



EDUCATIONAL NOTE

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AGGREGATION AND ALLOCATION OF POLICY LIABILITIES

COMMITTEE ON LIFE INSURANCE FINANCIAL REPORTING

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MEMORANDUM

TO: All Fellows, Associates and Correspondents of the Canadian Institute of Actuaries
DATE: September 15, 2003
FROM: Jacques Tremblay, Chairperson
Committee on Life Insurance Financial Reporting
SUBJECT: Educational Note – Aggregation and Allocation of Policy Liabilities

The Committee on Life Insurance Financial Reporting (CLIFR) has developed the attached Educational Note on the Aggregation and Allocation of Policy Liabilities. This educational note examines how asset/liability segments determined under the Canadian Asset Liability Method (CALM) can be combined, or aggregated, to develop the policy liabilities for a particular company. The note further considers allocating aggregated policy liabilities to policy subgroups.

This document is intended as a companion document to the Consolidated Standards of Practice (CSOP), Section 2320.09. That CSOP paragraph gives the following guidance.

“The actuary would usually apply the Canadian asset liability method to policies in groups which reflect the insurer’s asset-liability management practice for allocation of assets to liabilities and investment strategy. That application is a convenience, however, which would not militate against calculation of policy liabilities that, in the aggregate, reflect the risks to which the insurer is exposed.”

While the CSOP does not require that Canadian GAAP policy liabilities be allocated to individual policies or subgroups, allocation may be required to meet regulatory requirements, or assist in determining liability cash flows for CALM purposes. The actuary is advised to develop and document a methodology for allocating policy liabilities that is consistent with the valuation method followed. This educational note provides additional guidance.

In accordance with the Institute’s policy for Due Process, this educational note has been approved by the CLIFR, and has received final approval for distribution by the Practice Standards Council. As outlined in section 1220 of the CSOP, the actuary should: “be familiar with relevant educational notes and other designated educational material,” be aware that a “practice which the notes describe for a situation is not necessarily the only accepted practice for that situation and is not necessarily accepted actuarial practice for a different situation,” and be cognisant that “educational notes are intended to illustrate the application (but not necessarily the only application) of the standards, so there should be no conflict between them.”

CLIFR thanks the authors of this educational note: France Déziel, Micheline Dionne, Éric Jobin, Marie-Hélène Malenfant, and Daniel Pellerin. Any questions on the note should be addressed to me at my *Yearbook* address.

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AGGREGATION AND ALLOCATION OF POLICY LIABILITIES

SECTION 1 – INTRODUCTION

This educational note examines how asset/liability segments determined under the Canadian Asset Liability Method (CALM) can be combined, or aggregated, to develop the policy liabilities for a particular company. The note further considers allocating aggregated policy liabilities to policy subgroups.

The CSOP Practice-Specific Standards for Insurers, section 2320.09, gives the following guidance on the concept of aggregation:

“The actuary would usually apply the Canadian asset liability method to policies in groups which reflect the insurer’s asset-liability management practice for allocation of assets to liabilities and investment strategy. That application is a convenience, however, which would not militate against calculation of policy liabilities that, in the aggregate, reflect the risks to which the insurer is exposed.”

The provision for interest rate risk needs to be appropriate for the insurer. Where material, it is appropriate for interest rate scenarios to be consistent across any independently tested asset/liability portfolios. However, when determining the amount of provision for interest risk, the actuary is cautioned to ensure that the potential synergies (C-3 offset from one line of business to another) are real, and persisting and not simply a transitory result.

While the CSOP Practice-Specific Standards for Insurers do not require that Canadian GAAP policy liabilities be allocated to individual policies or subgroups, allocation may be required to:

- meet regulatory requirements such as:
 - determining negative policy liabilities,
 - other MCCR calculations,
- assist in determining liability cash flows for CALM purposes such as:
 - future tax cash flows where separate segments are not maintained for Pre 96 and Post 95 business,
 - determining appropriate directions for margins for adverse deviations (MfAD).¹

Where such an allocation is required, the actuary is advised to develop and document a methodology for allocating policy liabilities that is consistent with the valuation method followed.

Aggregation of risks other than interest rate risks is also considered in this note.

¹ Surrender benefits are paid by selling supporting assets at market rates and the sign of the lapse margin is determined by comparing the book value of the assets to be sold with the allocated book value of the corresponding liabilities.

SECTION 2 – AGGREGATION OF POLICY LIABILITIES

2.1 Advantages and Disadvantages of Aggregating Portfolios

An advantage of aggregating portfolios is that it recognizes permanent synergies among portfolios, thus reflecting the interest rate risk of the whole company (or a group of aggregated portfolios) at a point in time. This enables the calculation of the policy liabilities under a uniform interest rate environment.

A disadvantage of aggregating portfolios is that it may be difficult to identify and adjust the results for the impact of temporary synergies beyond the period they are expected to persist. Another disadvantage is that it creates additional volatility over successive reporting periods, as temporary offsets are not reflective of the portfolios' inherent risks.

2.2 Considerations for Determining the Appropriate Level of Aggregation

There are two major considerations for determining the appropriate level of aggregation of asset/liability segments: the insurer's asset-liability management practice, and the persistency of interest rate risk synergies.

2.2.1 Asset-liability Management Practice

Insurers, typically, break their asset portfolio into asset segments to support liability segments. Dedication of assets may occur by line of business, or, within a line of business, by product line.

An asset segment usually has the following characteristics:

- specifically identified assets,
- a separate investment strategy, and
- investment income determined from the asset segment (rather than allocated from a larger pool of assets).²

Given its ability to model one investment strategy at a time, and its ties to internal management reporting, the CALM is generally performed for each identified asset-liability segment.

Whenever notional asset segments are managed like factual asset segments, an actuary may consider notional allocation as asset segments for CALM purposes.

2.2.2 Persistency of Interest Rate Risk Synergies

Although CALM is performed at the asset-liability segment level, results may be aggregated if synergies exist among segments. In examining the potential for such synergies, the actuary considers several issues. For one, is it the practice of their portfolio managers to offset a particular portfolio's mismatch with the opposite position experienced by another? For another, are the offsets permanent, and inherent to opposing portfolios? (For example, an individual life insurance portfolio invested short because of the rarity of very long assets may have synergy with a shorter annuity portfolio invested long to take advantage of a positive yield curve, the short cash needs of the annuity portfolio being covered by the positive cash flows of the insurance portfolio.)

² Holdings of a segment may, however, include units of a unitized pool of assets, or a proportional interest in a such a pool.

A permanent synergy is one that can consistently be observed over time, and is expected to persist with a reasonable degree of confidence. It would be appropriate to reflect such synergy for aggregation purposes.

A temporary synergy is one that is not expected to be sustainable over time. Recognizing a temporary synergy beyond the period it is likely to persist inappropriately reflects the portfolios' C-3 risk, creating undue volatility in the policy liabilities as synergies appear and disappear. Temporary offsets would not be recognized beyond the period during which they are likely to persist (e.g., an asset segment that has an offsetting position that could reverse in the near future, would be considered to reverse its position in accordance with expectations).

The potential for synergies is limited when asset-liability segments operate under different interest rate environments (e.g., in different countries), unless the actuary can demonstrate that movements in the different interest rate environments experience high correlation.

The potential for synergies is also limited if funds cannot circulate freely between portfolios. An example is assets assigned to a participating fund (whether or not part of a closed block). Such fund assets benefit the participating policyholders; and since only limited amounts of profits can be transferred to non-participating accounts, these funds are not available to cover interest rate risks related to non-participating policies.

2.2.3 Example of Aggregation – Variation from the Results of Base Scenario

Results under CALM for scenarios 1 and 2 are shown below:

| Portfolio | C-3 Provision | | Comments |
|------------------------|------------------------------------|------------|---|
| | Scenario 1 | Scenario 2 | |
| 1 | -5 | 10 | This portfolio is tightly matched, with valuation results by scenario regularly changing signs. |
| 2 | -150 | 250 | The mismatch position of these portfolios is in line with that of prior quarters. |
| 3 | 300 | -420 | |
| Company Total | 145 | -160 | This provision (145) reflects the total company position. |
| Alternate Total | $10 + (-150) + 300 = \mathbf{160}$ | N/A | This provision recognizes the temporary nature of the synergy between Portfolio 1 and the other portfolios. |

Portfolios with permanent synergies and similar investment strategies may be aggregated to determine the total aggregate C-3 provision. Then, the allocation of the individual C-3 provision to each portfolio is determined as explained in section 3.3 of this note.

The above table only shows the C-3 provisions resulting from two scenarios even though a number of other scenarios have been calculated but not shown here. Generally, the larger the number of scenarios contemplated, the better the assessment of the C-3 risk.

In the above example, the “Company Total” approach is appropriate if portfolios are managed globally (with the position in one portfolio expected to offset positions in other portfolios).

The “Alternate Total” approach is more likely to be used if each portfolio is managed independently, and the offsetting impact of Portfolio 1 is considered temporary. The synergy between Portfolios 2 and 3 ought to be considered more permanent if they are conscientiously managed as offsetting portfolios, or if there is supporting evidence of synergies over a reasonable period of time.

A third approach (not illustrated above) may consider the sum of the most adverse scenario for each portfolio independently. This excludes all synergies among portfolios (and leads to a total provision of 560). This conclusion is reasonable if no such synergy exists. However, the actuary is cautioned to ensure that total C-3 provisions are not excessive and policy liabilities, in the aggregate, reflect the risk to which the insurer is exposed.

It is expected that the same aggregation approach will be used over time to ensure consistent results, with disclosure accompanying any changes.

2.3 Aggregation to Take into Account Other than Interest Rate Risk Synergies

Provisions for adverse deviations (PfAD) are expected to be appropriate in the aggregate as indicated in CSOP Practice-Specific Standards for Insurers section 2320.09.

At times, policy liabilities are broken into components for valuation purposes, with the actuary ensuring consistency of assumptions and margins between components for appropriate aggregate policy liabilities. For example, segregated fund liabilities may be valued in two pieces: the guarantee on death or withdrawal, and the balance of acquisition expenses. Then, particular attention is paid to the lapse assumption, as lapses increase the acquisition expenses recovery risk, but lower the guarantee risk.

At other times, policies with different risk characteristics are considered in aggregate to evaluate the risk exposure to the insurance company. For example, a homogeneous block of life policies may have one subset reinsured. Then, the subset reinsured may need a negative mortality MfAD to generate an increase in policy liabilities, while the opposite is needed for the remaining policies. As the actual mortality experience is not likely to differ between subsets in a homogeneous group, a MfAD determined in aggregate better captures the aggregate risk.

SECTION 3 – ALLOCATION OF POLICY LIABILITIES

3.1 Purpose and Scope

Once aggregation is established, the actuary may need to allocate policy liabilities at a more detailed level. Such allocation may be required to comply with the following reporting or filing requirements:

- reporting the gross and net policy liabilities by statutory lines of business,
- identifying the provisions and the impact of changes in valuation assumptions by product lines,
- reporting negative policy liabilities and cash value deficiencies per policy,
- reporting the policy liabilities for new business issued during the year,
- for Minimum Continuing Capital and Surplus Requirements (MCCSR), Test for Adequacy of Assets in Canada and Margin Requirements (TAAM) or provincial regulatory capital requirement purposes: allocating policy liabilities for the mortality component (by mortality classes, based on guarantees); the morbidity continuing claim risk component (by duration of policy liabilities and length of period remaining); the interest pricing risk component, C-2 (based on guarantees); the interest rate environment risk component, C-3 (by interest guarantees and product type); and the lapse risk component (between lapse supported and non lapse supported policy liabilities), and
- for tax reporting purposes, allocating policy liabilities between policies sold prior to January 1st 1996 or after December 31, 1995.

Even the CALM methodology requires some allocation by product type to determine the appropriate margin. A few examples of that required allocation are:

- determining the appropriate sign of the lapse and mortality margin for a block of policies, and
- projecting tax liabilities in order to determine future tax cash flows.

Other needs for allocation may also arise, such as in the following examples:

- profitability analysis by block of business (either product lines or blocks of issue years),
- profitability reporting by block of business for internal reporting needs,
- sources of earnings analysis,
- embedded value analysis, where the actuary separates the results of new business from the in-force, and
- reproduction of policy liabilities by policy to assess the reasonableness of the valuation process for audit purposes.

The above list is not meant to be exhaustive and will likely change as requirements and needs evolve, but the guiding principles in selecting appropriate methodologies will remain.

Given regulatory and other requirements, allocation may eventually be required by product line and issue year, leading the actuary to develop allocations at the policy level. Once the policy liability is determined at the policy level, adding appropriate policies to the required sub-groups ought to address any further needs. However, determining policy level liabilities may not be required, since liabilities by policy groupings (such as product type and cohort) may fulfill the actuary's needs.

3.2 Considerations for Selecting a Reasonable Allocation Methodology

The purpose of the allocation will determine whether a particular method is reasonable for a specific subset of policy liabilities.

Generally, a good allocation method has the following characteristics:

- It reflects the basic characteristics and risks of the policies being valued. (For example, policies may have adjustable premiums, or guarantees such as the minimum interest credited to Universal Life policies, or policies may pass results back to policyholders through dividends),
- It reflects the characteristics of the assets held (either currently, or in the future) on behalf of such policies,
- It is reasonably simple to apply, considering the tools and systems available to the actuary,
- It allows for a reasonable projection of policy liabilities (e.g., for future tax liabilities, DCAT, and embedded value), and results in current policy liabilities that are essentially equal to those obtained through a full CALM valuation, and
- It can be used for different purposes, over successive reporting periods, while still producing consistent results.

Any change in method would be disclosed.

3.3 Allocating Interest Rate Provisions to Segments or Portfolios

If asset-liability segments have been aggregated to determine the provision for interest rate risk, that provision might be allocated to individual asset segments or portfolios.

The following principles describe a reasonable allocation methodology:

- the C-3 provision of each portfolio is positive, as each single portfolio is subject to at least some interest rate risk,
- the allocation reflects the relative interest rate risk among the portfolios, and
- the allocation methodology is consistent over successive reporting periods.

One way to allocate the aggregate provision is to calculate the individual provisions ignoring synergies. The actuary may select the most adverse deterministic scenario for each portfolio (or for stochastic scenarios, the provision for the appropriate CTE level), and allocate the overall provision on a pro-rata basis. This provides allocation of the total interest rate provision based on the relative level of interest rate risk between the portfolios.

C-3 Provisions by Portfolio (data as in section 2.1)

| Portfolio | Stand-alone C-3 Provision | Company Total Allocation | Alternate Total Allocation |
|--------------|---------------------------|--------------------------|----------------------------|
| 1 | 10 | 2.6 | 10.0 |
| 2 | 250 | 64.7 | 68.2 |
| 3 | 300 | 77.7 | 81.8 |
| Total | 560 | 145.0 | 160.0 |

Under the “alternate allocation” approach, both the total provision and the distribution of the provision is done differently and recognize that Portfolio 1 is to be considered separately, and not aggregated with the other two portfolios.

3.4 Review of Potential Allocation Methodologies within a Segment or Portfolio

Once policy liabilities are determined at the segment or portfolio level, lower levels of allocation require an allocation of assets to the various sub-groups. The selection of sub-group assets would consider that policy liabilities are issued at different times, and backed with assets earning different yields. For example, new business policy liabilities are naturally backed by recently acquired assets. Assuming the same portfolio rate of returns for all the policy liabilities of a block may not properly reflect the cohorts' anticipated earnings, thus distorting the cohorts' policy liabilities. This is particularly true when reporting the embedded value for new business.

Another point to consider is that products associated with an asset segment may have varying degrees of risks: some products have adjustable premiums, while others have minimum guarantees (e.g., the minimum interest credited to Universal Life policies). Such features have been considered under CALM, but the resulting C-3 provision does not proportionally belong to each product line within a segment. It is useful to preserve and capture differences in risk levels in determining the C-3 provision if the underlying blocks of business are examined in isolation.

For practical purposes, some actuaries allocate total policy liabilities to sub-groups or individual policies by determining a vector of interest rates such that the sum of the present value of liability cash flows (over all sub-groups or individual policies) using that vector of interest rates reproduces the total policy liabilities.

A good starting point for determining a vector of interest rates for allocation purposes is to examine the base scenario portfolio interest rates, whether using stochastic or deterministic modeling. Under stochastic modeling, the fact that the level of desired policy liabilities does not correspond to a specific scenario may prove troublesome in determining portfolio rates of return for a scenario other than the base.

To recognize the product and cohort characteristics, the base interest rate vector can be obtained by running CALM for sub-segments. This requires existing assets to be tagged to each sub-segment in accordance with the investment policy and investments' history. Such a vector is later adjusted by the margin needed to reproduce total policy liabilities. This methodology provides useful insights on the allocation of interest margins.

The margin used would recognize the increasing level of uncertainty associated with the interest assumption over time. Therefore, it would be expressed either as a flat interest spread, or an interest spread increasing over time.

Under deterministic scenario testing, the interest rate margin can be established as the difference between the base scenario portfolio rates of return, and the rates derived from the most adverse retained scenario rates. This approach is detailed in Exhibit 1.

Calculations on sub-segments are not necessarily redone at each valuation, and may be performed off valuation cycles. However, calculations would be reviewed from time-to-time to ensure continued appropriateness. As a final test, the sum of the liability sub-segments would then be reconciled with the global policy liabilities allocated. Small differences would be allocated back to sub-segments using a reasonable method.

Simpler Methods

The above process can be complex but has the advantage of providing useful profitability information by blocks of policies and year of issue. When a block is fairly homogeneous, simpler methods can be used.

When a single premium block of business is well matched at issue and pricing interest rates are updated regularly to reflect current interest rates (e.g., annuity business), the pricing interest rate vector would provide a reasonable basis for the allocation. Then, an interest rate margin could be applied directly to the pricing interest rate vector to reproduce CALM policy liabilities. The margin itself may be obtained through an iterative process.

A block of short- to mid-term accumulation annuities could have policy liabilities allocated as a percentage of the accumulation funds. Such a method may distort the policy liabilities for the shorter and longer durations within a portfolio. A similar approach can be used with old blocks of individual life participating policies, where the CALM policy liabilities would be allocated by policy using a percentage of the cash surrender value.

While allocation methodologies can be simplified, allocations would preferably not ignore major risks or product characteristics. For example, the cost of interest rate guarantees under Universal Life policies would preferably not be spread to non-UL policies.

The above approaches do not comprise an exhaustive list, and are provided as examples.

EXHIBIT 1**Aggregation and allocation – example using the “company total” approach of section 2.1**

1. Determining the total PfAD for interest rate risk. (See discussion under section 2.1.3.)

| Portfolio | C-3 Provision | | Comments |
|----------------------|---------------|-------------|---|
| | Scenario 1 | Scenario 2 | |
| 1 | -5 | 10 | This portfolio is tightly matched, with valuation results by scenario regularly changing signs. |
| 2 | -150 | 250 | The mismatch position of these portfolios is in line with prior quarters. |
| 3 | 300 | -420 | |
| Company Total | 145 | -160 | Reflective of total company position. |

2. Allocating the total PfAD for interest rate risk to individual portfolios. (See discussion under section 3.3.)

| Portfolio | Stand-alone C-3 Provision | Company Total C-3 Provision |
|--------------|---------------------------|-----------------------------|
| 1 | 10 | 2.6 |
| 2 | 250 | 64.7 |
| 3 | 300 | 77.7 |
| Total | 560 | 145.0 |

3. Allocating the PfAD for interest rate risk of individual portfolios to blocks of policies.

Consider that Portfolio 1’s policy liabilities are determined separately for two blocks of business: a Guaranteed Interest Contracts block, and an Immediate Annuity block. In addition, suppose new business policy liabilities are examined separately from in-force policy liabilities (because of internal profitability requirements, and embedded value reporting).

For each of Portfolio 1’s product lines and cohorts, the base scenario and all other scenarios are run using an appropriate allocation of assets.

| Portfolio 1 | Base Scenario Liabilities | Scenario 2 results | Most adverse scenario results | C-3 PfAD for the pro-rata allocation | C-3 PfAD allocated |
|-------------------------|----------------------------------|---------------------------|--------------------------------------|---|---------------------------|
| GIC, excl. new business | 100 | 115 | 115 | 15 | 1.3 |
| GIC new business | 25 | 28 | 28 | 3 | 0.3 |
| IA, excl. new business | 42 | 39 | 52 | 10 | 0.9 |
| IA new business | 10 | 10 | 12 | 2 | 0.2 |
| Total | 177 | 187³ | 207⁴ | 30 | 2.6 |

The allocated PfAD for interest rate risk by product and cohort does not correspond to a specific scenario. It results from weighting the risks between portfolios, and within a portfolio, amongst product lines and cohorts.

The allocated PfAD for interest rate risk for a specific product and cohort can be converted into a constant interest margin. When applied to the base scenario vector of interest rates, it reproduces the provision level.

Another approach applies a pro-rata allocation to the base scenario and the most adverse scenario interest rates to reproduce the provision level. Then, the interest rate margin follows a more realistic pattern.

Attempting to modify the pattern of interest rates from the most adverse scenario by using a flat interest rate spread provides awkward interest rates patterns, such as potentially better than best estimates interest rates for the first few years.

Since there is no equivalent to the deterministic approach's "most adverse scenario concept" such an approach cannot be used under stochastic modeling.

³ Represents the policy liability for the whole portfolio under that scenario, and not the sum of the policy liabilities by product.

⁴ Represents the sum of the policy liabilities for each product, under each most adverse scenario.