Seeing Beyond Risk Canadian Institute of Actuaries Institut canadien des actuaires Voir au-delà du risque

Report

Report of the Task Force on Segregated Fund Liability and Capital Methodologies

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Memorandum

To: All Fellows, Affiliates, Associates and Correspondents of the Canadian Institute of Actuaries

From: Tyrone G. Faulds, Chairperson
Practice Council

Alexis Gerbeau, Chairperson
Task Force on Segregated Fund Liability and Capital Methodologies

Date: August 11, 2010

Subject: **Report – Task Force on Segregated Fund Liability and Capital Methodologies**

The Task Force on Segregated Fund Liability and Capital Methodologies ("the task force") has developed the attached task force report. It presents recommendations for the determination of policy liabilities for segregated fund guarantees and considerations for setting capital requirement for these guarantees.

The task force has solicited input from the Committee on Life Insurance Financial Reporting, the Committee on the Appointed/Valuation Actuary and the Committee on Risk Management and Capital Requirements. Although feedback was received and taken into consideration, this report solely represents the opinion of the task force members and is not endorsed by these committees.

The task force members are:

Allan Brender (Office of the Superintendent of Financial Institutions (OSFI) representative)
Byron Corner
Alexis Gerbeau (Chairperson)
Lynn Guo
Frédéric Kibrité
Ricardo Mitchell
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1 PURPOSE/SUMMARY

The primary objective of this task force was to explore alternate methodologies for the determination of policy liabilities and capital requirement for segregated fund guarantees considering the resulting total balance sheet requirements. The motivations for undertaking a review of these methodologies were twofold.

First, the strong rise of the hedging practice across the industry in recent years made the review of the methodology necessary. The current guidance for the valuation of segregated funds has been mostly developed in the early 2000s at a time when very few or no companies hedged their guarantees. Consequently, very little guidance for the recognition of hedging in the valuation exists. More fundamentally, the question of whether the current methodology was appropriate in a context of hedging had to be considered.

Secondly, there was the desire to maintain a consistency between the valuation standards and the capital requirement rules currently under review by the Office of the Superintendent of Financial Institutions (OSFI) with the assistance of the Autorité des marchés financiers (AMF) and the Minimum Continuing Capital and Surplus Requirements (MCCSR) Advisory Committee. As the use of hedging increased in the industry, OSFI became concerned that the current methodology might not reflect the true cost of hedging. Another concern of OSFI is the flexibility allowed in the setting of assumptions that are not company-specific and might result in a wider range of practice than appropriate. OSFI therefore undertook a major review of the capital requirement for segregated fund guarantees. For that purpose, we have been in communication with OSFI throughout our work.

The task force was instructed to approach the question from a fresh perspective and consider any avenue deemed appropriate. In particular, the task force was not bound by current Standards of Practice and could consider recommending a methodology that would fall outside the Canadian Asset Liability Method (CALM) framework.

Given the short timeframe of this task force, it was established that no quantitative analysis or impact studies would be conducted. Areas where further quantitative research was needed would be identified.

The methods reviewed in the course of our work fall into two broad families: CALM and the risk-neutral method.

The more fundamental concern with CALM in the context of hedging is that given the current calibration criteria, the uncertainty with respect to the future volatility of investment returns may not be adequately reflected in the calculation of policy liabilities. Other concerns are the impracticability of the reflection of hedging in CALM and the absence of guidance on how to account in the valuation for potential hedging weaknesses.

The risk-neutral method did appeal to some members, because of its high practicality and comparability. Other members, however, were concerned about a potential increase in pro-cyclicality, the inconsistency with the valuation method for other products and the relevance of applying the risk-neutral method when no hedging program is in place, i.e., the break of the relationship between the investment strategy and policy liabilities. Finally, the undertaking of a major change in the valuation method only a few years

before the coming into force of Phase II of International Financial Reporting Standards (IFRS) was raised as a concern.

It was acknowledged by all task force members that the adoption of the risk-neutral method would require significant additional quantitative analysis and impact studies. It was also felt that a short-term solution was required in order to address the more pressing issues. The task force therefore formulates two recommendations, one for the short term which addresses the more pressing issues, and a second for the long term.

For the short term, the task force recommends retaining the CALM framework and setting up one or more working groups with the mandate of

1) reviewing the calibration criteria for investment returns;
2) providing guidance for the use of approximation methods to account for hedging in the calculation of policy liabilities, and
3) providing guidance with respect to potential hedging weaknesses that would be reflected in policy liabilities.

For the long term, the task force recommends setting up a new working group with the mandate of analysing the merits of the risk-neutral method for the valuation of segregated fund guarantees. The development of Phase II of IFRS would be considered.

1.1 Abbreviations

The following abbreviations are used throughout this report:

CTE	Conditional Tail Expectation;
MfAD	Margin for Adverse Deviation;
PfAD	Provision for Adverse Deviation;
SOS	Stochastic on Stochastic (defined in section 2.1);
CALM	Canadian Asset Liability Method; and
AAE	Allowance for Acquisition Expense.

The following documents are referred to throughout this report:

Report: CIA Task Force on Segregated Fund Investment Guarantees, March 2002—"2002 Task Force Report" (http://www.actuaries.ca/members/publications/2002/202012e.pdf);

Educational Note: Considerations in the Valuation of Segregated Funds Products, November 2007—"2007 Educational Note" (http://www.actuaries.ca/members/publications/2007/207109e.pdf).

2 CURRENT STANDARDS OF PRACTICE

2.1 Valuation of Policy Liabilities

According to the current generally accepted actuarial practice, policy liabilities for segregated fund guarantees are calculated by a stochastic application of CALM. The stochastic model for investment returns is required to satisfy the calibration criteria set out in the 2002 Task Force Report.

When no hedging program is in place, the valuation process consists of the following steps:

1) Generate stochastic scenarios of market variables such as investment returns and interest rates using a model under the real-world measure;
2) For each scenario:
    a. Project liability cash flows over the term of the liabilities using actuarial assumptions that include MfADs;
    b. Perform a roll-forward CALM cash flow testing to determine the amount of required assets which reduce to zero at the last liability cash flow;
3) Calculate the CTE (level 60% to 80%) of the value of the required assets.

The policy liabilities for the guarantees is set to the CTE calculated in step 3) adjusted for any unamortized AAE. This adjustment, and the revenue included in the liability cash flows in step 2) a., depends on whether the Whole Contract or the Bifurcated approach is adopted.

The term of the liabilities for all segregated fund guarantees ends at the date after the valuation date which maximizes the policy liabilities at the level of aggregation chosen. This amounts to applying a floor of zero to the policy liabilities for segregated fund guarantees.

In practice, it may be impractical to perform a CALM testing in step 3) above. An approximation method is therefore typically used.

When a hedging program is in place, an exact application of CALM would consist of the following steps:

1) Generate stochastic scenarios of market variables such as investment returns and interest rates using a model under the real-world measure;
2) For each scenario:
    a. Project liability cash flows over the term of the liabilities using actuarial assumptions that include MfADs;
    b. At each time step, calculate the "greeks" of the guarantee using a set of scenarios generated using a model under the risk-neutral measure;
    c. Using the information from step b., project the rebalancing of the hedge portfolio and the resulting asset cash flows;
    d. Perform a roll-forward CALM cash flow testing to determine the amount of required assets which reduce to zero at the last liability cash flow taking into account the cash flows from the hedge portfolio calculated in step c.;
3) Calculate the CTE (level 60% to 80%) of the value of required assets.

The policy liabilities for the guarantees is set to the CTE calculated in step 3) adjusted for any unamortized AAE. This adjustment, and the revenue included in the liability cash flows in step 2) a., depends on whether the Whole Contract or the Bifurcated approach is adopted.

Further considerations such as the basis risk between the underlying segregated fund assets and the hedge positions and the liquidity risk would be reflected in the valuation. Guidance on the modeling of hedges is provided in section 2.3 of the 2002 Task Force Report.

The floor of zero still applies at the issue of a contract. However, negative liabilities are allowed at future periods, but "*subject to constraints on the amount of profit capitalized, consistent with an unhedged position*". This statement, taken from the 2007 Educational Note, proved difficult to interpret. It suggests liabilities would be set in part retrospectively based on past assets performance. This would be a departure from the forward-looking CALM. We will return to this issue in section 7.2.

This exact application of CALM in the context where a hedging program is in place will henceforth be referred to as the Stochastic-on-Stochastic (SOS) method in reference to the nested simulations of step 2) b.

Nested simulations make the process very time-consuming. It is therefore likely that many actuaries will prefer an approximation method. Very little guidance exists on this matter. The only guidance is provided in section 2.3 of the 2002 Task Force Report. It is stated that "*approximations may be used, but should be justified by reference to stochastic modeling of a representative sample of contracts*".

The use of the risk-neutral measure in step 2) b. assumes the hedging strategy is to hedge the risk-neutral value of the liability. We will refer to this strategy by saying that the hedge target is the risk-neutral value. Other hedge targets that would require nested simulations under the real-world measure are possible. In all cases, nested simulations are required.

2.2 Current Practice for Hedging and Reflecting Hedging in Valuation

Companies that were represented on the task force either had a hedging program in place or were about to implement one, at the time the report was prepared.

Of those that are currently hedging, some hedge only their GLWB-type guarantees, while running their death and maturity guarantees naked. Others are hedging all guarantees.

Dynamic hedging is used by all companies that currently hedge, with only one company using static hedging for their cohorts sufficiently close to maturity.

For dynamic hedging:

- The economic value of the guarantee is hedged. Some consideration may be given to the generally accepted accounting principles (GAAP) basis;
- For the economic value, some companies use implied volatilities in the short term and grade toward a long-term assumption, while others are using only a long-term assumption;
- Typically Delta and Rho are hedged while Vega and Gamma are only monitored;
- Some companies are holding long-dated puts in their hedge portfolio; and
- Only the risk-free rate component of the fixed-income exposure is hedged; nothing is done for provincial and corporate spread exposures.

For the fund mapping, a number of companies use statistical techniques to derive proxy funds as linear combinations of market indices. For internally managed funds, some companies are looking at actual funds holdings.

The methods used for recognizing hedging in policy liabilities vary.

A number of companies:

1) Do not reflect hedging at all in their liabilities, awaiting CIA guidance and IFRS Phase II;
2) Intend to implement an approximation method; and
3) Use the SOS method, although with much simplification.

A number of task force members stated that the disconnection between the economic value and the GAAP value of guarantees was their most important concern with respect to hedging.

2.3 Capital Requirement

The capital requirement for segregated fund guarantees in Canada is established with an internal model that needs to be approved by OSFI or using the prescribed factors approach. Both approaches aim at estimating CTEs of the amount of assets required to support liability cash flows over the term of the liabilities. The capital requirement is established at higher levels of CTE than actuarial liabilities. The levels of CTE depend on the term to maturity of contracts where the company has elected to adopt the alternative method developed by OSFI in 2008. Otherwise, the level of CTE is 95% for all contracts.

A significant difference between the methods for determining actuarial liabilities and capital requirement for segregated fund guarantees is the recognition of hedging. Explicit approval from OSFI is required before a company may recognize any hedge assets in the determination of capital requirement. Furthermore, the only hedge assets that can be considered in the determination of the capital requirement are those held as of the valuation date. Hedge assets that a company has not yet entered into as of the valuation date are not to be recognized in the determination of the capital requirement. As such, the reduction in capital requirement provided by dynamic hedging is generally very limited. Furthermore, some companies reflect the hedge assets only partially in the determination of capital requirement by applying the weighting scheme described in the Guidance Note on Capital Offset for Segregated Fund Hedging Programs (OSFI, 2001). Under this scheme, the capital requirement is a linear combination of two calculations, one that reflects the hedge assets held at the valuation date and one that does not.

In the absence of OSFI's approval for reflecting the hedge in the determination of capital requirement, the provisions for C-1 risk of section 3.7 of the MCCSR guideline apply. A capital charge is assigned to hedge items such as futures and options. No additional capital is required for purchased put options that clearly serve to hedge segregated fund guarantee risk. Also, where a company has both long and short positions in exactly the same underlying equity security, the capital requirement under section 3.7 is based on the company's net position in the equity security. This can result in higher capital requirements for companies that hedge but don't have offsetting long positions than for companies that don't hedge.

Reference on this topic is the Guidance Note on Capital Offset for Segregated Fund Hedging Programs (OSFI, 2001) and the Advisory on the Recognition of Hedge Contracts in the Determination of the Segregated Fund Guarantee Capital Requirement for Life Insurance Companies (OSFI, 2008).

3 COST OF DYNAMICALLY HEDGING A GUARANTEE

3.1 Dynamic hedging in theory

A dynamic hedging strategy for a contract is a self-financing investment strategy that involves the frequent rebalancing of a portfolio of assets that aims at replicating the payoff of the contract. Self-financing means that no cash flow aside from the premiums anticipated under the contract is required to be injected into or withdrawn from the portfolio over the term of the contract. Replicating means cash flows generated from the portfolio, including those generated from the liquidation of positions, correspond exactly to the cash flows for the contract. In theory, an entity issuing a contract and initiating a hedging strategy covering that contract assumes no risk by definition.

The existence of a hedging strategy for a contract provides the value of the contract. Indeed, according to the arbitrage-free principle, the value of the contract at any point in time must be the value of the portfolio required to initiate the strategy. The violation of this rule would provide arbitrage opportunities which would be eliminated immediately.

It is important to point out that two main categories of risk coexist within a segregated fund contract: insurance risks (lapse, mortality, policyholder utilization rates, etc.) and market risks. As a liquid financial market is not yet developed for insurance risks, we assume the dynamic hedging program addresses only market risks.

A simple theoretical setting of the Black-Scholes type will be used to illustrate our point[1]. In this setting, the market is composed of a bank account earning the risk-free rate and a single stock. The following assumptions are made:

- The stock price follows a specified process with a constant volatility;
- Market participants can invest and borrow at a constant risk-free rate;
- Short selling of securities is permitted;
- No transaction cost is incurred; and
- Security trading is continuous.

Under these assumptions, the theory of derivatives pricing provides a unique dynamic hedging strategy for any payoff that is a function of the stock. The cost of this hedging strategy, i.e., the value of the assets required to initiate the strategy, is given by the so-called risk-neutral value and is a function solely of the risk-free rate and the volatility of the stock return. The risk-neutral value at any time represents the amount of assets required at that time to pursue the hedging strategy and ultimately replicates the payoff of the contract being hedged. The unique hedging strategy consists of maintaining a portfolio of units of the bank account and stocks that matches the sensitivity of the risk

[1] (Hull, 2003) was used as reference.

neutral value of the contract with respect to the stock value (the delta) at any moment. This is known as delta hedging.

Technically, the risk-neutral value is the expectation under the risk-neutral measure of the contract payoff, discounted at the risk-free rate. The risk-neutral measure is a probability distribution that allows calculating the value of a contract with a simple payoff expectation, discounted at the risk-free rate with no adjustment for risk. The term risk-neutral stems from the fact that under this probability distribution the expected return of all securities is equal to the risk-free rate, so the securities are priced as if market participants were risk-neutral. It is important to stress that this has nothing to do with any assumption about the degree of risk aversion of market participants. It is simply an algebraic expedient to make calculations easier. The risk-neutral measure is in contrast with the real-world measure, which is the physical probability law that governs the behavior of prices in the observable, "real" world.

The important point above is that in theory the cost of hedging is a function of the risk-free rate and the volatility only. In particular, the expected return of the stock, or the risk premium, is irrelevant for pricing derivatives.

This theoretical framework can be generalized in various directions. For example, interest rates can be made stochastic and more than one stock can be modeled.

Note that alterative hedging strategies may be devised. For example, companies might select the GAAP liability or capital requirements as hedge target. None of these strategies, however, leads to a perfect replication of the contract payoff.

3.2 Dynamic hedging—from theory to practice

As with most mathematical models, theory is not a perfect reflection of reality. In the case of a dynamic hedging program, the disparity between theory and reality will affect the actual cost of hedging a contract.

In real life, an obvious departure from the theoretical model is that the volatility of equity is not constant and is not known in advance. In short, volatility is better represented as a stochastic variable. The fundamental consequence of this is that the actual cost of hedging a contract under the delta strategy outlined above is not known with certainty before the end of the contract. The actual cost of delta hedging is a function of the path of realized volatility from the inception of the strategy to the end of the contract.

The value of most, if not all options embedded in segregated fund products, is an increasing function of volatility, i.e., a higher volatility path leads to a greater cost of hedging. An important risk for companies using a delta hedging strategy for managing their segregated fund risk is therefore the risk of high volatility of investment returns.

We now reach the central message of this section. When a company switches from an unhedged position to a delta hedging strategy, the risk of high volatility supplants the risk of poor returns.

In a theoretical setting, the risk of volatility can be eliminated by incorporating in the hedging strategy nonlinear instruments such as equity options and swaptions. However, this would require the existence of a market for such instruments of terms up to the term of the contract to be hedged. For example, the hedging of a 30-year GLWB would require

the availability in the market of the whole range of options from terms of one year to 30 years. In Canada, there is no deep and liquid market for options of terms beyond approximately two years, so this possibility is only of theoretical interest. A company may try to reduce its exposure to volatility by taking some positions in the available short-term options, but the volatility risk cannot be completely eliminated for long-term contracts.

The volatility risk is one example of the parameter and model risk inherent to any dynamic hedging program. Other potential sources of hedging imperfections include the following elements:

- Continuous trading is not possible and a discrepancy will necessarily occur due to the discretization of the execution of the hedging program (rebalancing takes place at some finite frequency); a corollary is the gap risk associated with a rapid move of the markets;
- Transaction costs are incurred;
- The lack of liquidity for an instrument could create market impact;
- Potential restrictions on short selling;
- Basis risk created by a difference in the composition of the underlying funds to be hedged and the instruments used to hedge (the absence of dividends within the futures contracts is an example); and
- It is generally not possible to borrow at the risk-free rate.

In conclusion, the theory of derivatives pricing provides a framework for estimating the cost of hedging a contract. Any cost derived from this theory, however, is only an estimate, as model and parameters uncertainty exists. However, the main prediction of the model remains relevant for our purpose, i.e., the primary driver of the cost of a delta hedging strategy is not future equity returns, but the future path of volatility of equity returns.

4 DESIRABLE FEATURES FOR POLICY LIABILITIES AND CAPITAL REQUIREMENT

Before discussing the various methods for the valuation of policy liabilities and the determination of the capital requirement for segregated fund guarantees, a list of desirable features for these methods was first established.

4.1 Policy liabilities

1) Practical

- Easily repeatable;
- Easily auditable;
- Easily controllable; and
- Ability to project (for Dynamic Capital Adequacy Testing (DCAT)/business plan/stress-testing purposes).

2) Economically sound (as much as possible)
   - Prospective;
   - Results in a consistent balance sheet;
   - Provides incentive for sound risk management/hedging practice; and
   - Would be at least equal to the expected cost of fulfilling contractual obligations.
3) Comprehensive
   - No double counting; and
   - All components are taken into account.
4) Comparable
   - Provides for comparisons across companies;
   - Reflects a narrow range of practice;
   - Transparent; and
   - Is not excessively model dependent.
5) Avoids excessive and unnecessary pro-cyclicality.
6) Results in an appropriate emergence of profits.

4.2 Capital Requirement

1) Points 1 to 5 of the desirable features for valuation of policy liabilities:
   - Practical;
   - Economically sound (capital requirement focuses more on the risk aspects of the economics);
   - Comprehensive;
   - Comparable; and
   - Avoids excessive and unnecessary pro-cyclicality.
2) Prudent
   - The capital requirement would be dependent on supporting assets and investment strategy; and
   - More risk would give rise to a higher capital requirement.

Three criteria were discussed but in the end excluded from the list. The inclusion of PfADs in policy liabilities was not judged essential since the fundamental objective is that total asset requirements be prudent enough. This can be achieved by allocating all layers of prudence in capital requirements. The link between policy liabilities and the investment strategy was also excluded from our requirements because we saw no reason to reject at the outset market consistent methods unrelated to a company's specific investment strategy. Finally, the consistency with the method for other products was also

excluded because this would have restricted us to consider only the CALM framework. This was felt at odds with our mandate.

4.3 Competing Concepts for an Economically Sound Method

There is more than one general concept relying on economic principles for establishing policy liabilities.

4.3.1 Current Exit Value

Under this approach, policy liabilities are an estimate of the amount an entity would have to pay to transfer the liabilities to a willing third party in an arm's-length transaction.

Where blocks of a given type of contract are commonly transferred between carriers, the prices at which blocks are traded are arguably the best measure for determining the current exit value of these contracts.

In the absence of such a market, methods for estimating the current exit value rely on observable prices of financial instruments and on assumptions. It is generally accepted that the valuation of non-hedgeable risks would include margins, on the basis that a market would require a premium for bearing them. Implicit in the definition of the exit value is that assumptions would not be entity-specific but would be consistent with an abstract general entity. For example, the current exit value would not depend upon the costs of servicing contracts that a particular carrier expects to incur. Also, the exit value would not depend upon the particular investment strategy followed by an entity.

4.3.2 Fulfillment Value Concept

A competing concept for establishing policy liabilities is the concept of fulfillment value. The fulfillment value is the amount required by a company to fulfill its contractual obligations to its policyholders over time. Market information would be used where available and liabilities would include margins. The main difference with the exit value concept is that liabilities would be valued from the perspective of the entity liable for the contracts, so entity-specific assumptions would be used.

The issue of deciding on the best economic concept for determining policy liabilities is larger than the valuation of segregated fund liabilities and is out of the scope of this task force. We will content ourselves to retain what the various concepts have in common. The economic value would be prospective and would reflect information at the valuation date. Policy liabilities would include margins for non-hedgeable risks, whether financial or non-financial. A corollary is that policy liabilities would be at least as great as the expected cost of fulfilling contractual obligations. By that we intend that if a risk management strategy exists for eliminating or reducing to a large extent the risks, policy liabilities would be at least as great as the expected cost of pursuing that strategy.

By consistent balance sheet, we intend that two similar types of contracts would be valued with the same methodology. Similarly, a liability that is the exact mirror image of an asset would be valued consistently with this asset.

4.4 Emergence of Profits

Emergence of profits would be considered both at policy issue as well as after policy issue.

At policy issue, the task force has divergent views on whether policy liabilities would be allowed to go negative and the extent to which the policy liabilities can go negative (only to recover deferred acquisitions costs (DAC), or to CTE(80) or CTE(60)). Said in a different way, the degree to which the term of the liability can extend beyond time zero is subject to divergent views.

Those arguing in favor of a maintaining the restriction on negative policy liabilities are concerned with such things as early lapsation and bringing into income fees that may not yet be "earned."

Those arguing in favor of no restriction look to other applications of CALM where negative policy liabilities are common. Under CALM, the point in time that a new policy or a new liability (e.g., new deposit to an existing segregated fund annuity policy) goes into effect is the trigger event for profit recognition. CALM recognizes losses (or profits) at sale of an insurance policy to the extent that acquisition expenses are greater than (less than) the present value of future policy profit margins, such present value based on best estimate assumptions plus appropriate MfADs. Products with limited long-term guarantees, if any, and which provide the policyholder with a surrender right without cost, can result in front-ending of profit. The challenge with these products is estimating the lapse/surrender best estimate, as it often has to be conjectural, not fact- or experience-based. The term of the liability of zero in the case of segregated funds is effectively one and the same as prescribing a 100% withdrawal assumption immediately following the Balance Sheet date. Some members are of the opinion that it would be better to provide guidance with respect to the withdrawal best estimates and MfADs than to arbitrarily establish a zero floor. In this revision to the standards, the actuary would be required to assume higher withdrawal best estimates and MfADs, the lower the guarantees, the greater the annual profit margin or the lower the charge to the policyholder to withdraw. It would be appropriate to place a very strong onus on the actuary to demonstrate why it is appropriate to have an assumption set that front-ends profit (or increases the front-ending of profit at any point in time as a result of assumption re-set) above a certain prescribed percentage of the account balances.

Those in favor of no restriction on negative liabilities are also concerned with developing methodologies for moving from floored time zero policy liabilities forward over time in the context of hedging and the practicality of tracking at a policy or cohort level.

The methodology for determination of capital requirement is relevant for that discussion. In an approach where a total balance sheet requirement (TBSR) is used and capital requirement is simply the difference between TBSR and the liability, allowing negative policy liabilities would result in more capital held.

Given that this issue is more general than the valuation of segregated fund guarantees, we have not included it within our scope. Also, as all methods considered in this report can accommodate one view or the other, we will not return to this issue for the remainder of this report.

After policy issue there is more similarity in opinions. The task force considers that the alignment of policy liabilities changes to hedge assets changes is desirable to avoid a disincentive toward prudent risk management through hedging.

4.5 Issue of Pro-cyclicality

The economic value of the guarantee will typically increase as the guarantee is more in-the-money, as expected guarantee payoff obviously increases as the underlying fund value decreases. Compounding that effect, when the markets crash, the market volatility typically also increases, amplifying the increase of economic value.

As a decrease in equity value and an increase in volatility would increase both the expected guarantee payoff and the costs of hedging, an increase in the total balance sheet requirements resulting from such event is considered appropriate and desirable by this task force. The issue is to what extent total balance sheet requirements should increase. We will return to this issue in section 6.

5 METHODS CONSIDERED FOR VALUATION

The methods reviewed fall into two broad families: CALM and the risk-neutral method. We begin by providing an outline of the general principles underlying each of these two methods.

5.1 CALM Principles

The policy liabilities under CALM are defined as the amount of assets sufficient to support liability cash flows over the term of the liabilities, with a relatively high confidence level.

The investment strategy followed by the company is taken into account in determining the amount of sufficient assets. The risk of asset-liability mismatch is therefore reflected in policy liabilities.

The model and assumptions required to assess the range of possible outcomes are deemed to represent a realistic probabilistic view of the future. The assumptions are based on the actuary's best estimates of future experience, considering expert advice, and applying actuarial judgment to relevant company specific experience and/or industry experience and historical market data. While it is necessary to consider past experience and to draw on it to set future assumed experience assumptions, consideration is given as to how and why future experience might be different and to recognize this in the valuation. There is somewhat one-sided bias to developing the assumptions for future experience with a significant onus of proof on the actuary when using assumptions that are more aggressive than supported by past experience; and in some cases, the Standards of Practice prescribe assumptions no more aggressive than past experience.

Where policy liabilities are calculated on a deterministic basis, the PfADs with respect to scenario-tested assumptions result from calculating the policy liabilities over multiple scenarios and adopting a scenario whose policy liabilities are relatively high. Where policy liabilities are calculated using a stochastic application, the policy liabilities are set within the CTE(60) to CTE(80) range.

The PfADs with respect to assumptions other than the scenario-tested assumptions result from MfADs included in those assumptions.

5.2 Risk-Neutral Principles

An application of the risk-neutral valuation methodology would consist of the following steps.

1) Generate stochastic scenarios with relevant market variables such as equity returns and interest rates using a model under the risk-neutral measure;
2) For each scenario:
    a. Project liability cash flows over the term of the liabilities using, for insurance risks, actuarial assumptions that include MfADs;
    b. Calculate the present value of liability cash flows discounted at the risk-free rate;
3) Calculate the average over all scenarios (CTE (0%)) of the present value.

The policy liabilities for the guarantees would be set to the average calculated in step 3), adjusted for any unamortized AAE.

As explained in section 3, a risk-neutral valuation represents an estimate of the amount of assets required to pursue a dynamic strategy that replicates the segregated fund guarantee payoff under the market model assumptions.

Where a market exists for financial instruments of terms corresponding to the term of the guarantee, the risk-neutral model may be calibrated using these financial instruments. This will make the risk-neutral valuation of the guarantee consistent with these market prices. The risk-neutral value is an estimate of the price at which the guarantee would be traded should a market exist for it. It is only an estimate however, as the risk-neutral value is derived from financial instruments that would not generally have the exact same risk profile as the guarantee being valued. An example of this is the derivation of the value of a path-dependent guarantee using a model calibrated with plain vanilla options, which are not path-dependent. The greater the similarity between the guarantee to be valued and the financial instrument used to calibrate the model, the greater the reliability of the result.

As discussed in section 3, no dynamic hedging strategy is perfect; residual risks always exist. Therefore, the prices of derivatives in the market are often deemed to include some margins for risk. This is based on the assumption that the market is requiring a positive risk premium for bearing the risks. In short, this theory predicts that the price of an option would generally be greater than the expected cost of dynamically replicating the option payoff. This may explain in part why implied volatilities are generally greater than realized volatilities, i.e., why actual option prices are generally greater than prices predicted by the Black & Scholes model. Under this assumption, one may consider that if the risk-neutral method is used for valuing guarantees, the resulting policy liabilities would implicitly include some PfADs for market risks. Therefore, no additional explicit MfADs would be required where assumptions are calibrated with derivatives prices. This approach to setting PfADs would differ drastically from how PfADs are set under the current CALM framework, where they are explicitly set by the actuary to cover a given level of risk.

Where a market does not exist, or the market is not liquid, there are no reliable prices to calibrate the model. This does not forbid the use of the risk-neutral mechanism for the valuation of guarantees. In this case, market assumptions would be input based on a combination of historical data, judgement, broker quotes and shorter-term financial instruments, for example. For the purpose of setting policy liabilities, these assumptions would include explicit MfADs.

5.3 Relation between CALM and Risk-Neutral Principles

Where a company does not hedge its guarantees, or has a hedging program with a hedge target different from the risk-neutral value, there is an important and obvious philosophical difference between CALM and the risk-neutral method. The risk-neutral value is an estimate of the cost of initiating a hedging strategy with the risk-neutral value as hedge target, notwithstanding that the company is not actually pursuing this strategy. CALM is an estimate of the amount required to support future claims with a relatively high confidence level, reflecting the company specific strategy, or absence of strategy.

Where a company hedges its guarantees with the risk-neutral value as hedge target, the difference between the two methods is blurred. As explained above, the risk-neutral method provides the cost of dynamically replicating the liability payoffs using the risk-neutral value as target, which is exactly in this situation what CALM is aiming at in a more explicit way. Actually, if the parameters of the two methods are chosen consistently, both methods would give the same result.

The remainder of this subsection discusses the case of a company that dynamically hedges its guarantees using the risk-neutral value as hedge target.

When a deep and liquid market exists

In this context, the risk-neutral method results in an estimate of the cost of hedging that is consistent with market prices, while CALM results in an estimate of the cost of hedging using assumptions based on historical data and judgment.

When a static replicating portfolio exists and a company owns that portfolio, both methods are nevertheless equivalent because the policy liabilities under CALM are simply the value of the replicating portfolio.

When a dynamic hedging strategy is pursued, the risk-neutral method and CALM would generally not be equivalent since the actuary’s point of view would generally differ from the market.

Therefore, a true philosophical difference exists in this case too.

When a deep and liquid market does not exist

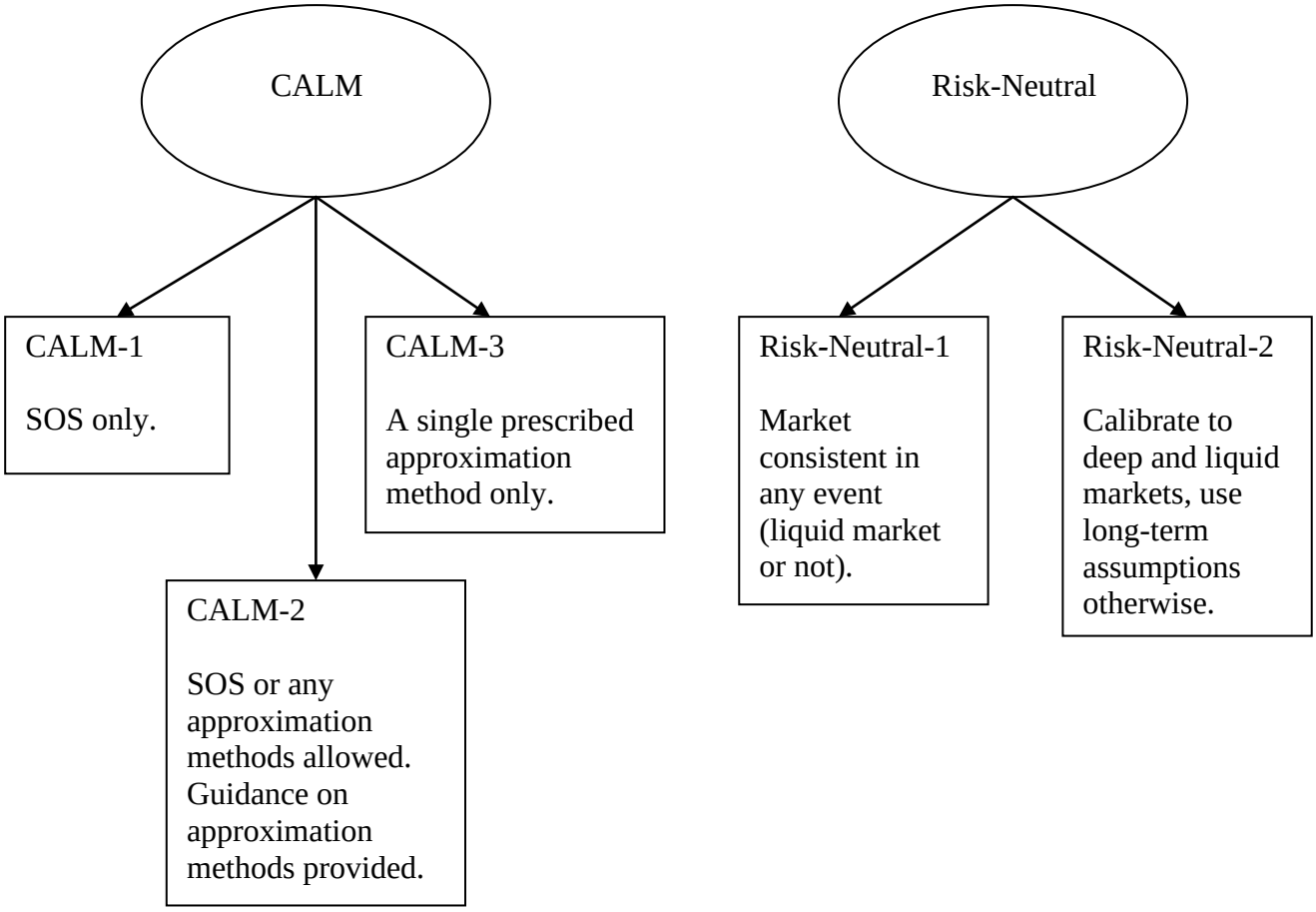
In this case, the risk-neutral method requires long-term assumptions which need to be derived from historical data and judgment, as for the CALM. These assumptions would be required to include MfAD, as for CALM. The two methods aim at estimating the cost of financing the hedging strategy, under the given set of assumptions.

Therefore, the two methods mainly differ by their mechanism in this case. Because there is no liquid market in Canada for options beyond two-year terms or so, and because the vast majority of guarantees extend to a much longer term, the CALM versus the risk-

neutral debate is, in practice, more a practical question than a conceptual one in the current Canadian environment.

5.4 Variants of Methods Considered

The following chart summarizes the methods we have discussed in our review.



CALM-1

The use of the exact application of CALM would be prescribed, so the SOS would be applied when a hedging program is in place.

CALM-2

Where a hedging program is in place, approximation methods would be allowed. Guidance would be provided by the CIA regarding the use of approximation methods. The SOS method would remain the standard of reference. The actuary would be required to demonstrate that any approximation method chosen produces similar results to the SOS method. Basically, this corresponds to the current situation, except that guidance would be provided regarding the use of approximation methods.

CALM-3

Where a hedging program is in place, a single approximation method would be prescribed. The SOS would not be allowed. The actuary would not be required to compare results with the SOS method.

Risk-Neutral-1

This is the "pure" and "orthodox" market consistent approach. All parameters would be derived from market inputs. In case of an illiquid or an inexistent market, prices would be derived from either investment banker quotes or extrapolation methods. Historical data would not be an input.

The liability would not be dependent on supporting assets and reinvestment strategy.

Risk-Neutral-2

This is an adaptation of the market consistent approach. Where a deep and liquid market exists, the model would be consistent with this market. Where a market is illiquid or does not exist, parameters would be developed based on historical data and judgment. These parameters would include MfADs.

The liability would not be dependent on supporting assets and reinvestment strategy.

5.5 Approximation to CALM Methods

This section outlines two approximation methods for reflecting hedging in CALM. These methods are either currently in use or being considered by some companies. They are presented here for information purposes and are not endorsed by this task force. Any approximation method would be justified by the actuary, as stipulated in the 2002 Task Force Report.

5.5.1 Risk-Neutral Method

A risk-neutral or market consistent approximation to CALM could be considered and tested for appropriateness for companies using a program that hedges against a risk-neutral or market consistent liability.

CALM requires taking into account the asset-liability strategy of the portfolio along the various real-world paths. When this asset-liability strategy is for the assets to replicate the changes in a risk-neutral or market consistent liability, CALM would result in gains and losses similar to risk-neutral gains and losses.

If the hedging program is robust and substantial enough, a real-world CALM liability determined by modelling assets that reproduce a risk-neutral liability may result in a liability that would be approximated by a risk-neutral liability or market consistent liability.

5.5.2 Hedge Cost Method

This method uses stochastic methodology with two simplifying assumptions:

- It recognizes the cost of hedging in the form of basis points of expense, as opposed to dynamically estimating the hedge costs using nested risk-neutral stochastic paths; and

- It recognizes the benefits of hedging in the form of a percentage of all future guarantee top-ups that will be offset by future hedging gains. This percentage is a measure of the expected effectiveness of the hedging program.

The above two assumptions would be developed as all other assumptions, drawing on the best available information and expertise. These assumptions need not be scalars—they can vary by duration or other attributes as appropriate. Each of these assumptions would have an MfAD appropriately recognizing the potential for misestimation of the best estimate or deterioration of the best estimate assumption.

5.6 Policyholder-Related Assumptions

Non-economic assumptions, such as mortality, surrenders and partial withdrawals, fund transfers and utilization rates of policyholder options are required for the valuation of policy liabilities and the determination of the capital requirement for segregated fund guarantees. The task force believes the approach for establishing these assumptions described in sections 7.1 and 7.2 of the 2007 Educational Note is appropriate, whether CALM or the risk-neutral method is chosen.

Assumptions that are non-scenario-tested and are assumed not to vary according to the financial interest of the policyholder would include MfADs.

For assumptions that are assumed to vary with the financial interest of the policyholder, the premise would be that policyholder decisions will tend to serve their perceived interest, but the actuary need not assume that all policyholders always act in a rational manner, or that they do so with perfect efficiency. These assumptions would also incorporate MfADs.

6 DISCUSSION ON METHODS AND RECOMMENDATIONS

	Methods				
Criteria	CALM-1	CALM-2	CALM-3	Risk-Neutral-1	Risk-Neutral-2
Practical	High without hedging, low with hedging	Much more than CALM-1 with hedging	Much more than CALM-1 with hedging	Medium to High	High
Economically Sound	Medium with adequate calibration	Same as CALM-1	Same as CALM-1	High when a deep and liquid market exists, low otherwise	High when a deep and liquid market exists, medium otherwise
Comprehensive	High	Same as CALM-1	Same as CALM-1	High	High
Comparable	Low	May be better than CALM-1, but no assurance	High with appropriate constraints	Medium	High with appropriate constraints
No excessive pro-cyclicality	Medium	Same as CALM-1	Same as CALM-1	Low	Medium
Emergence of profits	Could accommodate both views	Could accommodate both views	Could accommodate both views	Could accommodate both views	Could accommodate both views

6.1 CALM

6.1.1 General Considerations

As discussed in section 2.2, the most common risk management strategy currently in use in the industry for managing segregated fund risk is some variant of the delta-rho hedging strategy. One of the most important risks under this strategy, as explained in section 3, is the risk of future realized volatility of investment returns. The current calibration criteria have been developed in a context where companies did not hedge their guarantees and where poor investment returns was considered the most important risk, so the focus of these criteria was the left tail of the distribution for investment returns. Therefore, there is a concern that the current approach does not provide for enough PfADs for the risk of future volatility in policy liabilities.

Reset features on segregated fund products have become common in recent years. These reset features have exposed companies to the risk of experiencing a period of high investment returns followed by a period of negative returns. The right tail of the distribution of investment returns is therefore an important consideration when valuing these products. Another reason to consider the right tail of investment returns is the risk of "overhedging", i.e., the risk that a company underestimates the lapse rate of its contracts and as a result takes excessive short positions in equity. This would create a risk of high equity returns. The silence of the current calibration criteria about the right tail of investment returns is thus another concern about the current situation.

Recent years have seen the introduction of products such as the GLWB which are of much longer term than products that existed at the time the current calibration criteria were developed. This raises the issue of whether the current calibration criteria are adequate in this new market environment.

There is also a concern that the volatility regime prevailing at the valuation date may not be recognized in the valuation. A common practice is to start the generation of stochastic scenarios in the stationary, long-term steady state, ignoring the current market environment. This may understate the expected cost of hedging in situations where, such as during the 2008–09 financial crisis, the volatility of investment return is unusually high. The principle of reflecting the volatility regime at the valuation date is not different from that of initiating interest scenarios in CALM from the yield curve at the valuation date. The impact of reflecting the current volatility regime would be larger the closer contracts are to maturity.

There is very little guidance with respect to all other risks inherent to dynamic hedging. As mentioned in section 3 of this report, section 2.3 of the 2002 Task Force Report lists potential weaknesses in hedging strategy and states that they would be reflected in the valuation, but provides no guidance as to how this is to be done. As such, the range of practice for taking these risks into account is likely to be large.

Another concern with CALM is the blurred relationship between the investment strategy and the level of policy liabilities. It is not clear under the current calibration criteria whether the policy liabilities are larger under an unhedged strategy or under a hedging strategy. This would require further investigation.

Considering the foregoing, we are of the opinion that CALM would rank at mid-range for the economically sound criteria but only on the condition that adequate calibration criteria are in place.

Issue of pro-cyclicality

This task force does not believe that CALM exhibits excessive pro-cyclicality, because, as explained in section 5.1, it relies primarily on a long-term view that needs not to be changed in reaction to short-term turbulence.

In addition, the Educational Note *Use of Actuarial Judgement in Setting Assumptions and Margins for Adverse Deviations* supports reducing the level of CTE to account for the reduction in uncertainty when guarantees are more in-the-money. However, it is clear this practice would not be used to smooth earnings. A number of criteria for implementing this practice are provided in section 5.4 of this educational note.

Furthermore, the assumption that equity returns exhibit mean reversion is not prohibited by the current Standards of Practice and would diminish pro-cyclicality. The following paragraph is taken from the 2002 Task Force Report:

> "State-dependent models relate the change from one period to the next to current market levels or recent market performance. For example, a mean-reverting process is state dependent because the future scenarios depend on how the current market variables relate to long-term historical values. State-dependent models are not required, but are acceptable if they are justifiable based on the historical data and meet the calibration criteria."

However, the process of updating the model parameters under CALM may give rise to excess pro-cyclicality. Consider an actuary establishing the parameters of his valuation model by using directly, without adjustment, the estimates obtained from a statistical fitting to historical data. Immediately after a period of high volatility and low returns, the updated parameters would reflect this experience and would result in higher policy liabilities. Technically, the actuary is using the point estimate of the parameters without considering the confidence interval of these parameters related to the size of data used. The consideration of the significance of a change before adjusting parameters for every new data points would reduce this excess pro-cyclicality.

In addition, nothing prevents an actuary from using adjusted, more conservative parameters, in the same way an actuary can set his best estimate equity return for a deterministic application of CALM below the maximum benchmark return allowed by the Standards of Practice. In this case, recent adverse market experience would not necessarily trigger a change in parameters and would not amplify the pro-cyclicality of results.

To conclude on the issue of pro-cyclicality, we consider that excessive pro-cyclicality under CALM is not due to the CALM principle itself but may exist due to the approach of setting parameters.

6.1.2 CALM-1

The SOS method ranks very low in terms of practicality. This method is quite time-consuming and difficult to reconcile. The ability to project policy liabilities requires a substantial investment in technology.

Because many variables have to be modeled, and because of the large number of modeling assumptions and simplifications required, the SOS is not easily comparable across companies. Significant effort would be required to reduce the range of practice.

6.1.3 CALM-2

The main advantage of CALM-2 over CALM-1 is practicality. The two approximation methods discussed in section 5.5, the risk-neutral method and the hedge cost method, require the generation of two and one set of stochastic scenarios respectively. There is therefore no need for nested simulations, as in the case of the SOS method. However, the SOS infrastructure would still be required to demonstrate the appropriateness of the approximation method.

The CALM-2 approach would not necessarily provide more comparability across companies. More comparability would be achieved if most companies adopt the same approximation method. However, this cannot be guaranteed. Some companies are likely to continue to use the SOS method, while others may adopt different approximation methods. Also, since the SOS would remain the standard of reference, and is not easily comparable, how much the use of approximation methods would improve comparability and reduce the range of practice is not obvious.

6.1.4 CALM-3

The main advantage of CALM-3 over CALM-2 is in the improvement of the comparability criteria. This is obtained at the expense of more prescription. This would therefore deter research.

6.2 Risk-Neutral Method

6.2.1 General Considerations

The need for a single set of stochastic scenarios, as opposed to nested simulations, confers an appreciable advantage to the risk-neutral method in terms of practicality. The ability to project liabilities is also reasonable.

Furthermore, the issue of aggregation of cohorts does not exist under the risk-neutral method, since the actuarial liability is calculated as an average across all scenarios, as opposed to an average over a subset of worst scenarios.

On the other hand, where a hedging program is to be taken into account in the policy liabilities, certain types of risk such as basis risk and liquidity risk are more easily accounted for under CALM. CALM is considered superior for analyzing those types of risk.

All factors considered, the risk-neutral method is deemed considerably more practical than CALM when a hedging program is in place.

It must be noted that the relative simplicity of this method is dependent upon the proposed approach for modeling policy-behavior exposed in section 5.6. The assumption of pure rationality and optimal behavior would have required using advanced numerical techniques that would have rendered this method much less practical.

Where a deep and liquid market exists for financial instruments of the same term and nature as the liabilities, the risk-neutral method is viewed as economically sound. Where a deep and liquid market does not exist, the economical soundness of the method depends on how the required parameters are derived, as discussed in the following subsections.

Under the risk-neutral method, the policy liabilities would not depend on the supporting assets and investment strategy. Some task force members questioned the relevance of the risk-neutral method where a company does not actually hedge its guarantees. This question is related to the issue of whether the provision for mismatch risk should be included in policy liabilities or in capital requirements. This matter is larger than the valuation of segregated fund guarantees and is out of scope for this task force. We will only point out that under the risk-neutral method, policy liabilities would not include PfADs for the risk of not hedging guarantees, and that this risk would have to be allowed for in capital requirements.

As discussed in section 3, a strict application of the risk-neutral method uses risk-free rates. This implicitly assumes that companies are investing and borrowing at the risk-free rates. In the real world, a company cannot borrow at a risk-free rate, and it can be argued that in some circumstances, a company could earn a spread over the risk-free rates by investing in instruments such as provincial and corporate bonds. The issue of how to reflect a particular investment strategy under the risk-neutral method is not obvious and would require further investigation. The issue of how much of credit spreads would be reflected in a market consistent framework is part of a larger debate and is out of scope for this task force.

As mentioned in section 2.2, most companies that currently hedge their guarantees or intend to do so in the near future base their hedging program on some definition of an economic value of the liability. For these companies, after issue, the risk-neutral method would likely provide a more appropriate emergence of profits because the movements in policy liabilities would then be more in line with the movements in the market value of the hedge portfolio.

6.2.2 Risk-Neutral-1

This variant of the risk-neutral method ranks at mid to high range for the practicality criteria because of the requirement for investment banker quotes at each valuation date.

This method is considered economically sound only where a deep and liquid market exists. This approach is not viewed as economically sound in the absence of such a market. This is because prices, in an illiquid market, are affected to a large extent by supply-demand imbalances and are likely to include a high profit margin required by issuers, as measured by the bid-ask spreads.

This method is also considered excessively volatile and pro-cyclical, as a change in the observable short-end of the price surface would be extrapolated up to the term of liabilities.

This method ranks at mid range for the comparability criteria because its reliance on market quotes from investment bankers and on extrapolation methods for completing the price surface is likely to result in differences between companies.

6.2.3 Risk-Neutral-2

This approach is viewed as economically sound whether a deep and liquid market exists or not, provided that the long-term assumptions required in absence of a deep and liquid market are set adequately.

This method requires much less modeling assumptions than the SOS method. It ranks as high as the CALM-3 approach for the comparability criteria, when sufficient constraints exist for setting the required long-term assumptions.

This method is probably more pro-cyclical than CALM because of the calibration to market prices for the term for which a deep and liquid market exists. The resulting pro-cyclicality is not considered excessive, however. An increase in implied volatility in a deep and liquid market reflects the fact that the expected cost of replicating the guarantee has increased. We see no reason for not taking this into account in calculating policy liabilities.

The expected increase in pro-cyclicality must be put in perspective. In Canada, a deep and liquid market for options only exists for options of approximately two-year term or less. This means the volatility in the valuation would be graded toward a long-term assumption over some period. This long-term assumption would not have to be changed in reaction to temporary turbulence in financial markets. This anchor represents a strong element of cyclical neutrality.

Notwithstanding, there is a fear among some members that the risk-neutral approach may result in a too volatile financial result, and actually may reflect market anxiety that is unrelated to the long-term cost of fulfilling a company's obligations. A quantitative study would be required to validate or invalidate this perception.

6.3 Conclusion and Recommendations for the Valuation of Policy Liabilities

The more fundamental concern with CALM is that given the current calibration criteria, the uncertainty with respect to the future volatility of investment returns may not be adequately reflected in the calculation of policy liabilities. Other concerns are the impracticability of the SOS method and the absence of guidance on how to account in the valuation for potential hedging weaknesses. The CALM-2 variant resolves the practicality issue but only partially because of the requirement to justify any approximation with a reference to the application of the SOS method to a representative sample of contracts. Comparability across companies was also another concern.

The Risk-Neutral-2 method, with sufficient constraints on setting long-term assumptions, did appeal to some members, because of its high practicality and comparability. Other members, however, were concerned about a potential increase in pro-cyclicality, the inconsistency with the valuation method for other products, and the relevance of applying the risk-neutral method when no hedging program is in place, i.e., the break of the relationship between the investment strategy and policy liabilities. Finally, the undertaking of a major change in the valuation method only few years before the coming into force of Phase II of IFRS was raised as a concern.

It was acknowledged by all task force members that the adoption of the risk-neutral method would require significant additional quantitative analysis and impact studies. It was also felt a short-term solution was required to address the more pressing issues. The task force therefore formulates two recommendations, one for the short term which addresses the more pressing issues, and a second for the long term.

6.3.1 Recommendation for the Short Term

The task force recommends retaining the CALM framework and setting up one or more working groups with the mandate of

1) Reviewing the calibration criteria for investment returns;
2) Providing guidance for the use of approximation methods to account for hedging in the calculation of policy liabilities; and
3) Providing guidance with respect to potential hedging weaknesses that would be reflected in policy liabilities.

With respect to the calibration criteria, the working group would, in particular:

- Review the current criteria and consider adding criteria for the right tail of the distribution;
- Review the horizons over which criteria are provided;
- Provide guidance for the projection of future realized volatility of equity returns;
- Consider the relevance of reflecting the volatility regime prevailing at the valuation date in projecting equity returns;
- Determine what is the appropriate time step to use for estimating volatility in the context of hedging; and
- Consider the relation between policy liabilities calculated with and without the reflection of hedging.

With respect to the approximation methods, the working group would propose some specific methods and provide guidance on how to justify the use of an approximation method.

6.3.2 Recommendation for the Long Term

The task force recommends setting up a new working group with the mandate of analysing the merits of the risk-neutral method for the valuation of segregated fund guarantees. The development of Phase II of IFRS would be considered.

More specifically, the mandate of this working group would be:

- To compare CALM and the risk-neutral method in terms of the level and the volatility of policy liabilities;
- To perform back testing for the 2008–09 period;
- To perform an impact study;

- To address the issue of reflecting investment in instruments earning a spread over risk-free rate;
- To provide guidance with regards to the determination of the long-term assumption for volatility; and
- To develop a method for incorporating basis risk.

7 OTHER ISSUES

7.1 Bifurcated Versus Whole Contract Approaches

Two general approaches for valuing policy liabilities for segregated funds are considered to be in conformity with the current Standards of Practice. For the Bifurcated Approach, revenue is allocated between recoverability testing of the AAE and the liability for the guarantee. The allocation of future revenues between amortization of the AAE and the guarantee does not change from period to period. For the Whole Contract Approach, all net cash flows available are considered in determining the total liability. The implicit allocation of future revenue between the AAE and the guarantee may change from period to period as a result of market movements and other factors.

A discussion of the relative level and volatility of the policy liabilities under the two approaches is provided in the 2007 educational note.

A bifurcation of revenue is required in order to operate a hedging program, because it is not possible to hedge a stream of revenue that varies from period to period. For this reason, the Bifurcated Approach might be more appropriate when a hedging program is in place. This was already noted in the 2007 Educational Note. However, it is still possible to use the Whole Contract Approach for calculating the policy liabilities in this situation.

It is generally considered that it is easier to understand and analyze results under the Bifurcated Approach, especially when a hedging program is in place. The Whole Contract Approach is, on the other hand, considered more comprehensive. Opinions differ about the relative importance of these considerations, which is reflected by the fact that both approaches are commonly used in the industry.

In conclusion, the task force considers that there is no compelling argument for deciding on a single approach. The advantage of adopting a single methodology would be to narrow the range of practice. The question of whether it is worth doing so is out of the scope of this task force.

7.2 Term of the Liabilities

When a hedging program is in place, the floor of zero still applies at the issue of a contract. However, as per the 2007 Educational Note, negative liabilities are allowed at future periods, but "*subject to constraints on the amount of profit capitalized, consistent with an unhedged position*".

This statement suggests that liabilities would be set in part retrospectively based on past assets performance. Indeed, some companies have interpreted this by allowing policy liabilities to be negative only to the extent that the gain from negative policy liabilities is

offset by cumulative losses from the hedge assets. The task force is concerned this represents a departure from the forward-looking CALM.

A majority of the task force members are of the opinion that the following application of the Bifurcated Approach, which does not depend on cumulative losses from assets, satisfies the constraints on the capitalization of profits stipulated in the 2007 Educational Note. We invite the CIA to provide a clarification on this issue and to consider endorsing the following approach in an Educational Note.

For each new cohort, the fee income allocated to the guarantee at the time of issue would be adjusted such that the initial liability for the guarantee is equal or greater than zero. Once established at issue, the adjusted fee income would be kept constant throughout the remaining life of the cohort. In future periods, the fee income allocated to the guarantee would be that established at issue and the liability for the guarantee would be allowed to move freely up or down, without regard to cumulative gains and losses from the hedge assets.

As a simple example, assume the following for a particular cohort at issue.

Total fee income available = 150 basis points

Present value of total future revenue (150 basis points) = $300

Present value of future revenue corresponding to 100 basis points = $200

Present value of future revenue corresponding to 50 basis points = $100

Present value of future revenue corresponding to 25 basis points = $50

Present value of guarantee costs and expenses = $50

Unamortized AAE = $150

Under the Bifurcated Approach, recoverability testing is done assuming 100 basis points of revenue. As the present value of future revenue corresponding to 100 basis points is $200, which exceeds the unamortized AAE, the AAE is deemed recoverable. This left 50 basis points for the calculation of the liability for the guarantee. This is more than what is required to cover the present value of guarantee costs and expenses, as only 25 basis points is required to obtain a liability for the guarantee of zero. Therefore, 25 basis points would be reflected in the calculation of the liability for the guarantee. At all future periods, 25 basis points would be allocated to the liability for the guarantee.

If we now assume that the present value of guarantee costs and expenses is $125, the 50 basis points would be entirely allocated to the guarantee at issue. The initial liability for the guarantee would be $25, which is the difference between the present value of guarantee costs and expenses and the present value of future revenue corresponding to 50 basis points. At all future periods, 50 basis points would be allocated to the liability for the guarantee.

8 CONSIDERATIONS FOR DETERMINING CAPITAL REQUIREMENT

The purpose of this section is to share our thoughts on the issue of capital requirements for segregated fund guarantees. As this issue is even more complex than the issue of

valuation and would require significant quantitative research, no recommendation is provided for the choice of a particular method.

8.1 Reflection of Hedging in Capital Requirements

The task force is of the opinion that the current treatment of hedging in the determination of capital requirements is not appropriate. The impact of only reflecting the hedge instruments held at the valuation date is minimal for long-term contracts where a dynamic hedging strategy is used. Another weakness relates to the potential additional capital requirements for the C-1 risk. Therefore, it is deemed that the current rules do not reflect the true risk exposure of a company and do not provide incentives for sound risk management practices. Having said that, the task force acknowledges that the reflection of the limitation of dynamic hedging in capital requirements is desirable, considering all the potential weaknesses of such a strategy, as discussed in section 3. However, we consider that completely disregarding dynamic hedging is excessively conservative.

Finding an appropriate "dosage" for reflecting dynamic hedging is challenging because many risks inherent to dynamic hedging are not easily quantified. Examples of such risks are the liquidity risk in financial markets and the gap risk, i.e., the risk of large intra-day market movements. For this reason, we are of the opinion that any method for reflecting dynamic hedging would be based partly on a qualitative assessment of risks.

Before making changes to the capital requirements methodology that would result in a material change in capital levels associated with segregated funds guarantees, the task force is of the opinion that the current and proposed, if any, capital requirements for banks with similar products would be investigated in more details. In the last decade, banks have issued long-term equity-linked guaranteed investment contracts (GICs) which share financial characteristics associated with the guarantees on segregated funds products. It appears banks also use some form of dynamic hedging to manage the financial risks related to these products. While this task force is not an expert on the topic of bank regulation, it is nonetheless concerned about maintaining a level playing field between insurance companies and banks to avoid the creation of regulation arbitrage opportunities between insurers and banks.

We now discuss some alternative approaches for setting capital requirements.

8.2 Run-Off Approach

The run-off approach corresponds to the current approach where the capital requirement is set to the amount of assets required to fulfill financial obligations over the term of liabilities, with a high level of confidence. The reflection of hedging under this approach would be achieved with a CALM roll-forward projection that would reflect both assets held at the valuation date and future rebalancing. As long as CALM is used for valuation, the same valuation model would be used for setting capital requirements, but with a higher level of CTE. Where volatility is modeled stochastically, this approach is deemed to capture the risk of future volatility. In case where a deterministic volatility is used for valuation, a higher deterministic volatility would be used for capital requirements.

In order to take into account all risks related to hedging that are difficult to quantify, the task force is of the opinion that OSFI could draw inspiration from the approach adopted by the US regulator for determining the statutory reserve for variable annuities, the

VACARVM[2]. Under this approach, the reflection of hedging is done using a credibility-like weighting scheme. Two CTE are calculated, one that incorporates the hedging strategy in the projected cash flows, and one that allows only for the run-off of the hedge positions that exist at the valuation date. The capital requirement is then set to a weighted average of these two CTE. The weight assigned to the CTE reflecting dynamic hedging, the "effectiveness factor", reflects the level of sophistication of the modeling of hedging in the calculation of the CTE and is subject to a maximum. Criteria are provided to establish this factor. The rationale in the US for not fully reflecting hedging seems to be related to the limitation of the modeling of hedging in projections, and not to the limitation of the hedging program itself. Nevertheless, this approach may be an avenue for accounting for the risk of hedging ineffectiveness in the capital requirements for segregated funds.

8.3 One-Year Term Horizon Approach

This approach is the one put forward for the new capital requirements framework in the *Canadian Vision for Life Insurer Solvency Assessment*, endorsed by OSFI and AMF (MCCSR Advisory Committee, 2007). Under this approach, a company would hold assets equal to the best estimate of its liabilities plus a solvency buffer. The solvency buffer would be established so that a company can withstand adverse conditions over a one-year time horizon with a very high confidence level and have enough assets to sell or run off the business after the year (the terminal provision). *The Framework for a New Standard Approach to Setting Capital Requirements* provides a good account of this approach (Joint Committee of OSFI, AMF and Assuris, 2008).

For some types of products and risks, a practical method to implement this approach would be to set the solvency buffer equal to the impact on the surplus of an instantaneous deterministic stress applied at the valuation date. The instantaneous stress would be calibrated to the given confidence level over a one-year period. A more sophisticated extension of this method would be to stochastically generate scenarios for the risk factors over a one-year horizon, to calculate the instantaneous impact on the surplus of each scenario, and to set the solvency buffer to some CTE of the impacts. The stochastic model would be calibrated under the real-world measure. The practicality of this stochastic alternative depends on how the terminal provision is set and is discussed below.

This direct application of the instantaneous stress method without modification is not considered appropriate for segregated funds where a dynamic hedging program is place, because it ignores the mitigation effect of the rebalancing that would take place during the one-year horizon. For example, if the stress scenario is a drop in equity of 35 percent, simply calculating the impact on surplus resulting from this drop amounts to assuming that a drop of 35 percent materializes in an infinitesimal period during which no rebalancing is executed. This would be considered excessively conservative because the risk that a company cannot rebalance its hedge portfolio a single time during a one-year horizon is viewed as beyond any reasonable confidence level to be covered by capital requirements. The other extreme would be to assume that a company is able to rebalance

[2] Exhibit of the session 120 PD of the SOA 2009 annual meeting provides an introduction to VACARVM (Blaske, Chamberlain, & Motiwalla, 2009).

continuously during the one-year horizon, which would result in zero capital requirements.

A practical solution would be to assume a certain finite number of rebalancing points over the one-year horizon. We view that limiting the number of assumed rebalancing of the hedge portfolio as a way for reflecting the risk of hedging ineffectiveness in capital requirements. Also, this approach would provide incentives for tighter hedging practices as the hedging of a greater number of "greeks" would result in lower capital requirements.

8.3.1 Terminal Provision

Methods for Establishing the Terminal Provision

As long as CALM is used for determining policy liabilities, we are of the opinion that it would be appropriate to set the terminal provision using CALM. If the SOS technique is used for applying CALM to set the terminal provision, using stochastic scenarios over the one-year horizon would require a stochastic-on-stochastic-on-stochastic calculation. Therefore, we view that using deterministic scenarios over the one-year horizon would be more practical.

If the risk-neutral method is ever adopted for establishing policy liabilities, it would be then appropriate to set the terminal provision using this method. As a single set of stochastic scenarios is required to calculate a risk-neutral value, the use of stochastic scenarios over the one-year horizon would result in a SOS calculation and could therefore be considered.

Level of the Terminal Provision

The one-year horizon method originates from the principle that the risk can be eliminated from the balance sheet at the end of the horizon by either transferring the risk to a third-party or implementing an offsetting hedge. This assumption is clearly not realistic for some risks such as the longevity risk, for which transfers between carriers are uncommon and no strategies exist for eliminating the risk. In these situations, it is generally accepted that the terminal provision would be set to the amount of assets sufficient to run off the business and would include a margin for risk. The draft paper on terminal provision from the Solvency Framework subcommittee of the CIA provides a good account of this issue. The segregated fund risks fall into this category, because transfers between companies are uncommon and because no riskless replicating strategy exists. Therefore, the terminal provision would include margins. Where the terminal provision is determined using CALM, this would be achieved by selecting a level of CTE greater than zero. Where the risk-neutral method is used, this would be achieved by including margins in long-term economic assumptions. In both cases, non-scenario-tested assumptions would include MfADs.

9 Bibliography

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