SOCIETY OF ACTUARIES

Article from:

The Financial Reporter

August 2004 – Issue No. 58

Resolution of Circularity Issues in SOP 03-1

by Mike A. Lesar

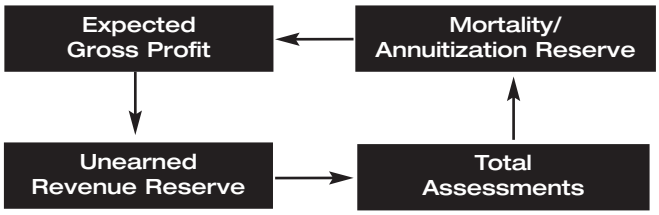
The new Statement of Position, "Accounting and Reporting by Insurance Enterprises for Certain Nontraditional Long-Duration Contracts and for Separate Accounts," (henceforth referred to as "the SOP") issued by the accounting standards executive committee of the AICPA provides new guidance for the calculation of GAAP assets and liabilities associated with various life insurance products, such as universal life, variable annuities and two-tier annuities. This article is not a general summary of the SOP, but instead offers a possible resolution to certain circularity issues that may arise while implementing it.

Circularity appears to arise when a product has one or more front-end loads deferred into unearned revenue and death or annuitization benefit characteristics that, under the SOP, require a liability calculated using the concept of "total assessments." Two examples of provisions that use total assessments in the liability calculation are:

1. **Insurance benefit features** that are "expected to result in current profits and future losses from the insurance benefit function" (paragraph 26). An example is a universal life policy with cost of insurance charges that are level for an extended period.
2. **Contract features** where the "present value of expected annuitization payments at the expected annuitization date exceeds the expected account balance at the expected annuitization date" (paragraph 31). An example is a two-tier annuity where the lower-tier balance is available on cash surrender and a higher-tier balance is available on annuitization.

Paragraph 26 of the SOP indicates that the amounts of front-end fees "recognized in income" should be considered assessments. Paragraphs 29 and 34 indicate the expected gross profits should be adjusted to reflect the recognition of the new death or annuitization liabilities, respectively. So now the circularity becomes apparent:

> Expected gross profit depends on mortality and/or annuitization liabilities, which depend on total assessments, which depend on unearned revenue reserve, which depends on expected gross profit.



Iterative methods may be used to resolve this circularity, but they may be computationally challenging and conceivably might not converge to a solution. Fortunately, the circularity can be resolved algebraically if we interpret the text of the SOP in the manner

continued on page 10

described below. In this example we have a UL product that has gains followed by losses in the mortality benefit function and a front-end load deferred into an unearned revenue reserve.

For policy year t we assume we know the following:

$TEGP_t$ = tentative Expected Gross Profit before reflecting effect of Mortality Reserve
TTA_t = tentative Total Assessments before reflecting effect of Unearned Revenue Reserve
$UREV_t$ = amount of Unearned Revenue capitalized
DB_t = death benefits in excess of account values
$DefCost_t$ = acquisition costs deferred

We wish to derive these amounts:

EGP_t = adjusted Expected Gross Profit, reflecting effect of Mortality Reserve
TA_t = adjusted Total Assessments, reflecting the effect of the Unearned Revenue Reserve
DAC_t = end of the year Deferred Acquisition Cost asset balance
URR_t = end of the year Unearned Revenue Reserve

MR_t = end of the year Mortality Reserve, the new liability required by the SOP

Normally we would start by calculating K-factors and benefit ratios. By "PV(quantity)" we mean the present value over the amortization period of the quantity in parentheses, discounted using the DAC amortization rate, typically the credited rate. Before the SOP, we would have:

(E1) Pre-SOP DAC K-factor = $PV(DefCost_t)$ / $PV(TEGP_t)$; and

(E2) Pre-SOP URR K-factor = $PV(UREV_t)$ / $PV(TEGP_t)$.

With the SOP we have:

(E3) Post-SOP DAC K-factor = $PV(DefCost_t)$ / $PV(EGP_t)$;

(E4) Post-SOP URR K-factor = $PV(UREV_t)$ / $PV(EGP_t)$;
and

(E5) Mortality Benefit Ratio = BR = $PV(DB_t)/PV(TA_t)$.

At first blush we cannot calculate these ratios because the circularity issues mean we do not know adjusted EGPs and total assessments for any particular year. Now the exact text of paragraph 29 for the SOP is:

The estimated gross profits used for the amortization of deferred acquisition costs should be adjusted to reflect the recognition of the liability in accordance with paragraph 28 of this SOP.

Paragraph 28 describes how the liability should be calculated, and goes on to say:

> The change in the additional liability should be recognized as a component of benefit expense in the statement of operations.

Does this mean that the adjustment to EGPs referred to in paragraph 29 is the change in the liability? That is how the sample calcu-

lation in Appendix E of the SOP works. Since the liability progression is

(E6) $MR_t = MR_{t-1} + BR*TA_t - DB_t + Interest;$

the increase in the reserve is

(E7) $BR*TA_t - DB_t + Interest;$

and the adjustment to the EGP in the sample calculation is

(E8) $EGP_t = TEGP_t - BR * TA_t + DB_t$ - Interest.

I propose that, instead, we take

(E9) $EGP_t = TEGP_t - BR * TA_t + DB_t.$

In other words, we eliminate the interest piece. This strikes me as more consistent with FAS 97 techniques than the SOP example, in that we are adjusting EGPs by simply replacing actual annual costs with costs that are a constant percentage of total assessments. Moreover, since

$PV(BR*TA_t) = BR*PV(TA_t) = PV(DB_t)/PV(TA_t) * PV(TA_t) = PV(DB_t),$

the item we are replacing and the item we are replacing it with have the same present value, so

(E10) $PV(EGP_t) = PV(TEGP_t).$

Again, this strikes me as conceptually more appealing than the approach taken in the SOP example.

(Another way to get to the same place is to add interest earned on the assets backing the mortality reserve to the EGPs in equation E8. If we assume the assets earn interest at the rate underlying the liability accrual, the two interest pieces offset and we end up with the proposed formula, E9.)

The reader may consult the response to Q31 of the AAA practice note on the SOP for further discussion of this issue. The conceptual justification for eliminating the interest piece is presented in the response, and a diversity of opinion among actuaries as to how binding the illustration in Appendix E should be is noted.

If we adopt this approach, then it is clear that the pre-SOP and post-SOP DAC (and UREV) K-factors are equal, because they have the same numerators and equal denominators.

We take a similar tack with total assessments. The last sentence of paragraph 26 is:

> The amounts recognized in income [from front-end fees] should be considered assessments for purposes of this paragraph.

Here we propose

(E11) $TA_t = TTA_t$ + URR K-factor * $EGP_t.$

That is to say, the adjustment to total assessments to reflect unearned revenue is the accrual for the year and does not reflect any interest component. Then it follows that

(E12) $PV(TA_t) = PV(TTA_t$ + URR K-factor * $EGP_t) = PV(TTA_t)$ + URR K-factor * $PV(EGP_t)$ $= PV(TTA_t) + PV(UREV_t)/PV(EGP_t)$ $*PV(EGP_t) = PV(TTA_t) + PV(UREV_t).$

This is useful because we know the year-by-year tentative total assessments and capitalized unearned revenue amounts a priori, so this present value may be calculated directly. We now have the ability to calculate the benefit ratio as well, without any circularity issues.

Finally we use a little algebra to solve for the year-by-year adjusted expected gross profits and total assessments. Substituting E9 into E11 we get

(E13) $TA_t = TTA_t$ + URR K-factor * ($TEGP_t - BR * TA_t + DB_t$)

so

(E14) TA_t *(1+URR K-factor * BR) = TTA_t + URR K-factor * ($TEGP_t + DB_t$)

and

(E15) $TA_t = [TTA_t$ + URR K-factor * ($TEGP_t + DB_t$)]/ (1+URR K-factor * BR),

continued on page 14

We now have the ability to calculate the Benefit Ratio, as well, without any circularity issues.

Exhibit 1—SOP Calculations Using Proposed Methodology

Known Quantities

Policy Year	TEGP	TTA	UREV	DefCost	COI	DB
1	500	1500	2000	3000	1000	600
2	600	1300	0	0	900	700
3	400	1100	0	0	800	800
4	200	900	0	0	700	900
5	0	700	0	0	600	1000

Present Values

PV @ 5%	$1,530	$4,847	$1,905	$2,857	$3,506	$3,421
PV TA		$6,752				

Ratios

DAC K-factor	187%
URR K-factor	124%
Benefit Ratio	51%

Solved-for Quantities

Policy Year	TA	EGP	BOY URR	UREV Cap'd	URR Accrual	URR Interest	EOY URR
1	1759	208	0	2000	259	0	1741
2	1789	393	1741	0	489	87	1338
3	1590	394	1338	0	490	67	915
4	1391	395	915	0	491	46	469
5	1192	396	469	0	492	23	0

Policy Year	BOY DAC	Def Cost Cap'd	DAC Amort	DAC Interest	EOY DAC
1	0	3000	389	-	2611
2	2611	0	734	131	2007
3	2007	0	736	100	1372
4	1372	0	737	69	704
5	704	0	739	35	0

Policy Year	BOY Mort Reserve	Mort Reserve Accrual	DB	Mort Reserve Interest	EOY Mort Reserve
1	-	892	600	-	292
2	292	907	700	15	513
3	513	806	800	26	545
4	545	705	900	27	377
5	377	604	1,000	19	(0)

Exhibit 2—SOP Calculations Using Iterative Methodology

Known Quantities

Policy Year	TEGP	TTA	UREV	DefCost	COI	DB
1	500	1500	2000	3000	1000	600
2	600	1300	0	0	900	700
3	400	1100	0	0	800	800
4	200	900	0	0	700	900
5	0	700	0	0	600	1000

Present Values

PV @ 5%	$1,530	$4,847	$1,905	$2,857	$3,506	$3,421
PV TA		$6,558				

Ratios

DAC K-factor	196%
URR K-factor	131%
Benefit Ratio	52%

Solved for Quantities

Policy Year	TA	EGP	BOY URR	UREV Cap'd	URR Accrual	URR Interest	EOY URR	UREV Accr-Int
1	1747	189	0	2000	247	0	1753	247
2	1719	388	1753	0	507	88	1334	419
3	1527	377	1334	0	493	67	907	427
4	1342	373	907	0	487	45	465	442
5	1165	373	465	0	488	23	0	465

Policy Year	BOY DAC	DAC Cap'd	DAC Amort	DAC Interest	EOY DAC
1	0	3000	370	-	2630
2	2630	0	760	131	2001
3	2001	0	740	100	1361
4	1361	0	731	68	698
5	698	0	733	35	0

Policy Year	BOY Mort Reserve	Mort Reserve Accrual	DB	Mort Reserve Interest	EOY Mort Reserve	Change in Mort Res
1	-	911	600	-	311	311
2	311	897	700	16	524	213
3	524	796	800	26	546	22
4	546	700	900	27	374	(172)
5	374	608	1,000	19	0	(374)

where all items on the right-hand side are already known quantities.

Likewise, substituting E11 into E9 we get

$$(E16)\ EGP_t = TEGP_t - BR * (TTA_t + URR\ K\text{-factor} * EGP_t) + DBt$$

so

$$(E17)\ EGP_t * (1 + BR * URR\ K\text{-factor}) = TEGP_t - BR * TTA_t + DBt$$

and

$$(E18)\ EGP_t = (TEGP_t - BR * TTA_t + DB_t) / (1 + BR * URR\ K\text{-factor}),$$

where, again, all items on the right-hand side are already known quantities.

With the year-by-year adjusted expected gross profits and total assessments in hand, it is straightforward to calculate the year-by-year DAC, URR and mortality reserve balances.

A numerical example is shown in the exhibits. Exhibit 1 [page 12] demonstrates the proposed method. The illustrative known quantities are given, present values at 5 percent are calculated (all cash flows are assumed to be at the end of the period), the ratios are developed, the URR, DAC and mortality reserve schedules are calculated. Note that the adjusted total assessments are the unadjusted total assessments plus the unearned revenue reserve accrual, and the adjusted expected gross profits equal the unadjusted expected gross profits, plus actual death benefits, less the mortality reserve accrual. Exhibit 2 [page 13] demonstrates the iterative solution. Here the K-factors and benefit ratio are solved iteratively (the iteration is not shown), so that the adjusted expected gross profits equal the unadjusted expected gross profits less the change in the mortality reserve, and adjusted total assessments equal the unadjusted total assessments, plus the decrease in the unearned revenue reserve, plus capitalized unearned revenue.

In Exhibit 3 [page 14] the net GAAP liability arising from the three calculated items, DAC, URR and mortality reserve, is shown for each method. The differences are minor and do not demonstrate a clear pattern.

In summary, this method avoids iterative methods in resolving circularities inherent in SOP 03-1, by using a reasonable interpretation of the text of the SOP. It can also be used as an approximation method by those who prefer the method used in Appendix E of the SOP but who wish to avoid iteration.

Mike Lesar, FSA, MAAA is an Assistant Vice President and Actuary with Great American Financial Resources in Cincinnati, Ohio. He can be reached at mlesar@gafri.com

Exhibit 3—Net GAAP Liability

	Proposed Method				Iterative Method			
Policy Year	DAC	URR	Mortality Reserve	Net GAAP Liability	DAC	URR	Mortality Reserve	Net GAAP Liability
1	(2,611)	1,741	292	(578)	(2,630)	1,753	311	(566)
2	(2,007)	1,338	513	(156)	(2,001)	1,334	524	(143)
3	(1,372)	915	545	88	(1,361)	907	546	92
4	(704)	469	377	142	(698)	465	374	141
5	-	-	-	-	-	-	-	-