

## Memorandum

**To:** All Fellows, Affiliates, Associates and Correspondents of the Canadian Institute of Actuaries and Other Interested Parties

**From:** A. David Pelletier, Chair  
Actuarial Standards Board  
Edward Gibson, Chair  
Designated Group

**Date:** July 3, 2012

**Subject:** **Final Communication of a Promulgation of Calibration Criteria for Investment Returns Referenced in the Standards of Practice for the Valuation of Insurance Contract Liabilities: Life and Health (Accident and Sickness) Insurance (Subsection 2360)**

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### INTRODUCTION

According to subsection 2360 of the Standards of Practice:

#### **Model calibration**

.01 *It is prescribed that the actuary's calibration of stochastic models used in the valuation of segregated fund guarantees should meet the criteria for investment returns as promulgated from time to time by the Actuarial Standards Board. [Effective January 1, 2011]*

The Actuarial Standards Board (ASB) is promulgating the use of the calibration criteria for equity returns described below, effective October 15, 2012. The process being used to implement this is described in section E of the ASB's Policy on Due Process for the Adoption of Standards of Practice.

### **RATIONALE**

The Standards of Practice outline a minimum insurance contract liability basis with respect to the model calibration for segregated fund business, and reference prescribed criteria for investment returns.

The change to the promulgated calibration criteria for equity returns is being proposed for the following reasons:

1. To reflect more recent market experience. The current calibration criteria are based on data from January 1956 to December 1999, while the proposed calibration criteria are based on data from January 1956 to June 2010.

2. The introduction of longer-term products and reset features in recent years has created new issues with regard to the calibration of investment returns.

A [research paper](#) that provides a rationale for this promulgation was released in February 2012 by the Canadian Institute of Actuaries (CIA) Committee on Life Insurance Financial Reporting (CLIFR).

This promulgation applies to equity returns only. Calibration criteria applicable to returns on fixed-income assets are currently being developed.

The promulgated calibration criteria have been developed using the data from the years since 1956. Data on equity returns for the U.S. market since 1926 were available. The choice of the historical period for developing criteria was a challenge and the subject of much debate. The research paper provides the rationale for choosing the 1956 to 2010 period.

As mentioned in the subsection 2360 of the Standards of Practice, calibration of investment returns would be promulgated from time to time. The calibration criteria promulgated in this document are expected to be reviewed approximately every five years.

The publication of this promulgation follows the publication of calibration criteria by Canadian regulators setting out calibration criteria for investment returns applicable when calculating capital requirements for segregated funds with an internal model. The actuary is reminded that the Canadian regulators' criteria apply to the calculation of capital requirements only, and that the criteria set out in this document apply to the calculation of insurance contract liabilities. However, nothing prevents the actuary from satisfying the Canadian regulators' criteria for calculating insurance contract liabilities, when these criteria are more stringent than those promulgated in this paper.

## **ISSUES RAISED**

On February 3, 2012, the ASB published an [initial communication](#) regarding this promulgation of calibration criteria for investment returns, in accordance with the policy on due process.

Two comments were received; one was technical in nature. The other comment related to the choice of historical period, disagreeing with the statement made in the research paper to the effect that the Great Depression was not likely to be repeated. The ASB acknowledges that the debate around this issue should be kept open.

## **PROMULGATION**

The criteria are applied by assessing whether the scenarios that are generated by the model and used for valuation meet the various metrics as defined herein. If a closed-form formula exists for a statistic subject to the criteria, it is sufficient to test that the theoretical value of the statistic calculated using the closed-form formula meets the criteria, as long as a large number of scenarios is used for valuation, and the actuary tests that the discrepancy between the theoretical value and the value calculated with the scenario set is not material.

The actuary is reminded that the promulgated calibration criteria are lower and upper bounds for various statistics, and that the actuary is expected to use sound statistical techniques and up to date data to parameterize the model used in valuation. This process could result in more conservative statistics than the promulgated criteria.

To model the investment returns of a specific fund, a proxy for the fund would be constructed. The proxy usually takes the form of a linear combination of market indices. The criteria

described below apply to the investment returns generated for equity indices that are used in the composition of the proxies. All calibration criteria apply to returns in local currency.

References are made below to indices of developed non-Asian economies. The developed non-Asian economies are those contained in the following table:

Developed Non-Asian Economies			
Americas	Europe and Middle East		Pacific
Canada	Austria	Italy	Australia
United States	Belgium	Netherlands	New Zealand
	Denmark	Norway	
	Finland	Portugal	
	France	Spain	
	Germany	Sweden	
	Greece	Switzerland	
	Ireland	United Kingdom	
	Israel		

Criteria have been established for the left and right tails of equity returns, as well as for the mean and volatility of equity returns.

### Left-Tail Criteria

Two sets of calibration criteria are established for the left tail of equity return distributions, one applicable to indices that are comprised of a diversified basket of indices of developed non-Asian economies or to a broad-based index of a large developed non-Asian economy (L1 indices), and one applicable to indices of small capitalization stocks of developed non-Asian economies (L2 indices)<sup>1</sup>.

The table below provides the maximum values for the 2.5<sup>th</sup>, 5<sup>th</sup> and 10<sup>th</sup> percentiles of the accumulation factors for the one-, five-, 10- and 20-year horizons.

Left-tail calibration criteria	One-year			Five-year			10-year			20-year		
	2.5 <sup>th</sup>	5 <sup>th</sup>	10 <sup>th</sup>	2.5 <sup>th</sup>	5 <sup>th</sup>	10 <sup>th</sup>	2.5 <sup>th</sup>	5 <sup>th</sup>	10 <sup>th</sup>	2.5 <sup>th</sup>	5 <sup>th</sup>	10 <sup>th</sup>
L1 indices	0.74	0.81	0.88	0.70	0.80	0.95	0.80	0.95	1.20	1.25	1.65	2.25
L2 indices	0.68	0.76	0.85	0.60	0.70	0.90	0.70	0.90	1.20	1.10	1.55	2.35

The criteria for equity returns are to be applied to a given index by working through the following decision tree:

- Case 1: For L1 indices or L2 indices the relevant set of calibration criteria applies.
- Case 2: If the index does not fall under case 1, but the actuary has sufficient credible data about returns for the index in question, then:
  - a. Perform a model test. The model would first be fitted to the S&P TSX Composite total returns from January 1956 to June 2010 inclusive (end-of-month values). The model outputs are then compared to the calibration criteria for L1 indices. If the model outputs satisfy those criteria, then the form of the model is acceptable and the

<sup>1</sup> The terms L1 and L2 indices are used consistently with their definitions in the [research paper](#).

actuary can proceed to the second step. If not, then the actuary would change the model form.

- b. Fit the model to the available data for the index. The model is then used to generate returns.
- c. A final test is to review the Sharpe ratio of the model outputs. The Sharpe ratio is to be calculated using the expectation and the standard deviation of the one-year accumulation factor. The Sharpe ratio would not exceed 0.40 with an assumed risk-free rate of 4.00%. If necessary, the fitted parameters for the mean from Step b. would be adjusted downward until this Sharpe criterion is satisfied.

Case 3: If the index does not fall under case 1 or case 2, then the criteria to be applied are derived from criteria for L1 indices with an adjustment for the expected differences in mean returns and volatility. Details are provided in the appendix.

### Mean and Volatility Criteria

The minimum value for the standard deviation of the one-year accumulation factor for U.S. broad-based indices is 16.5%. For all other L1 indices, the minimum value for the standard deviation is 17.5%. For L2 indices, the minimum value for the standard deviation is 23%.

The range for the expectation of the one-year accumulation factor is 1.08 to 1.12 for all L1 indices, and 1.11 to 1.15 for L2 indices.

These criteria are summarized in the following table:

Mean and volatility criteria	Minimum for the mean	Maximum for the mean	Minimum for the volatility
U.S. broad-based indices	1.08	1.12	16.5%
L1 indices other than U.S. indices	1.08	1.12	17.5%
L2 indices	1.11	1.15	23%

### Right-Tail Criteria

The table below provides the minimum values for the differences between the 90<sup>th</sup>, 95<sup>th</sup> and 97.5<sup>th</sup> percentiles and the median of the accumulation factors for the one-year horizon. These criteria are met if the differences between the right-tail percentiles and the median are greater or equal to the criteria. These criteria apply to L1 and L2 indices.

Right-tail calibration criteria	One-year		
	90 <sup>th</sup>	95 <sup>th</sup>	97.5 <sup>th</sup>
L1 and L2 indices	0.18	0.24	0.30

### CRITERIA FOR THE ADOPTION OF STANDARDS OF PRACTICE

The ASB's Policy on Due Process for the Adoption of Standards of Practice was followed in the development of the revision of the promulgated assumption. The proposed equity return calibration criteria promulgation meets the criteria set out in section B of the policy:

1. It advances the public interest through the use of a consistent basis for establishing equity return models for segregated fund business.
2. It provides for the appropriate application of professional judgement within a reasonable range. The proposed calibration criteria allow the actuary to use any model that fits with the promulgated criteria for equity return.
3. Use of the proposed decision tree and tables is practical for actuaries with relevant training. The calibration does not require use of a specific model, only that the scenarios used fit the calibration criteria.
4. The specified decision tree and tables are considered to be unambiguous.

#### **PROPOSED EFFECTIVE DATE**

These calibration criteria are to be used for valuations on or after October 15, 2012, and early implementation is permitted.

ADP, EG

## APPENDIX: LEFT-TAIL CRITERIA

The left-tail criteria for the accumulation factors of an index falling in case 3 of the decision tree are:

$$AF(F, p, t) = AF(TSX, p, t) \times \exp(\mu_{Diff} \times t + \sigma_{Diff} \times \Phi^{-1}(p) \times \sqrt{t})$$

where,

$AF(F, p, t)$  is the left-tail criterion for index F for the pth percentile at horizon t;

$AF(TSX, p, t)$  is the left-tail criterion for broad-based indices of non-Asian economies for the pth percentile at horizon t;

$\Phi^{-1}(p)$  is the inverse cumulative distribution function of the normal distribution;

$\sigma_{TSX}$  is the sample standard deviation for the TSX;

$\sigma_F$  is the sample standard deviation for the index;

$\sigma_{Diff}$  is equal to  $\sigma_F - \sigma_{TSX}$ , the differential in the standard deviation of the two indices;

$\mu_{TSX}$  is the sample mean for the TSX;

$\mu_F$  is the mean for the index, calculated using the Sharpe ratio as:

$$\mu_F = r + \sigma_F \times (\mu_{TSX} - r) / \sigma_{TSX};$$

$\mu_{Diff}$  is equal to  $\mu_F - \mu_{TSX}$ , the differential in the mean of the two indices;  
and

$r$  is the risk-free rate, established at 4% for this promulgation.

The sample volatilities for the TSX and the index would be calculated using the longest common historical period available. The sample mean for the TSX would be calculated using the data from 1956.

At a minimum, the index would be no less volatile than the TSX. If appropriate, the assumed volatility would be adjusted upward to reflect the stated objectives of the index.