

**Standardized Approach for Calculating
the Solvency Buffer for Market Risk**

Joint Committee of OSFI, AMF, and Assuris

November 2008

DRAFT FOR COMMENT

TABLE OF CONTENTS

Introduction.....	3
Approach to Market Risk.....	3
Interest Rate Risk.....	8
Interest Rate Spread Market Risk.....	10
Equity Risk.....	11
Real Estate Risk.....	12
Currency Risk.....	13
Market Options.....	13

STANDARDIZED APPROACH FOR CALCULATING THE SOLVENCY BUFFER FOR MARKET RISK

Introduction

- 1) This discussion paper proposes a new standard approach to determine the solvency buffer for market risk. The paper expands on the principles outlined in the earlier paper entitled “Framework for a New Standard Approach to Setting Capital Requirements” (Framework Paper). It was prepared by a joint committee of OSFI, AMF, and Assuris. It is being distributed to the industry and to the Canadian Life and Health Insurance Association (CLHIA) for discussion and feedback. After we have received the feedback on the paper we will design a quantitative impact study and ask companies to participate in the evaluation of the methodology.
- 2) This paper describes an approach to Canadian assets and liabilities. Further work is required to extend the concepts described in this paper to non Canadian assets and liabilities. We anticipate that the methods used will be similar but many of the tests will need to be calibrated for the individual foreign markets.

Approach to Market Risk

Definition

- 3) Market risk is the risk to an insurer’s financial condition arising from adverse movements of market prices.
- 4) Market risk involves the exposure to movements of financial variables such as equity prices, interest rates or exchange rates. It includes the exposure of derivatives to movements in the price of the underlying instrument or risk factor. Market risk also involves the exposure to other unanticipated movements in financial variables or to movements in the actual or implied volatility of asset prices and options. Market risk incorporates general market risk (on all investments) and specific market risk (on each investment).

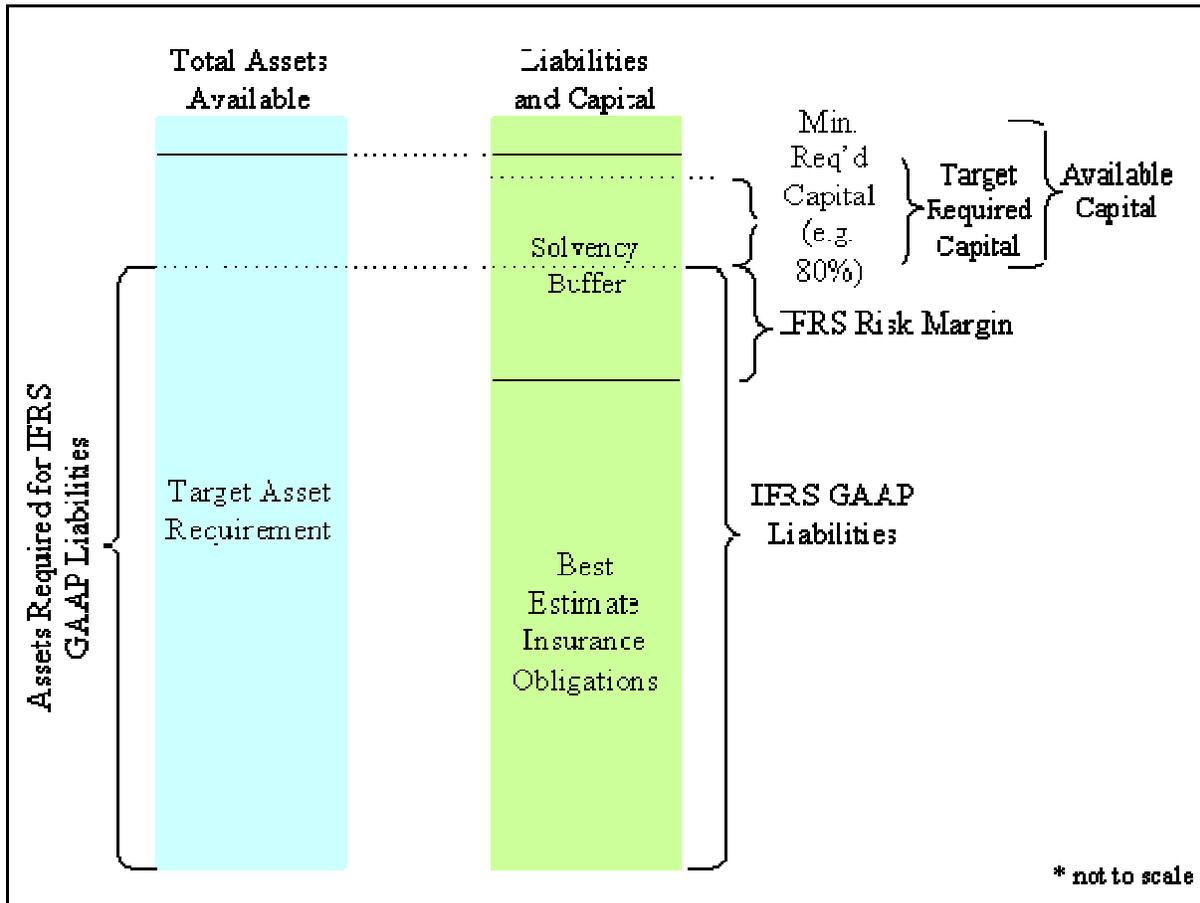
Same risk same solvency buffer

- 5) Under this standard approach to setting the solvency buffer for market risk, companies with identical assets and liabilities cash flows should have identical capital requirements. The calculations will therefore be objective and not include company assumptions about future reinvestments of cash.

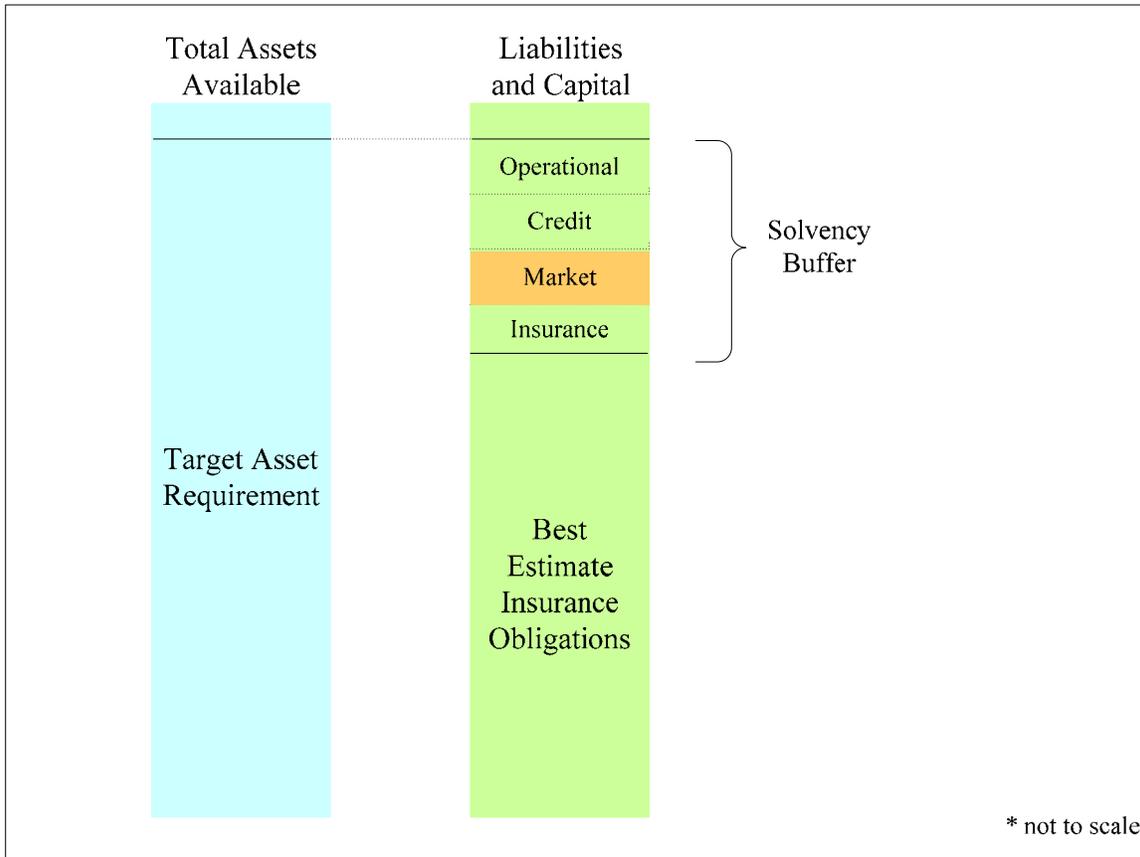
Consistent with future modeling approach

- 6) The standard approach to market risk will, where possible, be consistent with the future modeling approach as set out in the “Canadian Vision for Life Insurer Solvency Assessment,” (Vision Paper) endorsed by the Office of the Superintendent of Financial Institutions (OSFI) and *Autorité des marchés financiers* (AMF).

- 7) The Vision Paper and the Framework Paper outline the Target Asset Requirement (TAR) approach to setting solvency standards. Under this approach the total assets that the insurance company is required to hold are calculated as those required to match the best estimate insurance obligations plus a solvency buffer.



- 8) This paper outlines the method of calculating the portion of the solvency buffer related to market risk.



- 9) The future modeling approach seeks to have sufficient solvency buffer to cover risks over a one year time horizon. Under this future modeling approach the company holds sufficient assets to cover the results calculated at 99% CTE which is approximately at the 99.5% confidence level¹.
- 10) The future modeling approach also sets a solvency buffer for a terminal provision. That is the amount of additional solvency buffer required for the risks remaining after the one year adverse scenario has occurred.
- 11) For the standard approach, the solvency buffer required for the terminal provision is zero for assets where there is a deep and liquid market. This is because those assets are readily convertible to cash.
- 12) For risks that can be hedged, using assets and derivatives available in deep and liquid markets the terminal provision solvency buffer is the cost of the hedge. For example most interest rate risks can be hedged by buying or selling bonds or entering into a derivative contract.

¹ The details of the future modeling approach are being developed, and will be confirmed, through a separate process.

Deterministic stress tests

13) For each category of market risk the standardized approach will use a deterministic stress test approach. The required solvency buffer will be calculated by measuring the effect of predetermined adverse changes in the market. These deterministic stress tests will be done at the balance sheet date (time zero). They will use as a basis the cash flows used to determine the best estimate policyholder obligations under IFRS GAAP.

Calibration

14) The deterministic stress tests in the standardized approach will be calibrated with the objective of approximating the result obtained using the future modeling approach over a one year risk horizon at a 99% CTE. The regulators will take into consideration the current capital levels, the results obtained from companies using the future modeling approach as well as historical data when calibrating the stress tests.

15) When calibrating the deterministic stress tests, the regulators will use the financial history of western economies with an emphasis on Canadian financial history over the last 50 years. Many of the statistics used will focus on changes over a one year time period when measuring volatility and uncertainty. Statistics will be gathered from recognized reputable sources such as the Canadian Institute of Actuaries “Report on Canadian Economic Statistics”.

16) Separate calculations will be made to calculate the terminal provision portion of the solvency buffer for hedgeable risks, illiquid assets and unhedgeable risks.

17) All calibrations of the calculations to determine the solvency buffer in this paper are those which will be used as the base scenario in the quantitative impact study. They will be adjusted based on the results of that study.

Measure risk by legal entity

18) Market risk will be calculated at the regulated entity level. This means that the market risk will be calculated for every regulated legal entity consolidating with all of its direct and indirect subsidiaries but excluding any parent or sister companies. Within the legal entity market risk will normally be calculated by currency.

Hedging

19) The only hedge contracts that will be considered for recognition in the determination of a company’s regulatory capital requirement are the hedge contracts that the company holds as of the valuation date. Hedge contracts that the company has not yet entered into as of the valuation date will not be recognized in the determination of the company’s regulatory capital requirement. In particular, no recognition will be given for:

- anticipated rollovers or renewals of hedge contracts,
- hedge contracts expected to be entered into subsequent to the valuation date for the purpose of rebalancing a hedge position,

- hedge contracts that the company's risk management policy states would be entered into contingent upon the occurrence of particular future events, or
- any form of management action subsequent to the valuation date.

Explicit rules to be developed by the regulator will need to be met before a company may recognize any hedge contracts in the determination of the company's regulatory capital requirement.

20) For the purposes of determining capital requirements, hedge contracts are positions in financial instruments or derivatives, such as forwards, futures, swaps or options, whether purchased or sold, undertaken through a securities exchange or over-the-counter primarily for the purpose of managing or mitigating risk associated with insurance products.

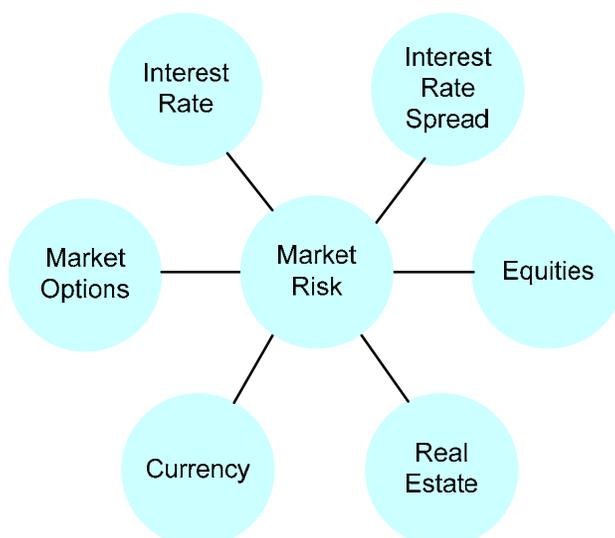
Participating products

21) The solvency buffer for participating products will be reduced where the company demonstrates that the risks on participating products are passed through to policyholders by reducing dividends. However, this will be done on the aggregate of all risks on participating products rather than a reduction of market risk.

Categories of market risk

22) Market risk is caused by volatility and uncertainty in the amount and timing of cash flows from these categories:

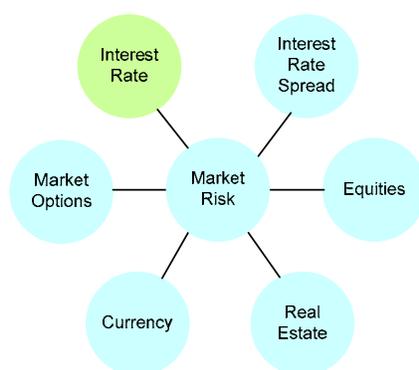
- Interest Rate
- Interest Rate Spread
- Equities
- Real Estate
- Currency
- Market Options



Correlation and concentration

- 23) A solvency buffer will be calculated separately for each category of market risk. Initially there will be no allowance for diversification between these categories. The solvency buffer for each risk will be added together. After more study on the inter-relationship of these risk categories in extreme circumstances the regulators will consider introducing an allowance for diversification where correlation is found to be less than 100%.
- 24) There will be no additional solvency buffer requirements for concentrations of risk in a particular market risk category. Concentration of risk will be subject to supervisory review (Pillar II).

Interest Rate Risk



Definitions

- 25) Interest rate risk is the risk of economic loss resulting from market changes in interest rates.
- 26) The most significant part of this risk is the risk of economic loss due to the effect of the volatility and uncertainty of future interest rates on the mismatch of cash flows from interest sensitive assets with liability cash flows.

Interest Rate Shock Method

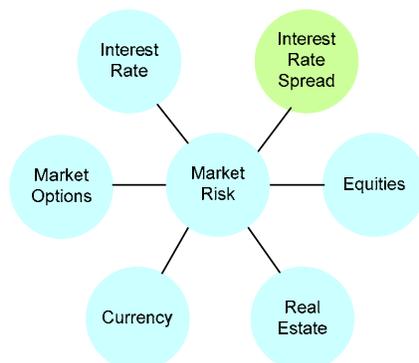
- 27) The standardized approach will use a projected cash flow methodology that measures the economic impact of a sudden change in interest rates at time zero. The procedure to calculate the solvency buffer is to project the best estimate contractual cash flows from all assets and liabilities held on the reporting date (see appendix I).
- 28) All interest rate risks from cash flows within 30 years are considered to be hedgeable and the solvency buffer in the terminal provision is the cost of that hedge.
- 29) For liability cash flows beyond 30 years there are no market rates of interest and no readily available assets available for matching. These cash flows are therefore not hedgeable. They are also not interest sensitive in that the value (the amount of assets a company would require to assume the obligation) does not change predictably with changes in market interest rates.

- 30) Consideration was given to using the 30 year spot rate in the shock technique to calculate the solvency buffer. If this technique is used the solvency requirement will be very sensitive to small changes in this long term rate. Significant volatility in the regulatory requirement for a solvency buffer on these very long term obligations is inappropriate. For these unhedgeable long term obligations a terminal provision technique is more appropriate.
- 31) The terminal provision solvency buffer will be calculated by taking the difference between:
- The present value of the cash flows calculated in the base scenario (see appendix I). (This base scenario discounts the cash flows beyond forty years at the average 30 year spot rate for the last 30 years and cash flows in the years 31 to 39 at rates interpolated between the 30 year spot rate and the rate used for cash flows over 40 years.)
- and
- The present value of the cash flows calculated in the same scenario above but using at the average 30 year spot rate for the last 30 years **less one percent** and cash flows in the years 31 to 39 at rates interpolated between the 30 year spot rate and the rate used for cash flows over 40 years.
- 32) Under each scenario the cash flows must be adjusted to ensure they are consistent with the interest rate environment being tested.
- 33) Cash flows from universal life contracts will be those used in the calculation of best estimate policyholder obligations.
- 34) When interest rates are stressed the cash flows will be adjusted to account for all interest rate guarantees in the universal life contracts.
- 35) No adjustments will be made to the universal life cash flows for increases or decreases in the cash flow due to anticipated changes in lapse rates and expense charges as interest rates change. A solvency buffer for these changes will be considered under insurance risk.
- 36) Cash flows from participating products will be those used in the calculation of best estimate policyholder obligations.
- 37) No adjustment to cash flows will be made for anticipated reductions or increases in dividends that may result from increases or decreases in interest rates. A reduction in the solvency buffer for potential reductions in dividends will be separately calculated for the participating products.

Other jurisdictions

- 38) The scenarios above are for Canadian assets and liabilities. In other jurisdictions a suitable risk free rate curve will be set by the regulator. The longest risk free rate assets in available in Canada are the Government of Canada 30 year bonds. In other jurisdictions the longest risk free bond may have a shorter maturity and the methodology will be appropriately modified.

Interest Rate Spread Market Risk



Definition of interest spread

39) Interest Spread is the additional interest over the risk free rate that is paid on instruments of lesser credit quality. For example a BBB rated bond will pay a higher interest rate than a government of Canada bond of the same maturity.

Definition of interest spread market risk

40) Interest rate spread market risk is the risk of economic loss resulting from the volatility and uncertainty in the amount and timing of cash flows from investments due to a systematic increase or decrease of spread for similar financial instruments.

41) If asset spreads increase the value of the assets will decrease even if the basic yield curve remains the same. A solvency buffer should be held for this potential decrease in value.

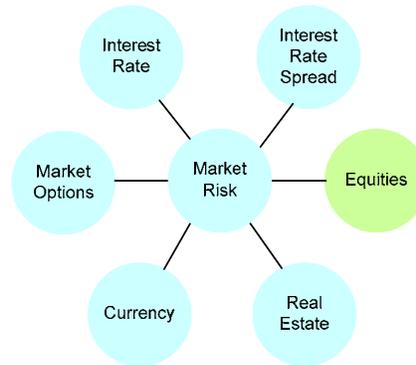
42) When interest rates and spreads are low there is a greater risk of increased spreads and the solvency buffer should be larger than when interest rates and spreads are high.

43) Spreads for all lower quality ratings are at a greater risk of increasing than for higher quality ratings and the solvency buffer should be greater.

44) To achieve this, the solvency buffer for spread risk will be calculated for each bond as the change in value of the bond if the spread over risk free bonds changed by:

- a) 50% of the long term average spread over risk free rates for similarly credit rated bonds (Average Spread).
- b) And, if the current spread is less than the Average Spread, add the difference between the current spread of the Bond and the Average Spread.

Equity Risk



Definition

Equity market risk is the risk of economic loss due to changes in the prices of common shares this includes both the systematic and specific components common share price fluctuation.

Using a simple shock

45) The calculation of the solvency buffer will use a simple immediate (time zero) deterministic downward shock to the market value of the equities.

Consistent with the future modeling approach

46) The quantum of the shock should be consistent with that used in the future modeling approach that is equivalent to 99% CTE over a one year risk horizon. No terminal provision solvency buffer is required for equities where there is a deep and liquid market as they can be converted to cash immediately.

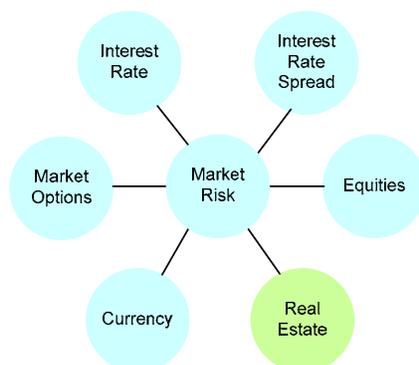
Historic data

47) To cover the worst shock in the last 50 years with a high degree of confidence a 20% decline for Canadian equity index stocks needs to be used. Since managed equity portfolios are more volatile than the index, a 30% decline in value will be used to set the solvency margin for these equities. The Canadian institute of Actuaries (CIA) “Report on Canadian economic statistics” was used as the data source.

Pass through to policyholders

48) Where equities are being used to back equity investment options in non participating products, such as universal life insurance, the equity risk is being passed through to policyholders. The solvency margin will be appropriately reduced using the correlations in the current MCCR guidelines to determine the amount of the reduction.

Real Estate Risk



Definition

49) Real estate market risk is the risk of economic loss due to changes in the amount and timing of cash flows from investments in real estate.

Using a simple shock

- 50) The solvency buffer will be calculated using a simple immediate (time zero) deterministic downward shock to the market value of the real estate.
- 51) The value of income producing real estate is primarily driven by net rental income and anticipation of capital appreciation. Accordingly, income producing real estate shares some of the same the risk characteristics of debt securities and common shares. However the market for real estate in an economic downturn has been found to be neither deep nor liquid. This requires that consideration of a solvency buffer for loss of value over a one year time horizon and a terminal provision. However in the interests of simplicity a simple shock technique has been chosen.

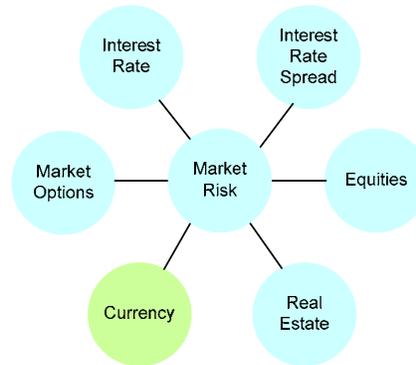
Consistent with the future modeling approach

52) The quantum of the shock should be consistent with that used in the future modeling approach that is equivalent to 99% CTE.

Quantum of shock

53) Reliable Canadian data to calibrate the quantum of the shock is difficult to find. However the initial calibration of the shock will be a 20% immediate downward valuation of real estate.

Currency Risk



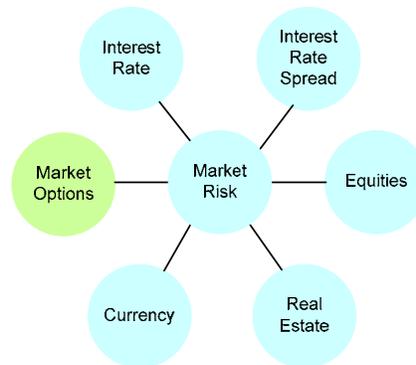
Definition

54) Currency market risk is the risk of economic loss due to changes in the amount and timing of cash flows arising from changes in currency rates of exchange.

Calculation

55) The solvency buffer for currency risk will be calculated by finding the net mismatch of cash flow in each currency and measuring the effect of an immediate change of 20% up and 20% down in that currencies value against the Canadian dollar.

Market Options



Liability Market Options

Definition

56) Liability market options risk is the risk of economic loss due to changes in the amount and timing of cash flows related to all market related options and guarantees in the liabilities.

Examples

57) These include minimum interest rate guarantees in universal life contracts and guarantees of segregated fund performance.

Alternatives for Minimum Interest Rate Guarantees in Universal Life

- 58) There are two possible methods of setting the solvency buffer requirements for minimum interest rate guarantees in universal life contracts; a cash flow method and an option pricing method.
- 59) The choice of method for setting the solvency buffer will be influenced by accounting developments. IFRS Phase II accounting standard for insurance contracts may require that the options are valued as part of the whole contract using a cash flow methodology or may require that they are separately accounted for using an option pricing methodology.

Cash flow method

In this paper a cash flow method is adopted as described in paragraph 33.

Option pricing method

- 60) If the Accounting treatment requires the option pricing method and it would be logical to extend this method for the calculation of the solvency buffer.
- 61) Under the option pricing method, assuming the liabilities have been calculated using methodology with volatility set at one standard deviation, the solvency buffer would be calculated by recalculating the value after increasing the volatility assumption to three standard deviations and setting a more conservative interest rate.
- 62) The solvency buffer will be the difference between the result of the liability calculation and the result of the calculation using increased volatility and interest.

Regulators to decide on the option to use

- 63) The regulators will make a final determination of which method to adopt after the accounting treatment becomes clearer.

Segregated Fund Market Performance Guarantees

Retaining and modifying the existing approach

- 64) The current factor based MCCR approach to setting capital requirements for segregated fund market guarantees will be retained but will be modified to be more consistent with the future modeling approach and to make the results more understandable.
- 65) The following deterministic shock scenarios will be added to more closely align with the one year time horizon of the future modeling approach.
- i. The equity market falls 20% and remains down
 - ii. The equity market falls 30% and recovers 4% per year
 - iii. The bond market interest rates double and stay at the new rate
 - iv. The bond market rates half and stay at the new rate

Calibration from the future modeling approach

66) Other shock scenarios will be added after results are obtained from companies using the future modeling approach.

Better disclosure

67) Better disclosure of the inputs to the calculations will be required including:

- i. Type of fund
- ii. Average term to the guarantee dates
- iii. Seriatim current surplus and short fall to the guaranteed amount

Other Market Guarantees

Guarantees under variable annuities

68) A method similar to that used for segregated funds will be developed for guarantees under variable annuities.

69) The following guarantees will be considered:

- i. Guaranteed Minimum Death Benefit (GMDB)
- ii. Guaranteed Minimum Income Benefit (GMIB)
- iii. Guaranteed Minimum Account Benefit (GMAB)
- iv. Guaranteed Minimum Withdrawal Benefit (GMWB)

Asset Market Options

Definition

70) Asset options risk is the risk of economic loss due to changes in the amount and timing of the cash flows related to all market related options and guarantees in the assets.

71) The current MCCR methods for all asset classes including mortgages, asset backed securities, derivatives, callable bonds, extendable bonds and commodities will be retained.

PROCEDURE TO CALCULATE THE SOLVENCY BUFFER

The procedure to calculate the solvency buffer is to project the best estimate contractual cash flows from all assets and liabilities held on the reporting date.

- a) Do not assume any reinvestment of cash flows.
 - b) Assume cash flow from non-interest sensitive assets such as real estate and equities are their market value at time zero.
 - c) Discount the best estimate assets cash flows at the risk free rate curve. This gives a present value of asset cash flows.
 - d) Discount the best estimate liability cash flows at the risk free rate, for cash flows beyond 30 years (where there is no market risk free rate) discount the cash flows beyond 40 years at the average 30 year spot rate over the prior 30 years. And for cash flows in the years 31 to 39 use rates interpolated between the 30 year spot rate and the rate used for cash flows over 40 years.
 - e) Deduct the present value of the liability cash flows from a present value of asset cash flows. This gives a net present value of the cash flows of this base scenario
 - f) Calculate the effect on net present value of the cash flows of a series of different interest rate shocks by varying the risk free rate curve. Use the following interest rate shocks from the base scenario using the current risk free yield curve:
 - i. 90 day T- bill up (T1) basis points 30 year spot rate up (B1) basis points linear interpolation between 90 days and 30 years
 - ii. 90 day T- bill down (T2) basis points 30 year spot rate down (B2) basis points linear interpolation between 90 days and 30 years
 - iii. 90 day T- bill up (T1) basis points 30 year spot rate down (B2) basis points linear interpolation between 90 days and 30 years
 - iv. 90 day T- bill down (T2) basis points 30 year spot rate up (B1)(basis points linear interpolation between 90 days and 30 years
 - v. Flat 3% rates from 90 days to 30 years
- Where T1 is the estimated 99.5% percentile of the potential **upward** change in 30 day T-bill rates over one year
 - Where T2 is the estimated 99.5% percentile of the potential **downward** change in 30 day T-bill rates over one year
 - Where B1 is the estimated 99.5% percentile of the potential **upward** change in 30 year spot rates over one year
 - Where B2 is the estimated 99.5% percentile of the potential **downward** change in 30 year spot rates over one year

The interest rate shocks to be used are the following linear functions of the square roots of the current rates (r). Where (r) is expressed as a decimal for example five percent will be expressed as 0.05. This function is based on a simplified Cox-Ingersoll-Ross model fitted to the historic data.

If the current 90-day rate is r , then

$$\begin{aligned} T1 & \text{ is } && 0.163\sqrt{r} + 0.0066 \\ T2 & \text{ is } && 0.163\sqrt{r} - 0.0066. \end{aligned}$$

If the current 30-year rate is $r1$, then

$$\begin{aligned} B1 & \text{ is } && 0.099\sqrt{r1} + 0.0027 \\ B2 & \text{ is } && 0.099\sqrt{r1} - 0.0027 \end{aligned}$$

If the calculated downward shock produces a negative number zero is to be used. In the above calculation no changes to the interest rates on cash flows beyond 40 years are to be made.

For each scenario calculate the difference in net present value of the cash flow mismatches.

The solvency buffer is the largest negative difference between the base scenario and the net present value of the cash flow mismatches.

**DEFINITIONS OF CREDIT AND MARKET RISK
AND A DISCUSSION OF INTEREST SPREAD RISK**

Credit risk and market risk are closely associated and it is important to ensure that risks are not double counted or ignored. By using the following definitions it is usually clear to which category a particular risk belongs.

Definition of Credit Risk

- Credit risk is the risk of default by counterparties on loans, debt instruments, derivatives, and reinsurance.

Definition of Market Risk

- Market risk is the risk to an insurer's financial condition arising from adverse movements of market prices.

Interest Spread Risk

However Interest Spread Risk on bonds and other financial instruments has some characteristics of Market risk and some characteristics of Default risk.

Definition of Interest Spread

- Interest Spread is the additional interest over the risk free rate that is paid on instruments of lesser credit quality. For example a BBB rated bond will pay a higher interest rate than a government of Canada bond of the same maturity.

Definition of Interest spread market risk

- A systematic increase or decrease of spread for similar financial instruments (for example BBB bonds) is due to a change in markets. It is the change in the price that the investors require for assuming the additional credit risk. Capital requirements for this risk will be classified as market risk.

Definition of Interest Spread Credit Risk

- An increase in spread for a particular instrument in the market due to actual or anticipated credit downgrade of the particular institution is a default risk. Capital requirements for this risk will be classified as Credit Risk.

DEFINITIONS
BEST ESTIMATE, VOLATILITY AND UNCERTAINTY

Definition of Best Estimate

1. Best estimate is the probability weighted mean of all outcomes.
2. The best estimate may be arrived at by statistical techniques using models of future possible outcomes. It may also be derived by non statistical judgment.

Definition of Volatility

3. Volatility is the random variations around the best estimate.
4. Volatility includes extreme volatility. The risk of extreme volatility occurring is sometimes called the catastrophic risk.
5. Some events, for example a pandemic, cause extreme volatility in more than one risk area. This type of catastrophic risk is not included in this definition of volatility.

Definition of Uncertainty

6. Uncertainty is the risk of misestimating the best estimate.
7. Incorrect assumptions or errors in the data can lead to errors in calculating the best estimate. Because one can never be sure our assumptions are correct and data is error free best estimates always have some degree of uncertainty risk.