, shopping for competitive rates, etc.)<br>• Assumption reinsurance<br>• Recapture is not available | • Recapture fee |

The actuary would consider all characteristics of a product to assess its liquidity. The tables above provide some guidance on characteristics to consider when making such assessment. Lapse level, tax implications and underwriting considerations are all additional factors that could be considered when assessing liquidity.

The presence of some features that add liquidity does not necessarily imply that a product is highly liquid, all characteristics would be considered. For example, a whole life product with cash surrender values could still be considered illiquid if the inherent value build-up is high and the policyholder cannot access it. Alternatively, a product without cash surrender values but with little inherent value build up could be considered liquid.

## 4. Development of liquidity premiums

This section provides guidance on how to quantitatively derive the market-based liquidity premium for the purpose of constructing discount rates, including practical ways to implement the top-down and bottom-up approaches. This section also provides guidance on approaches that can be used to set the liquidity premium in the unobservable period.

### 4.1 Key principles

IFRS 17 does not require a particular technique for determining the liquidity premium. However, IFRS 17.B78–B85 highlight the key principles to follow when performing such estimation:

1. Maximize the use of observable inputs and reflect current market conditions.

2. Exercise judgment to assess the degree of similarity between the features of the insurance contracts and assets with observable prices and make further adjustments as needed.
3. For liquidity premiums beyond the last observable point, the entity might place more weight on long-term estimates than on short-term fluctuations.

In theory, where insurance contracts are highly illiquid the discount rates could be set at a rate that is higher than the expected yield or market return on a portfolio of (less illiquid) assets. The actuary would understand the implications of setting discount rates that create a negative bias in investment results.

### 4.2 The top-down approach

The top-down approach requires the actuary to first construct a yield curve based on returns on a reference portfolio of assets, and to adjust the yield curve to eliminate factors not relevant to the insurance contract (e.g., credit and market risks) to arrive at a discount curve. This section discusses these two steps and provides practical examples of how to adjust the yield curve for credit and market risk.

#### 4.2.1 Reference portfolio

A portfolio of assets can be used as the reference portfolio if it reflects the characteristics of the insurance contracts (e.g., currency, liquidity).

An actuary may be able to justify using the entity's assets as a reference portfolio if it reflects the characteristics of the contracts or the yield curve can be adjusted to reflect those characteristics.

The following section discusses the pros and cons of two types of reference portfolios.

| | **Advantages** | **Disadvantages** |
|---|---|---|
| Own Assets Portfolio<br><br>(The portfolio would consist of own assets) | • Enables partial linkage between the insurance contract discount rates and supporting asset returns.<br>• Reduce earnings and/or balance sheet volatility as assets/liabilities will move together for changes in risk-free rates and liquidity premium. | • Operationally more difficult to produce as the reference portfolios must be adjusted as the asset holdings change.<br>• Actuary would need to demonstrate the portfolio reflects the characteristics of the liabilities<br>• Trading activities in the asset portfolio can affect the insurance contract value and if the impact is significant it would be disclosed. |
| Custom/Reference Portfolio | • Operational simplicity<br>• Separation between insurance contract | • Can increase earnings and/or balance sheet volatility if there are differences between |

| | | |
|---|---|---|
| (The portfolio would be composed of assets that best reflect the characteristics of the insurance contracts) | reference portfolio and actual asset portfolios, easier to make adjustments to align liquidity characteristics, if needed<br>• Actual trading activities will not affect the discount rates | underlying assets held and the custom reference portfolio. |

#### 4.2.2 Credit risk adjustment

Once a reference portfolio is selected, adjustments are required to eliminate factors that are not relevant to insurance contracts such as credit risk. In this section, two approaches are discussed for the derivation of the credit risk adjustment: a credit loss model approach, and a market-based approach using credit default swaps.

**Credit loss model approach**

The actuary can build a credit loss model to explicitly calculate both the Expected and Unexpected Credit Losses (ECL and UCL); the ECL and UCL are both deducted from the yield. The ECL represents the expected present value of losses that arise if a borrower defaults on its obligations at some time during the life of the financial asset. One common formula used to calculate ECL is: $ECL_t = PD_t$ (probability of default) x $LGD_t$[9] (loss given default) x $EAD_t$ (exposure at default) for each point in time t. The total ECL would be equal to the sum of the present value of all future $ECL_t$'s.

One way to value the ECL is to look at historical information and is often referred as to a “through-the-cycle” (TTC) estimation. This approach would lead to a very stable adjustment for ECL and UCL, and as a result, adjustments may be required in some market conditions. Forward-looking techniques or “point-in-time (PIT) estimations, such as those used for IFRS 9, could be applied to reflect current actual default behaviour, market dynamics and current economic cycle. Some approaches can be found in Appendix 4.

UCL represent the cost of bearing the risk. It represents the compensation sought by an investor to face variations in credit losses. Several approaches to determine the UCL can be found in Appendix 4.

**Market-based approach**

The credit default swap (CDS) spreads compensate investors for taking on the credit risk associated with the underlying reference entities. CDS spreads therefore inherently account for both the ECL and UCL that would be deducted from the reference portfolio yield when using a top-down approach to derive IFRS 17 discount rates.

However, CDS information in Canada is limited. According to a published note from BoC: “A CDS index does not currently exist for Canada and only eight Canadian reference entities are included in the various North American indexes. The universe of liquid CDSs on Canadian-based

[9] LGD is the percentage of the loan that is not recoverable if a default occurs.

entities is too small to create a diversified index." In addition, CDS spread reflects risks other than credit such as counterparty risk and liquidity risk. It may be difficult to extract the credit component out of the CDS spread. Hence, it is not recommended that entities rely on Canadian CDS data solely when deriving the credit risk adjustment.

Entities can extract CDS information from other markets, such as the US market and adapt it for Canadian use. Still, in practice, only a select number of reference entities are available under the CDS indexes. Therefore, it would be up to the actuary to make the appropriate adjustments to account for both the difference in asset composition between the reference portfolio and the CDS index as well as the difference in markets. A description of how CDS information from the US/North American market can be adapted for Canadian use can be found in Appendix 4.

#### 4.2.3 Market risk adjustment

A reference portfolio could contain non-fixed income assets such as public equity and real estate. Public equities are considered to be highly liquid since they can usually be sold at any time at the prevailing market price. Therefore, the risk premium over risk-free rate represents a premium for market risk and would not be considered relevant to the insurance contract and would be removed from the discount rate. However, investments such as real estate which are real property that consists of land and improvements, which include buildings, fixtures, roads, structures, and utility systems, typically include a liquidity component in their price and expected return. The actuary could take the position that such a liquidity premium is a component of the return and include it in the discount rates derived from the reference portfolio.

For example, for real estate, the accounting carrying value of the asset is the result of an estimation done by evaluators whose models incorporate expected cash flow projections and a discount rate. The cash flows include inflows (lease income, growth, etc.) as well as outflows (vacancy rate, leasehold improvements, maintenance and repairs, administration expenses, cost of leverage). The discount rate represents the required rate of return on the asset. If the cash flows include all expected inflows/outflows, the future income method of valuing business assumes that the discount rate is mainly composed on the following elements:

1. Current risk-free rate
2. A liquidity risk premium
3. Market risk premium (encompassing all other risks associated with real estate, except illiquidity)

The market risk premium could be estimated using multiple techniques. One possible technique could be to use the cost-of-capital approach (e.g., based on LICAT), as for fixed-income asset unexpected losses. Then, the liquidity premium is estimated as the discount rate less the risk-free rate less the market risk premium. The actuary would need to ensure the relationship between the cash flows and the discount rate is consistent. For example, when cash inflows do not include the long-term growth assumption, the rate used to present value would be the CapRate (i.e., Cap Rate = Discount Rate – Long Term Growth).

### 4.3 The bottom-up approach

The bottom-up approach aims to explicitly derive a liquidity premium over risk-free rates. The following approaches were considered in deriving the liquidity premium:

- A hybrid approach that combines a market spread based on an asset reference portfolio adjusted to remove the ECL and UCL, and a constant adjustment to account for the difference in liquidity level between the asset reference portfolio and the insurance contracts.
- A market-based approach using covered bonds and National Housing Act (NHA) mortgages.

**Bottom-up approach, but with a liquidity premium curve derived from a top-down analysis (referred to as the Hybrid Approach)**

The liquidity premium can be expressed as a fixed percentage of asset reference portfolio spread over risk-free rates and an additional constant adjustment to reflect the difference between the liquidity characteristics of the insurance contract and the asset reference portfolio.

$$Liquidity\ Premium = r * asset\ reference\ portfolio\ spread\ over\ risk\ free + \ constant$$

The multiplicative factor *r* represents the portion of the asset spread that relates to the liquidity premium and can be calibrated historically by calculating [asset spread – (expected loss + unexpected loss)] / (asset spread). For simplicity, *r* can be a single percentage across the curve. Alternatively, entities can also calibrate *r* based on the term structure of the credit default adjustment. With the term structure, and, if the same reference portfolio is used, the bottom-up approach and the top-down approach can be reconciled exactly.

The multiplicative factor r would depend on the assets in the reference portfolio. If the reference portfolio is comprised of Canadian publicly traded corporate bonds, then based on the top-down approach and empirical research results (see Appendix 3), credit risk typically accounts for 15%–40% of the overall asset spread. The multiplicative factor *r* would then be in the range of 60%–85%. The top end of the range, 85%, would be appropriate in some circumstances such as in a liquidity crisis event. Similarly, the minimum would only be appropriate in circumstances where credit risk has significantly increased. It would be reasonable to use a factor closer to the middle of the range in normal market conditions.

The constant in the formula is to account for the liquidity difference between assets in the reference portfolio (asset spread) and the insurance contracts. The application of the constant adjustment depends on the combination of reference portfolio and the liquidity characteristic of the insurance contracts:

- For highly liquid cash flows (e.g., amounts on deposit), it is likely that a reference portfolio can be found from the market that approximates the liquidity characteristics of the insurance contract very well, therefore the constant adjustment is not needed.
- For illiquid cash flows (e.g., T100), with liquidity characteristics similar to those of mortgages and private debts, if the reference portfolio already contains illiquid assets such as private debts and mortgages, the constant adjustment may also not be

necessary. If the liquidity premium was set using a combination of investment grade bonds (A to BBB) and a constant adjustment, then the constant could be defined as the historical difference between mortgage and private debt spread versus investment grade bonds. This approach may be favored as the spread data for investment grade bonds are more easily observable than for mortgages and private debts.

  - In this paper it is estimated that an adjustment of up to 50 bps could be appropriate. This was estimated using the historical spread difference of privates and mortgages versus investment grade bonds with similar credit ratings.

- It is noted that certain insurance contracts may be even less liquid than these types of assets. It could be concluded that some of the Canadian products, such as Term to 100 without cash surrender value, are very illiquid and that the liquidity premium could exceed that of mortgages or private debts. The actuary would use their professional judgment when determining the liquidity premium for these types of contracts, the pricing of these contracts may be a good reference to inform this judgment. The actuary would understand the implications of setting a discount curve that creates a negative bias in investment results.

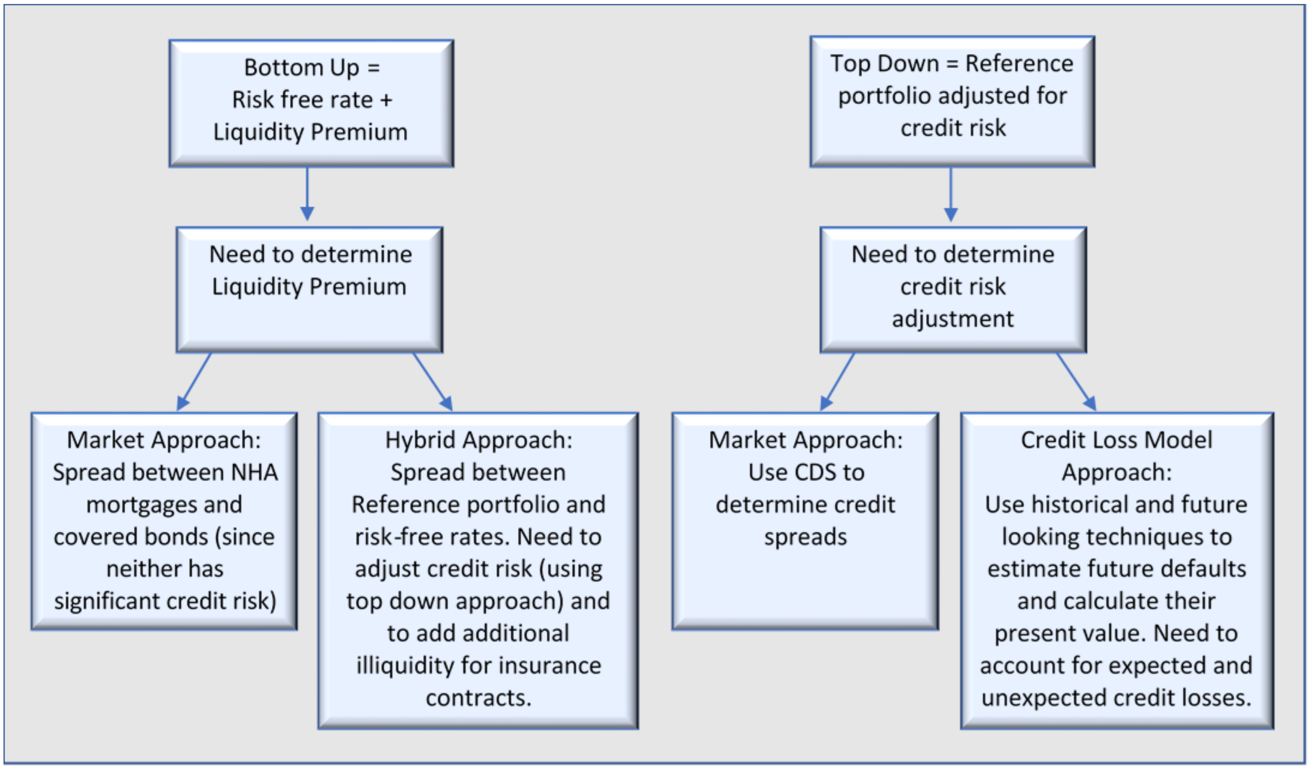
**Market-based techniques**

Market based techniques aim to use the spread difference between covered bonds and risk-free bonds in the same currency to directly derive the liquidity premium. In Canada, the Canadian registered covered bonds and NHA Mortgage Backed Securities (NHA MBS) are both insured by Canada Mortgage and Housing Corporation and thus carry no credit risk. Any spreads over the GoC risk-free rates can be interpreted as a liquidity premium. However, there are a number of limitations:

- Covered bonds: There are a limited number of issuers and all the issuers are banks. They are mostly denominated in Euro. There is a lack of index data. The longest maturity is 10 years and significant interpolation is required.
- NHA MBS: They have maturity of up to five years and significant interpolation is required. The spread over GoC risk-free rates is only published at the time of transaction. There is no established index for NHA MBS.

Due to the limitations described above, neither would be appropriate as a standalone source for calculating the liquidity premium in the IFRS 17 discount curves.

The following diagram summarizes the different approaches that can be used to determine the discount rate:




**4.4 Ultimate liquidity premium**

Beyond the observable period, the discount rates will grade to an ultimate rate which can be set in the form of ultimate risk-free rate plus ultimate liquidity premium. The subcommittee provides an example below on how to derive an ultimate liquidity premium applying the bottom-up approach and using the credit loss model.

**Example:**

1) An entity sells two types of products, one liquid and one illiquid, and as a result two liquidity categories are set up to derive the discount rate.
2) Two asset reference portfolios were selected that reflect the characteristics of the insurance contracts as the basis of the analysis.
3) The ultimate liquidity premium is assumed to be equal to the historical average of the liquidity premium on the 30-year term for each reference portfolio. No further adjustment was made for any term premium.
4) The credit loss model approach was used to calculate the credit adjustment, as well as the approaches described in Appendix 4 to calculate an unexpected credit loss component. This led to a range of outcomes and the ultimate liquidity premium was selected by considering the range of historical outcomes and the level of the overall ultimate rate.

| Liquidity Categories | Asset reference portfolio | Example of Ultimate liquidity premium (bps) |
|---|---|---|
| **Liquid (Amounts on deposit)** | Provincial bonds | 70 |
| **Illiquid (T100)** | Privates and uninsured mortgages | 150 |

It is interesting to note that the liquidity premium could converge to an ultimate liquidity premium at a faster pace than risk-free rates. As opposed to the risk-free rate, which is observable up to 30 years, the liquidity premium is not directly observable. It is estimated based on techniques discussed previously and relevant market information is only available on a short-term basis (e.g., CDS are generally only observable up to five years). As liquidity premiums are mostly based on estimation techniques, a faster convergence period might be more appropriate, would not contradict observable market data and would avoid short-term fluctuations.

## 5. Other observations

When setting the discount curve, the actuary would also consider and understand the implications associated with the chosen formulation. In theory, the discount rates could be set at rates that are higher than the expected yields or market returns on a portfolio of assets, for example:

- The higher the ultimate risk-free rate or liquidity premium, the higher the insurance finance expense (and vice versa).
- The higher the liquidity premium in the observable period, the higher the insurance finance expense (and vice versa).
- The methodology chosen to interpolate the curve between the last observable point and the ultimate rate impacts the speed of grading to the ultimate rate. To the extent the ultimate rate is higher than current rates, the faster the grading the higher the insurance finance expense (and vice versa).

In addition, the discount curve has implications on other aspects of the financial statements, such as:

- the discount curve impacts the initial CSM and subsequent insurance service results; and
- the discount rate formulation impacts the sensitivity of the estimate of future cash flows to changes in interest rates, etc.

Appendix 5 presents a very simple example based on a five-year life insurance contract. In this example, it can be observed that overall, the IFRS 17 discount curve does not increase or decrease profits. It only impacts the profit timing and the allocation between investment and insurance results.

## 6. Cash flows that vary based on the returns on underlying items

This section describes the application of discount rates for typical universal life products available in the Canadian market.

Separate draft educational notes provide guidance with respect to cash flows that vary with underlying items for other products. The *IFRS 17 Market Consistent Valuation of Financial Guarantees for Life and Health Insurance Contracts* includes some specific guidance related to segregated fund products. A draft educational note providing guidance on participating products is also expected to be published in 2020.

### 6.1 Key principles

IFRS 17.B74(b) provides guidance with respect to estimating discount rates for insurance contracts that have cash flows that vary with returns on underlying items. It states that an entity can either (i) discount using rates that reflect that variability or (ii) adjust the cash flows for the effect of that variability and discount them at a rate that reflects the adjustment made.

- Option (i) could be analogous to a real-world valuation framework which is concerned with producing a realistic view of potential future economic variables. In this framework, the discount rates for cash flows that vary would reflect the rates of return used to project the underlying items on a real-world basis (asset-based discount rates).
- Option (ii) permits a rate of return on underlying items that is not necessarily a real-world framework, with cash flows adjusted to be consistent. This framework relies on mathematical relationships within and among financial instruments and could include a risk neutral valuation where risk-free rates of return (with or without liquidity premium) are used to project the underlying items and to discount the cash flows. This framework could also include using the discount rates for cash flows that do not vary with underlying items as both the rate of return for underlying items and the discount rates for cash flows that vary.

IFRS 17.B75 states that the variability of insurance cash flows would be considered even if the entity exercises discretion or the underlying items are not held by the entity.

IFRS 17.B77 indicates that it is not required to divide cash flows between those that vary and those that do not vary. If the cash flows are not divided, then the discount rates would be appropriate for the estimated cash flows as a whole.

IFRS 17.B47–B48 notes that a replicating portfolio technique does not need to be applied, and that other techniques such as stochastic modelling may be more robust and easier to implement. However, where replicating assets do exist for some cash flows, the entity shall satisfy itself that the replicating portfolio technique would be unlikely to produce a materially different result. Judgment is required to determine the technique that best meets the objective of consistency with observable market variables based on the specific facts and circumstances.

Guarantees and other product features create non-linearity in the future cash flows estimation which means that the present value of future cash flows depends on the return used to project the underlying items. Features that create non-linearity often require the use of stochastic modelling techniques. Guidance relating to stochastic modelling under IFRS 17 is available in the draft educational note *IFRS 17 Market Consistent Valuation of Financial Guarantees for Life and Health Insurance Contracts*.

### 6.2 Separation of cash flows for typical Canadian universal life products

Under IFRS 17, it is possible to separate the insurance contract cash flows between those that vary with returns on underlying item and those that do not, and to use different discount rates to calculate the present value of each set of cash flows. This section describes the application of bifurcation before adjusting for the non-linearity that can be introduced by minimum crediting rate guarantees or policyholder behaviour. Section 6.3 will cover product features that create non-linearity and may require stochastic valuation.

In general, ignoring features that create non-linearity, the present value of cash flows that vary would be insensitive to changes in the rate of return on underlying items when discounted at the rate of return on underlying items, whereas the present value of cash flows that do not vary would be insensitive to changes in the rate of return on underlying items when discounted at a fixed rate.

Cash flows for universal life products can be projected under the following views:

- Whole Contract view includes all cash flows transferred between the insurer and the policyholder. This view includes cash flows such as deposits that cannot naturally be bifurcated between cash flows that do and do not vary with underlying items.
- Core Cash Flows view includes just cash flows transferred between the insurer and the product's account value. Transfers in and out of the account value by the policyholder are excluded, but the fees collected from the account value are included. This view more readily lends itself to bifurcation and is mathematically equivalent as it results in the same present value of cash flows as the Whole Contract view when all cash flows are discounted at the rate of return used to project the cash flows.

In the illustrative example below, the equivalency of the two views is demonstrated. The Whole Contract view projects deposits into the account and payouts from the account to the policyholder, while the Core Cash Flows view only projects the management expense ratio (MER) cash flows.

- Initial deposit of $10,000 at the beginning of Year 1
- Accumulated account value withdrawn at the end of Year 2
- Management expense ratio of 2%
- Return on account value of 10%
- Insurance contract discount rate of 10% (same as return on account value)

| Year | Deposit | MER | Account value (end of year) |
|---|---|---|---|
| 1 | 10,000 | (220) = 10,000 * (1 + 10%) * -2% | 10,780 = 10,000 * (1 + 10%) * (1 – 2%) |
| 2 | n/a | (237) = 10,780 * (1 + 10%) * -2% | 11,621 = 10,780 * (1 + 10%) * (1 – 2%) |

| Initial reserve | Core Cash Flows calculation: Present value of MER | Whole Contract calculation: Present value of payouts less deposits |
|---|---|---|
| (396) | (220) / (1 + 10%) + (237) / (1 + 10%)^2 | 11,621 / (1 + 10%)^2 – 10,000 |

The chart below illustrates potential bifurcation under both views. An alternative approach which does not require bifurcation would be to use the discount rate for cash flows that do not vary as the growth rate of the underlying items for cash flows that vary, and then to discount all cash flows at that rate. Any adjustment for guarantees would need to be updated accordingly. Judgment is required to determine the most appropriate bifurcation (if any) based on the product features.

| **Method** | **Whole Contract** | **Core Cash Flows bifurcation for increasing face amount** | **Core Cash Flows bifurcation for level face amount** |
|---|---|---|---|
| **Description** | Cash flows between the insurer and the policyholder are considered. | Cash flows between the insurer and the account value are considered. Cash flows between the account value and the policyholder are not considered. | Same as increasing face amount, but for level face amount products, the death benefit and cost of insurance are also split between a face amount component and a negative account value component. |
| **Cash flows that do not vary** | Deposits, death benefit, commissions, general expenses | Death benefit, cost of insurance rate * net amount at risk, expenses, initial account value | Face amount, cost of insurance rate * face amount, expenses, initial account value |
| **Cash flows that vary** | Withdrawals | Management expense ratio | Management expense ratio, (net amount at risk – face amount), cost of insurance rate * (net amount at risk – face amount) |

The net amount at risk (NAAR) for a level face amount product is equal to the face amount which is fixed less the account value which varies based on the rate of return on underlying items. Cash flows such as death benefits and cost of insurance (COI) charges depend on the NAAR.

This can be handled by splitting the NAAR into face amount and negative account value components and then discounting the face amount component at the IFRS 17 discount rates used for cash flows that do not vary and the negative account value component at the rate of return on underlying items.

### 6.3 Features that create non-linearity for typical Canadian universal life products

The present value of cash flows that vary is theoretically insensitive to any change in the rate of return on underlying items since these cash flows grow and are discounted at the same rate. However certain product features could lead to changes in the present value of cash flows when there is a change in the rate of return on underlying items (i.e., non-linearity). This section describes features that could create non-linearity in future cash flows.

Features that create non-linearity often require the use of stochastic modelling techniques. Guidance relating to stochastic modelling under IFRS 17 is available in the draft educational note *IFRS 17 Market Consistent Valuation of Financial Guarantees for Life and Health Insurance Contracts*.

#### 6.3.1 Dynamic lapses

For many universal life products, the lapse assumption depends on the rate of return on underlying items. For example, fewer lapses would be expected when market rates are below the guaranteed crediting rate (in the money) compared to a situation where market rates exceed the guaranteed crediting rate (out of the money) because the guarantee is worth more for the policyholder in that situation.

Since the lapses depend on the rate of return on underlying items, the present value of future cash flows will be impacted non-linearly by the rate of return on underlying items. An example is shown in Appendix 6.

#### 6.3.2 Minimum return guarantee

Minimum return guarantees are a type of investment option for universal life insurance. They create non-linearity because the guarantees kick in when the returns of underlying items are lower than the guaranteed returns and the credited returns are calculated based on the guarantees rather than the returns of the underlying items.

### 6.4 Replicating portfolio

If a replicating portfolio is used for the valuation, then a stochastic valuation is not required and bifurcation of cash flows between those that do and do not vary may not be needed.

Paragraph B46 indicates that a replicating portfolio is one whose cash flows exactly match the cash flows of a group of insurance contracts and that if a replicating portfolio of assets exists for some or all of the cash flows that arise from a group of insurance contracts then the fair value of those assets can be used to measure the present value of the cash flows.

IFRS17.B47–B48 notes that a replicating portfolio technique does not need to be applied, and that other techniques such as stochastic modelling may be more robust and easier to implement. However, where replicating assets do exist for some cash flows, the entity shall satisfy itself that the replicating portfolio technique would be unlikely to produce a materially different result. Judgment is required to determine the technique that best meets the objective of consistency with observable market variables based on the specific facts and circumstances.

# Chapter 2 – Reference Curve, Deviations from the Reference Curve, and Guidance for Disclosure in the Appointed Actuary's Report

## 1. Introduction

The language related to discount rates in IFRS 17 is brief and principles-based. The principles-based nature of IFRS 17 could lead to a wide range of practice among actuaries, particularly when setting discount rates beyond the observable period. Consequently, CLIFR and PCFRC have created parameters for a set of reference curves to facilitate comparison of discount rates among entities. It is expected that the actuary compares the entity's discount curves used to calculate the discounted value of the estimate of future cash flows against these reference curves in the AAR to the regulator. In some instances, it is also expected that the actuary would compare the present value of the estimates of future cash flows obtained using their own curve with the present value obtained when using the reference curve parameters for the unobservable period.

This chapter presents reference curves for insurance contracts that are deemed to be liquid and illiquid and outlines how these curves are constructed in the observable period and beyond the observable period.

This draft educational note only defines reference curves for liquid and illiquid insurance contracts. An entity may have grouped its insurance contracts in more than two liquidity categories. To the extent an entity has more than two discount curves, the actuary would use judgment to derive the reference curve that would apply to the insurance contracts that fall between the liquid and illiquid categories.

## 2. Defining the reference curve

In this section, the reference curves are defined for liquid and illiquid insurance contracts based on the following parameters:

- the length of the observable period;
- the risk-free rates and liquidity premiums for the observable period; and
- the ultimate risk-free rate, the ultimate liquidity premium and the approach used to interpolate between the last observable point and the ultimate point.

### 2.1 Defining the reference curve in the observable period

In the observable period, for terms up to 30 years, the risk-free rates are derived from the GoC debt securities.

The last observable point is set at the 30-year term based on GoC debt securities as outlined in Chapter 1. The actuary would not deviate from the 30-year observable period for insurance contracts sold in Canada and in Canadian currency.

The reference curve liquidity premiums for liquid insurance contracts (e.g., amounts on deposit or liability for remaining coverage (LRC) for most P&C products) are set using provincial bonds as a reference portfolio and a credit risk adjustment. For each term up to 30 years, the liquidity premium is defined as the interest rate spread of the portfolio, adjusted for credit risk, over the risk-free rate derived from the GoC debt securities. This is approximately equivalent to a liquidity premium equal to 90% of the provincial bonds spread.

The reference curve liquidity premiums for illiquid insurance contracts (e.g., T100, or liability for incurred claims (LIC) for most P&C products) are set using Canadian investment grade corporate bonds as a reference portfolio, adjusted with a constant to reflect the fact that these insurance contracts are less liquid than corporate bonds, and a credit risk adjustment. For each term up to 30 years, the liquidity premium is defined as 0.50% + 75% of the Canadian investment grade bonds spread over the risk-free rate derived from the GoC debt securities.

A linear interpolation method is used to interpolate the rates between the different data points available during the observable period for the purpose of the reference curve.

The resulting reference curves in the observable period are therefore:

a. Liquid curve: Risk-free rate + 90% of provincial bonds spread
b. Illiquid curve: Risk-free rate + 0.50% + 75% of Canadian investment grade corporate bonds spread

**2.2 Defining the reference curve in the unobservable period**

The unobservable period begins after the last observable point, which is set at the 30-year term. To derive the curve in the unobservable period, the ultimate risk-free rate, the ultimate liquidity premium, and the period of time between the last observable point and the ultimate point are defined. The reference curve is then interpolated from the last observable point to the ultimate point and held constant beyond that point.

The ultimate risk-free rate and the ultimate liquidity premium are reached at the 70-year term. A linear interpolation method is used between the last observable point (i.e., 30-year term) and the 70-year term for purposes of the reference curve.

The ultimate risk-free rate is set at 4% on a spot rate basis. The ultimate liquidity premiums for the liquid and illiquid categories are set at 0.7% and 1.5% respectively, on a spot rate basis, at the 70-year term. The ultimate risk-free rate and the ultimate liquidity premiums are held constant beyond the 70-year term for purposes of the reference curves.

The resulting reference curves in the unobservable period are therefore:

a. Liquid curve: grade linearly from the 30-year point to the ultimate 70-year point of 4.7%
b. Illiquid curve: grade linearly from the 30-year point to the ultimate 70-year point of 5.5%

When developing a curve for the unobservable period for insurance contracts sold in Canada and in Canadian currency, the actuary needs to select various parameters, such as an ultimate risk-free rate, an ultimate liquidity premium, a period of time between the last observable point and the ultimate point, a methodology to interpolate between the last observable point and the ultimate point, and a spot versus forward construct. When selecting these parameters, the actuary would choose parameters that result in the discounted value of the estimates of future cash flows being as high as the discounted value of the estimates of future cash flows obtained using the reference curve parameters beyond the observable period. This comparison would be performed in aggregate for all insurance contracts sold in Canada in Canadian currency (see Section 4 for examples).

CLIFR and PCFRC will periodically review the ultimate risk-free rate and ultimate liquidity premiums outlined in this chapter. The following methodologies presented in Chapter 1 and Appendix 2 were considered to set the ultimate risk-free rate:

- Historical long-term nominal rate median using data since 1991;
- Average historical long-term real rate using data since 1936 + inflation target;
- OECD GDP Growth Forecast + inflation target; and
- Historical GDP growth using data since 1999 + historical CPI.

These four approaches led to a range of ultimate risk-free rates between 3.5% and 4.2%. The subcommittee analyzed the results of the four methodologies and applied actuarial judgment to set the ultimate risk-free rate at 4%. When updating the ultimate risk-free rate CLIFR will look at the impact of updating the data on the various methodologies outlined above, assess their continued appropriateness, consider other methodologies, and determine whether an update to the ultimate risk-free rate is warranted. The ultimate liquidity premiums will also be monitored and updated as warranted.

## 3. Other considerations

### 3.1 Insurance finance expense versus investment income

There could be cases where the expected return on the assets of the insurer is lower than the discount rates applied to the estimates of future cash flows which would lead to the investment income for the assets supporting the insurance contracts being lower than the insurance finance expense. The actuary would understand the implications of setting discount rates that create a negative bias in investment results.

### 3.2 Negative estimates of future cash flows and applicability of the reference curves

In instances where the present value of estimates of future cash flows beyond the observable period is negative, in aggregate, a lower discount curve may lead to a lower present value of estimates of future cash flows. If this occurs the facts and circumstances may justify the situation and a deviation between the entity's discount curve to the reference curve may be appropriate and still represent the characteristics of the liabilities.

### 3.3 Segregated funds

The *IFRS 17 Market Consistent Valuation of Financial Guarantees for Life and Health Insurance Contracts* draft educational note provides additional considerations for segregated fund business.

## 4. Suggested disclosures in the Appointed Actuary's Report

The discount curve applied to the estimates of future cash flows is a significant assumption impacting many aspects of the financial statements. The discount curve will be a driver of the fulfilment cash flows, the CSM at initial recognition and the insurance finance expense. As a result, it is recommended that the actuary include information in the AAR's to outline the methodology used to develop the discount curves for all insurance contracts inforce. In addition, for insurance contracts issued in Canadian currency, it is recommended that the actuary compare the resulting discount curves to the reference curves outlined in this section.

The information provided would include a description of the methodology used to set the discount curves for all currencies, and would cover:

1. the last observable point;
2. the ultimate risk-free rates and whether a spot or forward ultimate rate is used;
3. the convergence period between the last observable point and the ultimate rate;
4. the interpolation methodology used to interpolate between the last observable point and the ultimate point;
5. the derivation of the liquidity premiums in the observable period and beyond the last observable point;
6. the derivation of the reference curves used for liabilities that fall between the liquid and illiquid categories described in this draft educational note; and
7. a demonstration that the discounted value of the estimates of future cash flows calculated using the parameters of the entity's discount curves beyond the observable period is not lower than the value obtained using the parameters of the reference curves beyond the observable period. This demonstration would be performed in aggregate for all insurance contracts sold in Canada in Canadian currency.

   Below are two possible approaches to demonstrate the point above, other approaches may also be appropriate:

   a. For long term insurance contracts where only net cash outflows are expected beyond the observable period, the actuary could demonstrate that the discounted value of the estimates of future cash flows calculated using the entity's discount curve is at least equal or higher than if using the parameters of the reference curve beyond the observable period by ensuring its curve is always lower than the reference curve in the unobservable period.
   b. Alternatively, if the facts and circumstance differ from above, the actuary could compare the discounted value of the estimates of future cash flows obtained using the entity's own curve with the discounted value of the estimates of future cash flows obtained when using the entity's own curve in the observable period and the parameters of the reference curve in the unobservable period (i.e., the only difference being the discount curve within the unobservable period).

   If an actuary selected the parameters below to build the entity's discount curve, approach (a) may be applicable without requiring the calculations under approach (b):

   i. Observable period of 30 years.

ii. Liquidity premium in the observable period is set at 85% of investment grade corporate bonds.

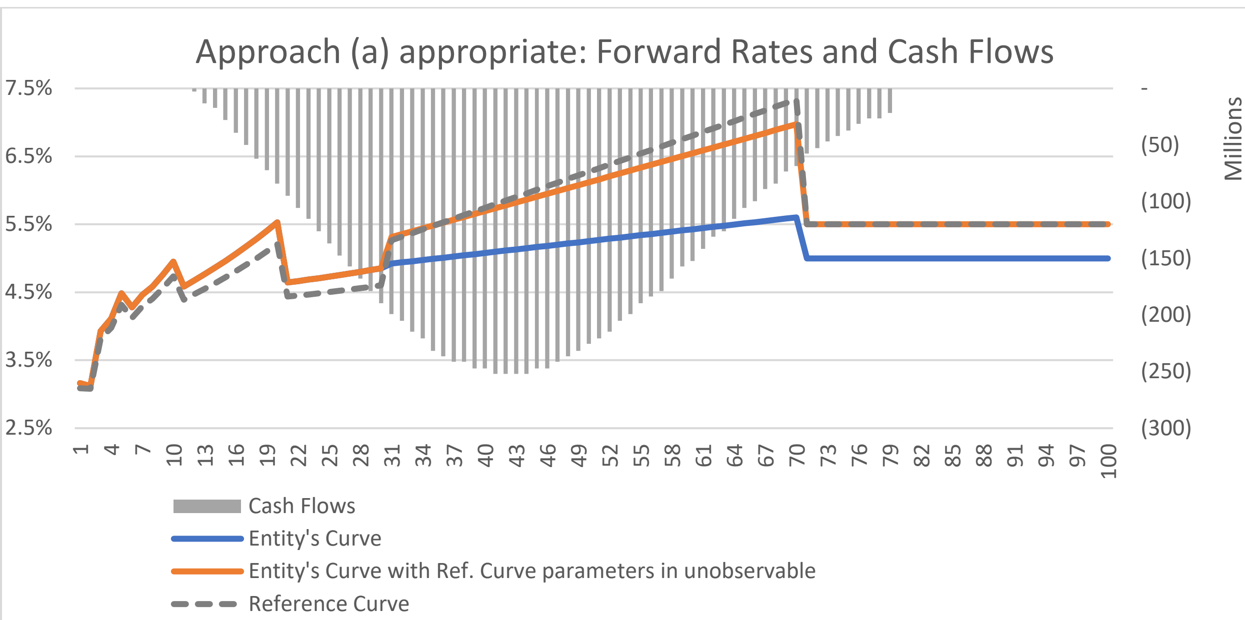
iii. A spot construct is chosen, and the ultimate point is reached in year 70.

iv. Linear grading of spot rates from the 30-year point to the ultimate 70-yr point is used.

v. The ultimate risk-free spot rate is set at 4.0% and the ultimate liquidity premium is set at 1.0%.

vi. Sample cash flows (all outflows) are used in the examples to follow.

The actuary could graph the entity's discount curve and compare it to the entity's curve with the reference curve parameters in the unobservable period. Based on the graph below, the entity's own curve is always below the reference curve in the unobservable period (Y30+). To the extent the actuary only expects net cash outflows beyond the observable period then the graph would be sufficient to demonstrate that the actuary's own curve leads to a discounted value of estimates of future cash flows that are at least as high as if the actuary was using the parameters of the reference curve in the unobservable period.




If an actuary selected the following parameters to build the entity's discount curve, approach (b) may be required:

i. Observable period of 30 years.

ii. Liquidity premium in the observable period is set at 85% of investment grade corporate bonds.

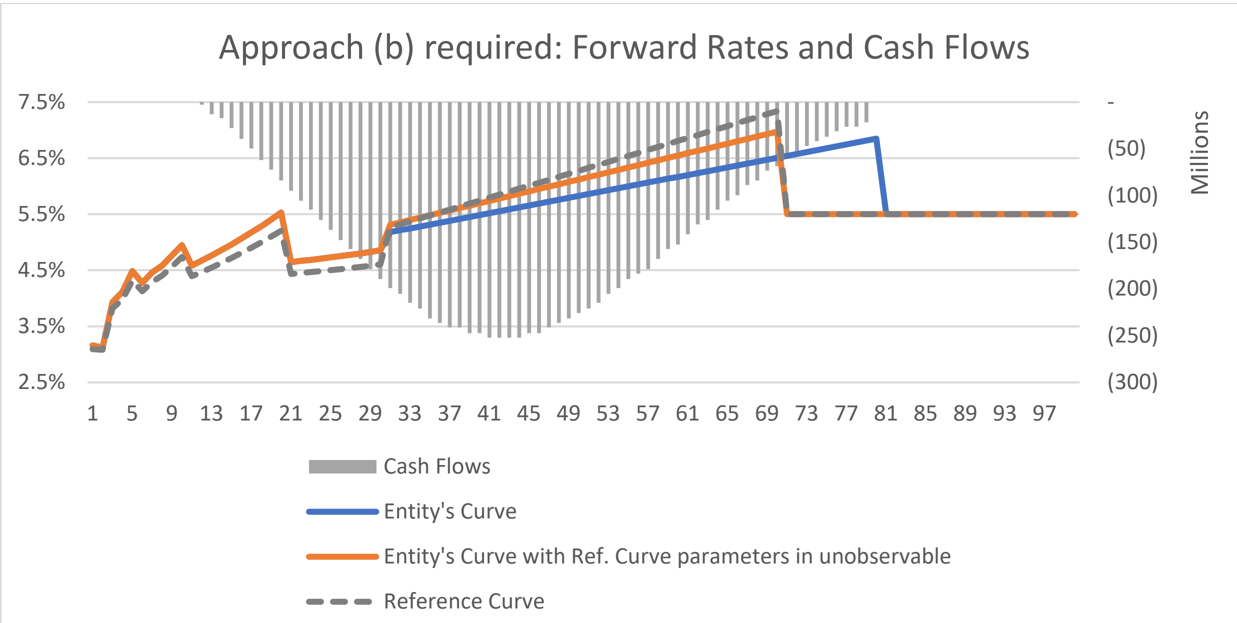
iii. A spot construct is chosen, and the ultimate point is reached in year 80.

iv. Linear grading of spot rates from the 30-year point to the ultimate 80-yr point is used.

v. The ultimate risk-free spot rate is set at 4.0% and the ultimate liquidity premium is set at 1.5%.

vi. Sample cash flows (all outflows) are used in the examples to follow.

In this example, the entity's curve is not always below the entity's curve with the reference curve parameters in the unobservable period. In this case the actuary could compare the discounted value of the estimates of future cash flows using the entity's curve and then using the entity's curve modified to use the parameters of the reference curve in the unobservable period (i.e., the only difference being the discount curve within the unobservable period).




The present value of the estimates of future cash flows using the entity's curve is $1.50B, which is higher than the present value using the entity's curve adjusted to use the reference curve parameters in the unobservable period of $1.48B.

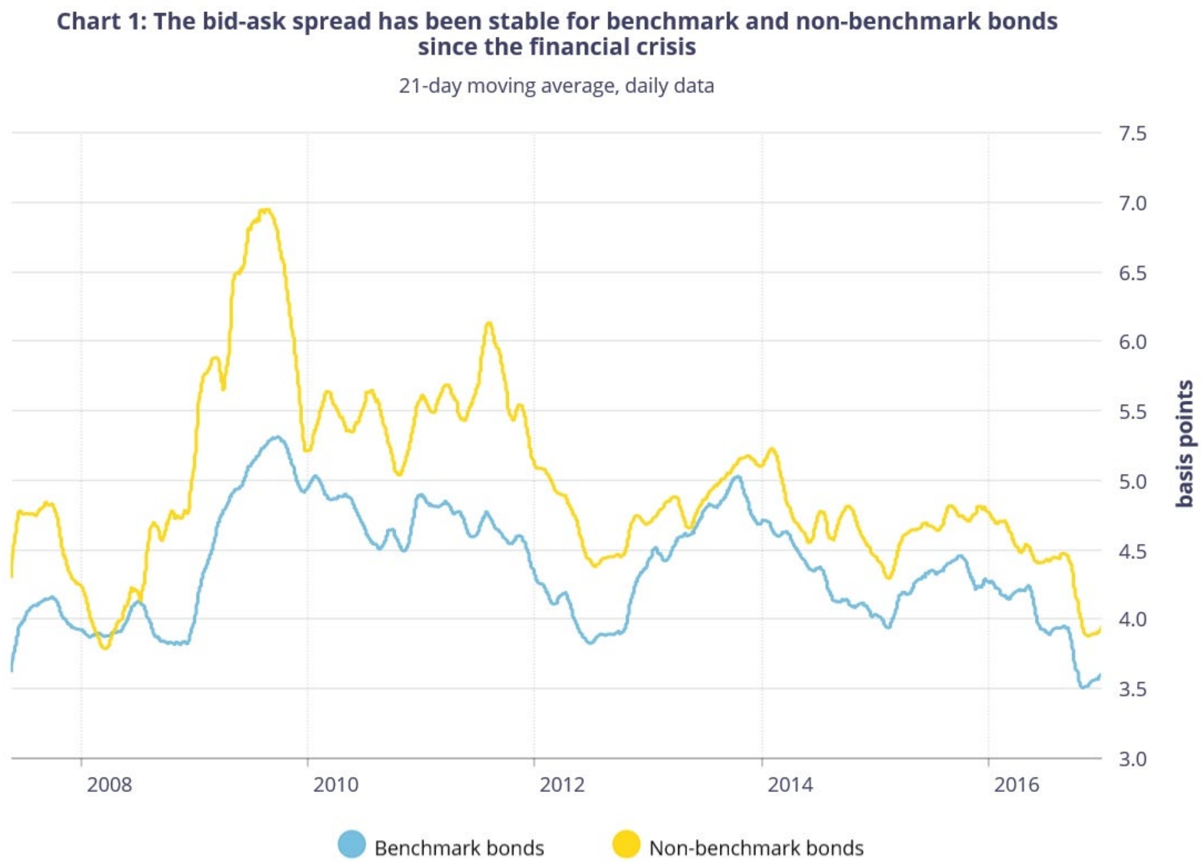
If the present value of the estimates of future cash flows using the entity's curve is lower than the present value using the entity's curve adjusted to use the reference curve parameters in the unobservable period, then the actuary would adjust their curve in the unobservable period until the amount is equal to or higher.

## Appendix 1 – Trading of Government of Canada bonds

This appendix discusses assessing the end of the observable period using factors such as bid-ask spread, trading volume, trade size, and the impact of trades.

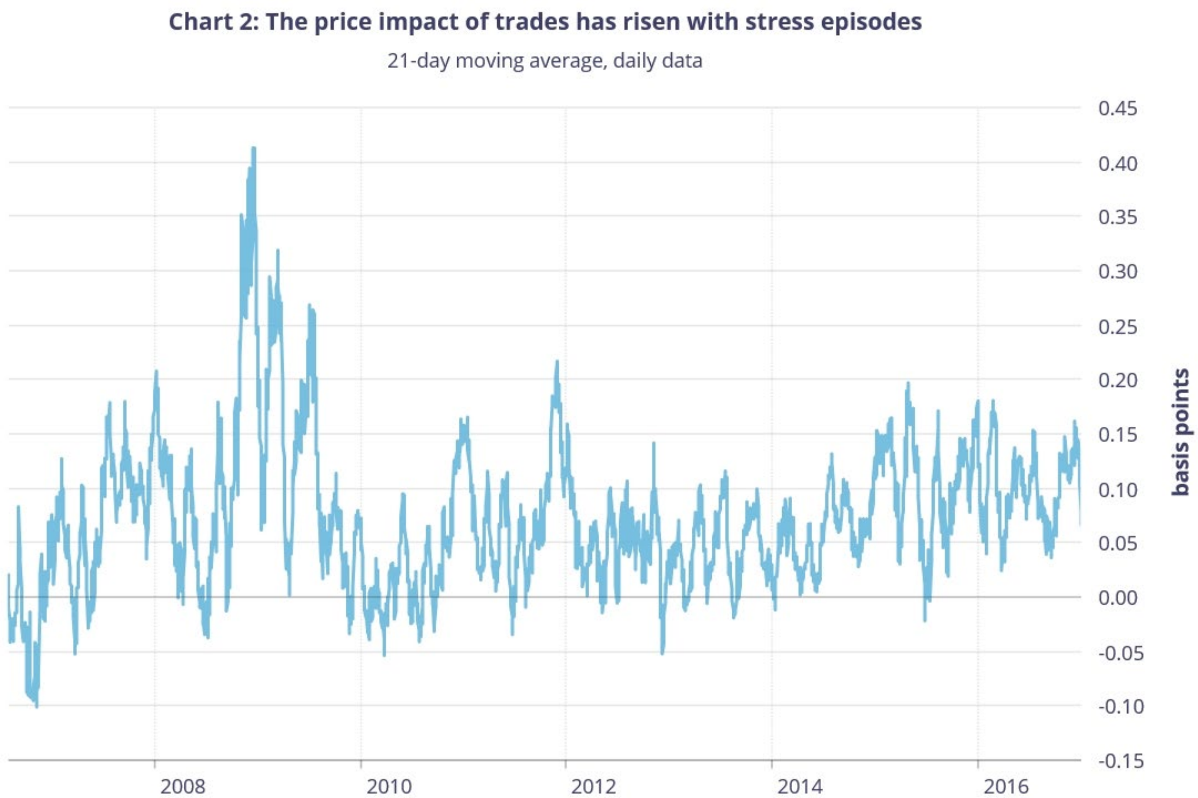
There are limited sources to assess the liquidity of GoC bonds; however, one source is a 2017 BoC staff analytical note[10] (the "analytical note"). The analytical note analyzed the bid-ask spread, trading volume, trade size and the impact of trades for GoC bonds with terms of 2, 5, 10, and 30 years. The analytical note also compared these metrics for benchmark bonds vs. non-benchmark bonds. For the same bond term, non-benchmark issues tend to have less liquidity than benchmark issues.

The analytical note analysis on the bid-ask spread is illustrated in the graph below. During the financial crisis it may be observed that the bid-ask spread spiked and has since returned to pre-crisis levels. As the bid-ask spread is relatively small (3.5–5.0 basis points), this is indicative of an active market out to 30 years (the longest-term bonds included in the analysis).



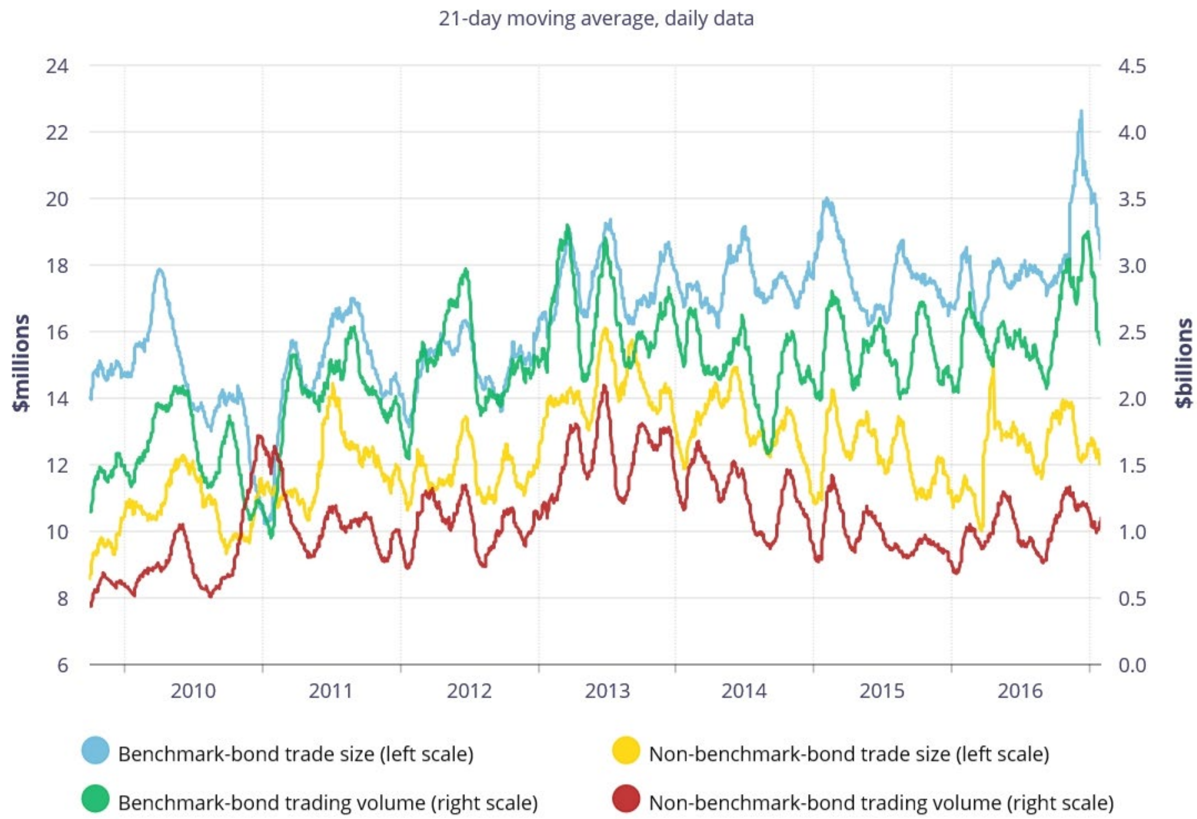

To assess the impact of trades, the BoC analyzed the price impact of trades normalized to a $1 million trade size. The price sensitivity to trade size of GoC bonds up to 30-year term is relatively small indicating an active market.

[10] https://www.bankofcanada.ca/2017/08/staff-analytical-note-2017-10/

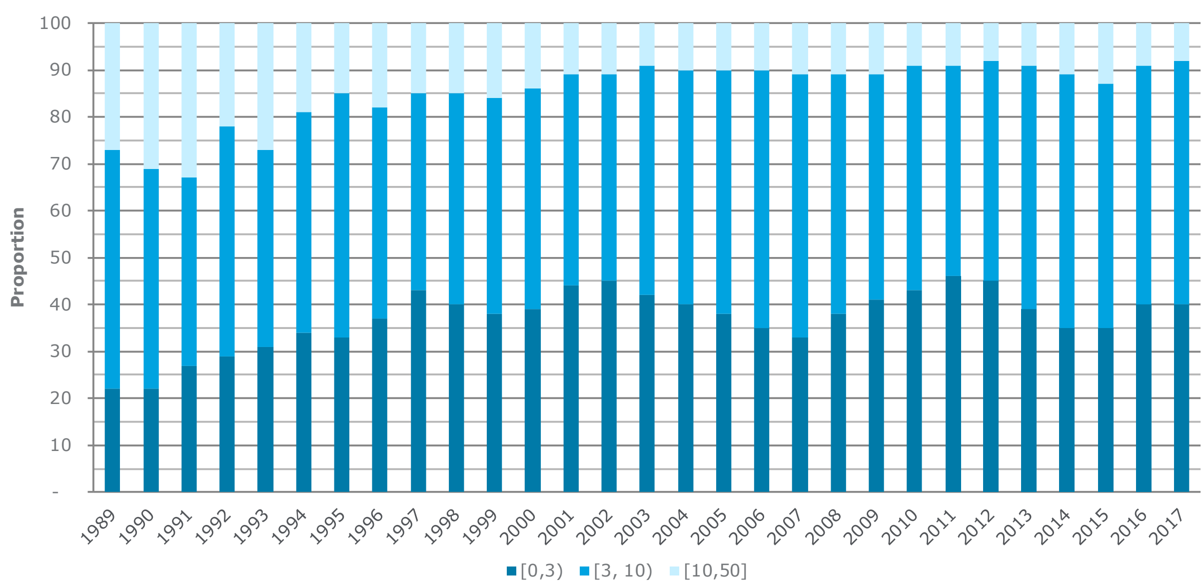



Lastly, the analytical note analyzed the trading volume and trading size for GoC bonds. This analysis showed that the daily volume for benchmark GoC bonds has recently ranged between approximately $2–$3 billion while the daily volume for non-benchmark GoC bonds has recently ranged between approximately $0.75–$1.25 billion.

**Chart 3: Trading volume and trade size have increased for benchmark bonds but remained stable for non-benchmark bonds**




In addition to the above, the BoC publishes information on market trading by duration of security as shown in the chart below:




Source: Bank of Canada (Historical bond market trading by type of security – formerly F12)

This chart shows that approximately 10% of the GoC bonds that trade have a maturity of 10 or more years.

Unfortunately, more refined data on the trading volume on GoC bonds with a maturity over 10 years is limited. To estimate the trading volume of GoC bonds with a term over 30 years the above information was combined with trading data from the analytical note.

GoC bonds with a term in excess of 30 years are non-benchmark bonds. From the analytical note approximately 30%-40% of GoC bonds that trade are non-benchmark bonds. It was assumed that this proportion holds for bonds trading with a term over 10 years.

For non-benchmark bonds with a term over 10 years, approximately 10% have a term of over 30 years.

Using the above, the proportion of GoC bonds trading with a maturity over 30 years is estimated as:

- proportion of GoC bonds trading with a maturity over 10 years (~10%); *times*
- proportion of non-benchmark bonds trading (~30-40%); *times*
- proportion of non-benchmark bonds with a term over 10 years that have a term over 30 years (~10%).

Assuming that trading was to occur uniformly across all durations per above, GoC bonds with a term greater than 30 years would represent 0.4% of the total trading volume of GoC bonds. Based on this it is doubtful that there is an active market for GoC bonds in excess of 30 years.

## Appendix 2 – Approaches to set the ultimate risk-free rate

As discussed in Section 2 of Chapter 1, there are different approaches that can be used to set the historical risk-free rate. This appendix summarizes the risk-free rates obtained under different approaches.

Par rates are used as an approximation to long-term spot and forward rates since short-term spot, forward and par rates are expected to behave similarly, and long-term par rates incorporate the term premium.

### 1. Historical nominal rate

| Method | Historical period * | Result[11] | |
|---|---|---|---|
| Long-term nominal rate average | 1936–2019 | **5.7%** | |
| Long-term nominal rate **median** | 1936–2019 | **5.1%** | *≈ CALM base scenario* |
| Long-term nominal rate average | 1991–2019 | **4.7%** | |
| Long-term nominal rate **median** | 1991–2019 | **4.2%** | |

* 1936 is in line with the historical period considered to set the ultimate reinvestment rate (URR) under CALM. 1991 corresponds to the date when the BoC central bank decided to set the inflation-control target.

### 2. Historical real interest rate + inflation target approach

| Method | Historical period * | Real rate[12] | + Inflation target** | Result | |
|---|---|---|---|---|---|
| Long-term real-rate average | 1936–2019 | 2.1% | + 2.0% | **4.1%** | |
| Long-term real-rate average | 1960–2019 | 3.0% | + 2.0% | **5.0%** | |
| Short-term real-rate average | 1961–2019 | 1.7% | + 2.0% | **3.7%** | *≈ Solvency II* |

* 1961 corresponds to start of the period considered under Solvency II for most countries (excluding Canada). Also, GDP Growth information is only available since 1960.
** The inflation target is as at December 31, 2017.

[11] Using the BoC V122487 series (GoC marketable bonds—average yield—over 10 years).
[12] Calculated as the nominal rates less CPI. CPI is sourced from Statistics Canada and the nominal rates are sourced from the BoC using the V122487 series (GoC marketable bonds—average yield—over 10 years) for the long-term rate and V122541 series (GoC Treasury bill – average yields – 3 month) for the short-term rate.

**3. Real GDP Growth expectation + inflation target approach**

| Method | Historical period | GDP growth | + Inflation | Result[13] | |
|---|---|---|---|---|---|
| Historical GDP growth + inflation target | 1960–2019 | 3.1% | + 2.0% | **5.1%** | |
| OECD GDP growth forecast + inflation target | s/o | 1.5% | + 2.0% | **3.5%** | |
| Historical GDP growth + historical CPI | 1999–2019 | 2.3% | + 1.9% | **4.2%** | *≈ LICAT* |

* The inflation target is as at December 31, 2018 and the OECD GDP growth forecast is based on the most recent publication (Guillemette, Y. and D. Turner (2018), "The Long View: Scenarios for the World Economy to 2060," *OECD Economic Policy Papers*, No. 22, OECD Publishing, Paris, https://doi.org/10.1787/b4f4e03e-en.)

[13] Historical GDP growth is based on OECD data. Historical inflation is based on Statistics Canada data.

## Appendix 3 – Methodologies adopted to analyze the historical liquidity premiums

This section documents how the liquidity premium examples for the observable and non-observable period in Sections 4.3 and 4.4 were developed.

**Data sources**

Yields for Canadian risk-free and corporate bonds: Canadian Corporate A Bonds, Canadian Corporate BBB Bonds, Canadian Provincial bonds and Canada risk-free Bonds information going as far back as possible were sourced from Bloomberg.

Credit migration matrix: The North American matrices from the S&P Annual Global Corporate Default Study[14].

Privates and mortgages data: As there is no data available from public sources, information from an independent research report was sought. High level ranges for the liquidity premiums paid on these instruments over public investment grade instruments are around 35–200bps level. Fifty bps were used based on feedback from the working group and to recognize that this is only an approximation.

**Calculation**

Calculating the Expected Credit Loss (ECL):

The one-year credit migration matrix was used as the basis to calculate the longer duration transition probabilities (from two years to 30 years), because the longer duration matrices provided in the report do not cover all the tenors. Cumulative default probabilities were converted into an annual number. The Loss Given Default (LGD) is assumed to be 40%[15] based on research findings and applied to the annualized credit default spread.

Calculating the Unexpected Credit Loss (UCL):

Three approaches of calculating UCL were tested to provide a range of outcomes for the credit default spread:

(i) A fixed margin of 100% of ECL. This level was selected to be at the conservative end of the existing asset credit margins used in CALM.

(ii) The LICAT Cost of Capital (CoC) approach using a CoC assumption of 10% (after adjusting for risk-free returns), LICAT target ratio of 115%, scalar of 105% and diversification factor of 84%.

(iii) The cost of capital approach as defined by Basel III.

[14] The North American data was used because of lack of Canadian specific public data. It should also be recognized that the study period of default data and the credit spread data do not exactly align but credit spread data was used as far back as available and the difference in study period was deemed immaterial.

[15] Reference: LGD Report 2018 - Large Corporate Borrowers https://www.globalcreditdata.org/library/lgd-report-large-corporates-2018

Building a reference portfolio:

To conduct our analysis, two reference portfolios representative of liquid and illiquid insurance contracts were selected:

- Liquid: Portfolio consists of provincial bonds.
- Illiquid: Portfolio consists of private placements and mortgages, formulated as the Canadian investment grade corporate bonds plus a fixed spread due to lack of publicly available data.

Calculating the credit risk adjustment:

The credit risk adjustments were calculated as the sum of ECL and UCL for each credit rating. ECL and UCL derived using this approach are TTC estimates and remain flat regardless of current market environment. PIT adjustments may be necessary to incorporate a forward-looking view if market conditions were to change. However, historical statistics were used so no PIT adjustments were made to the data. The three UCL methods provided a range for the adjustment, from which the average was calculated with rounding.

Calculating the liquidity premium:

The liquidity premiums for different credit ratings were derived applying a top-down approach as the asset spreads minus the credit risk adjustment at each time point. The asset spreads were calculated as the difference between the yields of the provincial bonds or corporate bonds and the risk-free bonds.

The ultimate liquidity premiums were calculated as the historical averages of the liquidity premiums at the 30-year term. The liquidity premium for the most liquid products was set using the historical average liquidity premiums for provincial bonds, while the liquidity premium for the illiquid products was set using the historical average liquidity premiums for private placements and mortgages.

| **Ultimate liquidity premium (%)** | | |
|---|---|---|
| **UCL methods** | **Most liquid** | **Most illiquid** |
| **1** | 0.72 | 1.54 |
| **2** | 0.66 | 1.43 |
| **3** | 0.71 | 1.57 |
| **Average** | **0.70** | **1.50** |

Liquidity premiums were calculated and analyzed as a ratio of the asset spreads at each time point. The reference curve proposals were made after analysis of the results for liquidity premiums across a range of percentiles.

| **Average across tenors (over 1Y)** | | | |
|---|---|---|---|
| **Percentiles** | **Corp A** | **Corp BBB** | **Average** |
| **97.5%** | 90% | 85% | 88% |
| **95.0%** | 87% | 81% | 84% |
| **85.0%** | 84% | 78% | 81% |
| **50.0%** | 78% | 69% | 74% |
| **15.0%** | 65% | 51% | 58% |
| **5.0%** | 56% | 40% | 48% |
| **2.5%** | 50% | 33% | 41% |
| **Average** | **75%** | **66%** | **71%** |

# Appendix 4 – Considerations in applying the top-down approach

This appendix covers various considerations in applying the top-down approach

**Steps to adapt US CDS information for Canada**

This section describes a methodology that users could use to adapt the US CDS information for use in Canada.

Example:

- Available CDS spreads data can be obtained using Bloomberg for Markit CDX North America Investment Grade Index for maturities 1, 3, 5, 7, and 10 years.
- Observed CDS spreads will need to be interpolated to the end of observable period.
- CDS spreads can be compared to the underlying bond portfolio spread to derive the percentage of the total spread representing credit risk.
- The same percentage could be applied to the reference portfolio spread in Canada to derive the equivalent credit risk adjustment.
- Additional adjustments could be made to account for basis and other risks.

**Approaches to make forward-looking adjustment to credit risk**

The approach used to derive examples of liquidity premium in Canada used historical information and TTC default expectations. Adjustments could be made to reflect the current and forward-looking credit expectations. The IFRS 9 lifetime default provision models could be leveraged to convert TTC to point in time ECL estimates, since IFRS 9 requires ECL to be point in time.

One approach could be to use multiple sets of assumptions that adequately reflect the credit cycle. Accordingly, multiple (or dynamic) transition matrix models (e.g., low default experience, average default experience, high default experience) could be used based on current market and anticipated economic conditions.

Another approach (commonly by banks) would be the Z-score method (see more information in JPMorgan paper). Under such technique, default transition matrices are calculated conditionally on an assumed value of Z. The Z score is calibrated using historical information and measures the credit cycle of past credit conditions. In good years, Z is positive (lower default rate, higher credit ratings) and in bad years, Z is negative. Based on current and anticipated macroeconomic variables, one could estimate current and future values of Z, and apply it to derive forward-looking rating transition matrices.

**Approaches to calculate unexpected credit loss**

One possible approach for calculating the UCL would be to apply a simple margin (i.e., 100%) to the credit risk default adjustment estimated for the ECL. This method could be based on a certain confidence level sought by investors in order to make sure that ECL+UCL will cover the credit risk. Such a method has the advantage of being simple to apply operationally. The difficulty comes from the calibration of the margin to relevant market information, on an ongoing basis.

Another possible approach would be to use the cost of capital approach. For example, the Basel Capital Framework could be used and was developed in Gordy-Jones. The underlying capital requirement is based on a Value-at-Risk measure.

The advantage of this method is that it is linked to the cost of capital incurred by major financial institutions trading securities. It also directly makes use of key parameters derived in the ECL section, ensuring consistency between ECL and UCL. (For example, UCL could be point in time or TTC, depending on how the ECL parameters were derived). One disadvantage is that it still relies on some parameters that could be hard to calibrate with the market (e.g., the cost of capital itself).

## Appendix 5 – Discount curve formulation implications

This Appendix illustrates implications using a five-year life insurance contract with the following characteristics:

- Expected and actual premiums of $1,300 per year (end-of-year);
- Expected and actual claims of $6,500 at end of year 5 (with $65 risk adjustment); and
- No expense and tax-free environment.

**Scenario 1 – Liquidity premium of the insurance contract = Liquidity premium of the assets**

Assumptions:

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Actual investment rates: | **2.0%** | **3.5%** | **4.5%** | **4.5%** | **4.5%** |
| - Illiquidity part | **1.0%** | **2.3%** | **3.0%** | **3.0%** | **3.0%** |
| - Credit part (ECL/UCL) | 1.0% | 1.2% | 1.5% | 1.5% | 1.5% |
| Valuation rates: | **1.0%** | **2.3%** | **3.0%** | **3.0%** | **3.0%** |

Then, initial CSM = $290.

Profit & Losses correspond to:

| | | 1 | 2 | 3 | 4 | 5 | TOTAL |
|---|---|---|---|---|---|---|---|
| Insurance revenue | | 62 | 62 | 62 | 62 | 6,627 | |
| Insurance expense | | - | - | - | - | (6,500) | |
| Insurance results | - | 62 | 62 | 62 | 62 | 127 | **373** |
| Investment revenue | | - | 46 | 119 | 183 | 250 | |
| Interest expense | | - | (28) | (75) | (115) | (155) | |
| Investment results | | - | 17 | 44 | 68 | 94 | **224** |
| **Total results** | **-** | **62** | **79** | **106** | **130** | **221** | **597** |

**Scenario 2 – Liquidity premium of the insurance contract > Liquidity premium of the assets**

Assumptions:

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Actual investment rates: | **2.0%** | **3.5%** | **4.5%** | **4.5%** | **4.5%** |
| - Illiquidity part | **1.0%** | **2.3%** | **3.0%** | **3.0%** | **3.0%** |
| - Credit part (ECL/UCL) | 1.0% | 1.2% | 1.5% | 1.5% | 1.5% |
| Valuation rates: | **1.8%** | **3.1%** | **3.8%** | **3.8%** | **3.8%** |

Then, initial CSM = $368.

Profit & Losses correspond to:

| | | 1 | 2 | 3 | 4 | 5 | TOTAL |
|---|---|---|---|---|---|---|---|
| Insurance revenue | | 80 | 80 | 80 | 80 | 6,645 | |
| Insurance expense | | - | - | - | - | (6,500) | |
| Insurance results | - | 80 | 80 | 80 | 80 | 145 | **465** |
| Investment revenue | | - | 46 | 119 | 183 | 250 | |
| Interest expense | | - | (37) | (93) | (142) | (193) | |
| Investment results | | - | 8 | 26 | 41 | 56 | **132** |
| **Total results** | **-** | **80** | **88** | **106** | **121** | **202** | **597** |

**Scenario 3 – Higher ultimate rate**

Assumptions:

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Actual investment rates: | **2.0%** | **3.5%** | **4.5%** | **4.5%** | **4.5%** |
| - Illiquidity part | **1.0%** | **2.3%** | **3.0%** | **3.0%** | **3.0%** |
| - Credit part (ECL/UCL) | 1.0% | 1.2% | 1.5% | 1.5% | 1.5% |
| Valuation rates: | **1.0%** | **2.5%** | **5.0%** | **5.0%** | **5.0%** |

Then, initial CSM = $485.

Profit & Losses correspond to:

| | | 1 | 2 | 3 | 4 | 5 | TOTAL |
|---|---|---|---|---|---|---|---|
| Insurance revenue | | 106 | 106 | 106 | 106 | 6 671 | |
| Insurance expense | | - | - | - | - | (6 500) | |
| Insurance results | - | 106 | 106 | 106 | 106 | 171 | **593** |
| Investment revenue | | - | 46 | 119 | 183 | 250 | |
| Interest expense | | - | (30) | (121) | (187) | (256) | |
| Investment results | | - | 16 | (2) | (4) | (6) | **4** |
| **Total results** | **-** | **106** | **121** | **104** | **102** | **165** | **597** |

## Appendix 6 – Cash flows that vary example on dynamic lapses

Below are the assumptions used for this example:

- Initial account value of $10,000 is withdrawn at the end of year 2.
- Management expense ratio of 2%.

**Without dynamic lapses**

Examples A and B assume returns of -10% and +10%, respectively. The annual lapse rate is 1% in both years.

| **Example A** | 1 | 2 | Calculation for year 2 |
|---|---|---|---|
| Account value | 9,000 | 7,857 | (9,000 – 180 – 90) * (1 - 10%) |
| MER | (180) | (157) | 7,857 * 2% |
| Lapses | (90) | (79) | 7,857 * 1% |
| Withdrawals | - | (7,621) | -(7,857 – 157 – 79) |

| **Example A** | FCF | Calculation |
|---|---|---|
| That do not vary | 10,000 | Initial account value |
| That vary | (9,606) | -(7,621 + 79)/(1 - 10%)^2<br>- 90/(1 - 10%) |
| Total | **394** | 10,000 – 9,606 |

| **Example B** | 1 | 2 | Calculation for year 2 |
|---|---|---|---|
| Account value | 11,000 | 11,737 | (11,000 – 220 – 110) * (1 + 10%) |
| MER | (220) | (235) | 11,737 * 2% |
| Lapses | (110) | (117) | 11,737 * 1% |
| Withdrawals | - | (11,385) | -(11,737 – 235 – 117) |

| **Example B** | FCF | Calculation |
|---|---|---|
| That do not vary | 10,000 | Initial account value |
| That vary | (9,606) | -(11,385 + 117)/(1 + 10%)^2<br>- 110/(1 + 10%) |
| Total | **394** | 10,000 – 9,606 |

Since the total insurance contract in example A and B is the same, the result is not dependent on the asset return used and there is no “non-linearity”.

**With dynamic lapses**

Examples A and B assume returns of -10% and +10%, respectively. The annual lapse rate is 5% if returns are higher than 0%, 1% otherwise.

| **Example A** | 1 | 2 | Calculation for year 2 |
|---|---|---|---|
| Account value | 9,000 | 7,857 | (9,000 – 180 – 90) * (1 - 10%) |
| MER | (180) | (157) | 7,857 * 2% |
| Lapses | (90) | (79) | 7,857 * 1% |
| Withdrawals | - | (7,621) | -(7,857 – 157 – 79) |

| **Example A** | FCF | Calculation |
|---|---|---|
| That do not vary | 10,000 | Initial account value |
| That vary | (9,606) | -(7,621 + 79)/(1 - 10%)^2<br>- 90/(1 - 10%) |
| Total | **394** | 10,000 – 9,606 |

| **Example B** | 1 | 2 | Calculation for year 2 |
|---|---|---|---|
| Account value | 11,000 | 11,253 | (11,000 – 220 – 550) * (1 + 10%) |
| MER | (220) | (225) | 11,253 * 2% |
| Lapses | (550) | (563) | 11,253 * 5% |
| Withdrawals | - | (10,465) | -(11,253 – 225 – 563) |

| **Example B** | FCF | Calculation |
|---|---|---|
| That do not vary | 10,000 | Initial account value |
| That vary | (9,614) | -(10,465 + 563)/(1 + 10%)^2<br>- 550/(1 + 10%) |
| Total | **386** | 10,000 – 9,614 |

Since the total insurance contract in example A and B is not the same (394 vs 386), the result is dependent on the asset return used and there is “non-linearity”.