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ADDITIONAL SOURCE-OF-EARNINGS ANALYSIS UNDER *FAS 97* UNIVERSAL LIFE ACCOUNTING AND SOME OBSERVATIONS ON THE EFFECT OF UNLOCKING ASSUMPTIONS

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ABSTRACT

Tan's paper "Source-of-Earnings Analysis under *FAS 97* Universal Life Accounting" [2] defines a procedure for analyzing the sources of profit for a sample universal life product accounted for under *FAS 97*. This paper extends that analysis to consider the effect of actual experience varying from expected and the effect of those variances on assumptions for the future. Also, the paper illustrates examples of the effect of changing future assumptions (unlocking) on the magnitude and incidence of actual profits.

INTRODUCTION

By starting with Tan's procedure for analyzing the various sources of profit for universal life under *FAS 97*, a calculation of gain by source that will prove informative to management can be developed. For example, Table 9 of Tan's paper, which illustrates a source-of-earnings analysis reflecting all the changes made to the experience factors discussed in the paper, shows a variation in gain from mortality in the fifth policy year of -0.264. This variation in the gain from mortality is present even though the cost of insurance and mortality rates experienced in that year are exactly equal to expected. Similarly, there are negative variations for withdrawal and interest in the fifth year, despite the fact that those rates are also equal to expected. Management should wonder why there are such large negative variances even though the rates are equal to expected. Clearly, we must divide these variations into an amount caused by events in prior periods and an amount caused by variations between actual experience in the current period and our best estimate of that experience at the beginning of the current period.

In his paper, Tan highlighted two of his interpretations of *Statement of Financial Accounting Standards No. 97* (*FAS 97*) [1]. Interpretation 1 called for the nondeferrable expense to be considered a maintenance expense in the calculation of the gain from expense. Interpretation 2 defined the interest-earned portion of the gain from interest as the interest earnings on the beginning-of-year account balance plus the change in cash flow during the year.

Although I disagree with Tan's Interpretation 1, I have applied his Interpretations 1 and 2 for easier comparisons with his results.

I add two more interpretations to those of Tan. First, I interpret *FAS 97* as requiring the substitution of actual experience for the estimated experience for past periods. I define the substitution of actual for expected as "truing-up." Second, I interpret paragraph 25 of *FAS 97* as a definition of unlocking. Paragraph 25 states,

"Estimates of expected gross profit used as a basis for amortization shall be evaluated regularly, and the total amortization recorded shall be adjusted by a charge or credit to the statement of earnings if actual experience or other evidence suggests that earlier estimates should be revised."

Because I have already defined truing-up as a substitution of actual for expected experience, the revision of "earlier estimates" in paragraph 25 refers to estimates of future experience. Therefore, unlocking is defined as a change in future assumptions.

To summarize:

Interpretation 3: FAS 97 *requires truing-up by the substitution of actual experience for expected experience. Such substitution may affect the future expected gross profits used for amortization.*

Interpretation 4: FAS 97 *defines unlocking as the revision of future assumptions, and unlocking does not include the substitution of actual experience for expected experience.*

In the calculation of the *DAC*, the use of actual experience to date or a revision of future expected assumptions results in a "catch-up" adjustment. This catch-up is the amount by which the *DAC* reported at the end of the prior period differs from that recalculated after the substitution of actual experience or changes in future assumptions.

Note, however, that truing-up affects future expected experience. For example, a higher-than-expected lapse rate results in lower in-force in the future. This lower in-force causes a decrease in expected gross profits.

In this paper, *DAC* is calculated by using the credited interest rate at inception of the contract, even though the credited rate itself may change. This is one of the options given in paragraph 25 of *FAS 97*:

"The interest rate used to compute the present value of revised estimates of expected gross profits shall be either the rate in effect at the inception of the book of contracts or at the latest revised rate applied to the remaining benefit period."

CALCULATION PROCEDURE

For the illustration in Tan's paper, I reflect the variations in experience that he used in his calculation of his Tables 4 through 8 and develop a new reported profit based upon my Interpretations 3 and 4. The Appendix contains the policy values and assumptions used for my calculations. The first step is to fix the gain from the various sources expected in the following year. For example, at issue of the policy, the expected gains from mortality, withdrawal, expense, and interest are fixed for the first policy year. At the first valuation, actual experience is substituted for the expected values.

A new *DAC* and a new percentage of gross profits used for amortization ($A\%$) are calculated by using the gains based upon actual experience to date and expected experience for the future. The new *DAC* is recalculated for all years. The difference between the *DAC* reported at the end of the prior period and its recalculated value is the catch-up adjustment.

The next step is to quantify the change in the current period's reported profit from that expected due to past experience, the change in the $A\%$ used for amortization, the change in the beginning-of-year *DAC* (or catch-up), and the effect of actual experience factors that differ from those assumed at the beginning of the year.

Before the cycle is started again, the expected gains for the next policy year are fixed along with the reported *DAC* for the current period.

A simple example illustrates the process. By using Tan's data, actual experience is the same as that assumed for the first three years. The expected gains by source for the fourth and later years are:

EXPECTED GAINS BY SOURCE

Policy Year	Mortality	Withdrawal	Expense	Interest	Total
4	2.522	0.982	1.089	1.022	5.614
5	2.494	1.088	1.032	1.177	5.791
6	2.439	1.099	0.978	1.323	5.839

$A\% = 10.9453\%$; reported *DAC* @3 = 5.353.

These values are the same as Tan's except that these reflect survivorship. These values are per unit issued.

The actual withdrawal rate in the fourth year is 15 percent or three times that expected. This variation from expected affects both the current and expected future gains by source.

GAINS BY SOURCE
ACTUAL IN YEAR 4
REVISED EXPECTED IN YEARS 5 AND 6

Policy Year	Mortality	Withdrawal	Expense	Interest	Total
4	2.522	2.946	1.089	1.022	7.579
5	2.231	0.973	0.923	1.053	5.180
6	2.182	0.983	0.875	1.183	5.223

$A\%=11.4064\%$; revised *DAC* @3 = 5.260.

The change due to the higher withdrawals can be reflected in four items. First, future gains from all sources are reduced because the in-force is less. As we analyze the gains of the fifth and later years, this will be a factor.

Second, $A\%$ has increased and more of each year's gain is required for amortization. In addition to an effect in the fourth year, we can expect lower gains in years 5 and later.

Third, the higher value of $A\%$ means more amortization should have taken place in the first three years. The revised third-year *DAC* is \$5.260, or \$0.093 less than reported. This decrease is reported as a current period loss. In addition, interest on the difference, or (0.08)(0.093), is reported as a loss.

Finally, the portion of additional withdrawal charges that does not influence amortization increases GAAP profit. This portion is $1-A\%$ (using the expected value of $A\%$).

The resulting actual GAAP profit can be derived as:

Expected GAAP Profit	\$4.893
Past Experience	0.000
Change in $A\% - 0.4611\% \times 7.579$	-0.035
Catch-up (1.08)(0.093)	-0.100
Withdrawal $(1-10.9453\%)$ $(2.946-0.982)$	1.749
Actual GAAP Gain	6.507

These items are calculated for the variations shown in Tan's Tables 4 through 8.

A revision and expansion of Tan's notation will be useful:

GM	= Gain from mortality per unit issued
GW	= Gain from withdrawal per unit issued
GE	= Gain from expense per unit issued
GI	= Gain from interest per unit issued
G	= Estimated gross profit per unit issued
	$= GM + GW + GE + GI.$

Subscript t	= Time t
Superscript G	= GAAP assumption
Superscript P	= Actual experience through $t - 1$, GAAP assumptions thereafter
Superscript A	= Actual
$A\%^G$	= Amortization rate on original GAAP assumptions
$A\%^L$	= Amortization rate used in prior period's valuation
$A\%^C$	= Amortization rate used in current period's valuation
DAC^G	= Outstanding deferred acquisition cost on original GAAP assumptions
DAC^R	= Outstanding deferred acquisition cost actually reported
DAC^C	= Outstanding deferred acquisition cost as calculated in current period's valuation

Using the example given above, assuming a valuation at $t=4$:

DAC_3^R	= 5.353
DAC_3^C	= 5.260
$A\%^L$	= 10.9453% = $A\%^G$
$A\%^C$	= 11.4064%
GW^P	= 0.982 = GW^G
GW^A	= 2.946

Variations Due to Past Experience

Interpretation 3 states that future expected experience is dependent upon actual past experience. In the example above, a high lapse rate in year 3 reduced future in-force and future expected profits. This difference between reported results and those estimated at issue is referred to as a variation due to past experience.

Table A (I use letters to designate my tables to avoid confusion with Tan's tables) shows three sets of figures. The first set shows the gains used to calculate the amortization schedule based upon original GAAP assumptions; these figures are the same as those in Table 2 in Tan's paper, with an adjustment to reflect in-force. All values in Table A are per unit issued. The second set of figures is the expected gains used in my calculation. The third is the actual gains experienced.

The expected gains exactly match those in Tan's paper for years 1 through 3. At the beginning of the first year, I set the expected gains equal to those based on the original assumptions. The substitution of actual experience,

TABLE A

COMPARISON OF ESTIMATED GROSS PROFITS (GAINS)

Policy Year	Original GAAP Assumptions (Superscript G)					Reflect Past Experience (Superscript P)					Actual (Superscript A)				
	GM	GW	GE	GI	G	GM	GW	GE	GI	G	GM	GW	GE	GI	G
1	4.130	0.099	1.000	0.027	5.256	4.130	0.099	1.000	0.027	5.256	4.130	0.099	1.000	0.027	5.256
2	3.546	1.027	1.349	0.817	6.739	3.546	1.027	1.349	0.817	6.739	3.546	1.027	1.349	0.817	6.739
3	2.971	1.630	1.212	0.930	6.742	2.971	1.630	1.212	0.930	6.742	2.836	1.630	1.212	0.930	6.608
4	2.522	0.982	1.089	1.022	5.614	2.521	0.982	1.088	1.022	5.613	2.380	2.946	1.088	1.022	7.436
5	2.494	1.088	1.032	1.177	5.791	2.230	0.973	0.923	1.053	5.178	2.230	0.973	−0.615	0.899	3.486
6	2.439	1.099	0.978	1.323	5.839	2.181	0.983	0.874	1.183	5.221	2.182	0.992	−0.583	0.278	2.869
7	2.390	1.022	0.926	1.459	5.797	2.135	0.921	0.828	1.311	5.196	2.137	0.930	−0.552	0.288	2.802
8	2.405	0.866	0.877	1.584	5.733	2.148	0.787	0.784	1.431	5.150	2.149	0.794	−0.523	0.296	2.717
9	2.467	0.639	0.830	1.701	5.637	2.200	0.585	0.742	1.545	5.072	2.202	0.590	−0.495	0.304	2.602
10	2.498	0.348	0.785	1.808	5.440	2.225	0.321	0.702	1.651	4.899	2.227	0.324	−0.468	0.311	2.394
11	2.476	0.000	0.743	1.906	5.125	2.201	0.000	0.664	1.751	4.616	2.204	0.000	0.664	0.417	3.285
12	2.422	0.000	0.702	1.996	5.120	2.149	0.000	0.628	1.844	4.620	2.153	0.000	0.628	0.417	3.197
13	2.307	0.000	0.663	2.076	5.046	2.041	0.000	0.593	1.930	4.564	2.046	0.000	0.593	0.416	3.055
14	2.205	0.000	0.626	2.148	4.978	1.945	0.000	0.560	2.008	4.513	1.951	0.000	0.560	0.415	2.925
15	2.122	0.000	0.590	2.209	4.922	1.866	0.000	0.528	2.079	4.473	1.872	0.000	0.528	0.412	2.812
16	1.896	0.000	0.556	2.262	4.713	1.660	0.000	0.497	2.143	4.300	1.668	0.000	0.497	0.408	2.573
17	1.903	0.000	0.522	2.303	4.728	1.657	0.000	0.467	2.198	4.322	1.667	0.000	0.467	0.402	2.536
18	1.899	0.000	0.491	2.336	4.725	1.643	0.000	0.439	2.246	4.328	1.653	0.000	0.439	0.395	2.487
19	1.876	0.000	0.460	2.360	4.696	1.610	0.000	0.412	2.287	4.308	1.622	0.000	0.412	0.385	2.419
20	1.841	0.000	0.431	2.375	4.647	1.565	0.000	0.386	2.321	4.272	1.579	0.000	0.386	0.374	2.338

which was exactly equal to expected, produced new expected gains that naturally were the same as the original gains.

The original gains were reproduced through the third year. In the third year, there was a variation due to mortality. The actual mortality was 110 percent of the original assumption. Therefore, the expected fourth-year gains are slightly different, because there will be less in-force in future years than under the original GAAP assumptions. The fourth-year gain was then fixed for my calculations and actual experience substituted for it. The higher mortality and lapse in the fourth year led to lower expected gains in succeeding years.

This step-by-step and year-by-year procedure of substituting actual for expected produces a set of expected gains that are used for the calculation of the *DAC* under Interpretation 3. The difference between the original gain from the various experience factors and that which I calculate is the variation due to accumulated past experience. For example, the total expected gain (G) per unit issued in the fifth year is \$5.791 under the original assumptions and \$5.178 taking into account past experience. Therefore, without even knowing the actual experience in the fifth year or how it varies from expected, reported profits are expected to be lower than those based on the original GAAP assumptions, just because there is less business in-force.

The portion of the difference due to past experience that will flow through to income depends upon the percentage of the gross profit used for amortization. As past experience is substituted for estimated experience, this percentage will also change. In calculating the change in expected gain due to past experience, the $A\%$ used at the end of the prior period will be used. The formula below gives the calculation.

Expected Gain Due to Past Experience

$$= (1 - A\%^P)\, G_t^P - (1 - A\%^G)\, G_t^G$$

Table B gives an illustration of the change in expected GAAP profit due to past experience. The expected gain using the original GAAP assumptions is adjusted by the change due to past experience. As the table shows, the higher lapses in the fourth year have a dramatic effect on future expected profits.

Change in A%

The substitution of actual experience for expected experience causes a change in the factor used for amortization, $A\%$. Because the profit from the various sources is $(1-A\%)$ multiplied by the total gain, the change in $A\%$ also has an effect on the reported profits. Table C gives the development of the $A\%$ factors that result when actual experience is substituted for expected experience.

TABLE B

CHANGE IN EXPECTED GAIN BY SOURCE DUE TO PAST EXPERIENCE

Policy Year	Mortality	Withdrawal	Expense	Interest	Total	Interest on *BOYDAC*	Total
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	−0.001	0.000	0.000	0.000	−0.002	0.000	−0.002
5	−0.246	−0.108	−0.102	−0.116	−0.572	0.007	−0.566
6	−0.247	−0.111	−0.099	−0.134	−0.591	0.052	−0.539
7	−0.250	−0.100	−0.097	−0.146	−0.593	0.048	−0.545
8	−0.261	−0.082	−0.094	−0.157	−0.594	0.044	−0.550
9	−0.277	−0.059	−0.092	−0.167	−0.593	0.040	−0.554
10	−0.290	−0.031	−0.089	−0.175	−0.585	0.036	−0.549
11	−0.299	0.000	−0.086	−0.181	−0.566	0.032	−0.534
12	−0.300	0.000	−0.083	−0.184	−0.566	0.029	−0.537
13	−0.293	0.000	−0.079	−0.184	−0.557	0.026	−0.530
14	−0.289	0.000	−0.076	−0.183	−0.548	0.023	−0.524
15	−0.287	0.000	−0.072	−0.180	−0.540	0.020	−0.520
16	−0.265	0.000	−0.069	−0.176	−0.509	0.017	−0.493
17	−0.276	0.000	−0.065	−0.170	−0.511	0.014	−0.498
18	−0.288	0.000	−0.062	−0.161	−0.511	0.010	−0.501
19	−0.298	0.000	−0.059	−0.152	−0.508	0.007	−0.501
20	−0.307	0.000	−0.056	−0.140	−0.504	0.004	−0.500

TABLE C

CHANGE IN *A*% BY SOURCE

Policy Year	*A*%	Mortality	Withdrawal	Expense	Interest	Total
0	10.9453%	—	—	—	—	—
1	10.9453	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
2	10.9453	0.0000	0.0000	0.0000	0.0000	0.0000
3	10.9680	0.0228	0.0000	0.0000	0.0000	0.0228
4	11.4553	0.0223	0.4649	0.0000	0.0000	0.4872
5	11.7128	0.0000	0.0000	0.2575	0.0000	0.2575
6	12.0522	0.0000	0.0000	0.2356	0.1038	0.3394
7	12.3909	0.0000	0.0000	0.2184	0.1202	0.3387
8	12.7279	0.0000	0.0000	0.2020	0.1350	0.3370
9	13.0624	0.0000	0.0000	0.1865	0.1480	0.3345
10	13.3933	0.0000	0.0000	0.1718	0.1591	0.3309
11	13.5590	0.0000	0.0000	0.0000	0.1657	0.1657
12	13.7279	0.0000	0.0000	0.0000	0.1689	0.1689
13	13.8986	0.0000	0.0000	0.0000	0.1707	0.1707
14	14.0698	0.0000	0.0000	0.0000	0.1713	0.1713
15	14.2406	0.0000	0.0000	0.0000	0.1707	0.1707
16	14.4098	0.0000	0.0000	0.0000	0.1692	0.1692
17	14.5764	0.0000	0.0000	0.0000	0.1667	0.1667
18	14.7399	0.0000	0.0000	0.0000	0.1634	0.1634
19	14.8994	0.0000	0.0000	0.0000	0.1595	0.1595
20	15.0545	0.0000	0.0000	0.0000	0.1551	0.1551

As Table C shows, the factor used for amortization through the second year is at the original level of 10.9453 percent. With the higher mortality in the third year, the factor increases. This is due to the fact that with higher mortality, there is a lower gain from mortality in the third year. Deferrable expenses remain the same, while the denominator in the calculation of the $A\%$ decreases. Therefore, more of each year's gain is required for amortization.

The higher mortality in the third year also influences the future. With less business in-force, there are lower future gains. This also pushes the value of $A\%$ upward.

The formula below defines the variation in profit due to the change in $A\%$.

$$\text{Change in Profit Due to Change in } A\% = (A\%^L - A\%^C)G_t^A$$

For year 3 in the illustration, Table C shows the change in $A\%$ is 0.0228 percent and Table A shows the actual gain in the third year is \$6.608. Therefore, the decrease in gain due to the increase in $A\%$ is \$0.002, found in Table D.

TABLE D

CHANGE IN GAIN BY SOURCE DUE TO CHANGE IN A%

Policy Year	Mortality	Withdrawal	Expense	Interest	Total
1.......	0.000	0.000	0.000	0.000	0.000
2.......	0.000	0.000	0.000	0.000	0.000
3.......	−0.002	0.000	0.000	0.000	−0.002
4.......	−0.002	−0.035	0.000	0.000	−0.036
5.......	0.000	0.000	−0.009	0.000	−0.009
6.......	0.000	0.000	−0.007	−0.003	−0.010
7.......	0.000	0.000	−0.006	−0.003	−0.009
8.......	0.000	0.000	−0.005	−0.004	−0.009
9.......	0.000	0.000	−0.005	−0.004	−0.009
10.......	0.000	0.000	−0.004	−0.004	−0.008
11.......	0.000	0.000	0.000	−0.005	−0.005
12.......	0.000	0.000	0.000	−0.005	−0.005
13.......	0.000	0.000	0.000	−0.005	−0.005
14.......	0.000	0.000	0.000	−0.005	−0.005
15.......	0.000	0.000	0.000	−0.005	−0.005
16.......	0.000	0.000	0.000	−0.004	−0.004
17.......	0.000	0.000	0.000	−0.004	−0.004
18.......	0.000	0.000	0.000	−0.004	−0.004
19.......	0.000	0.000	0.000	−0.004	−0.004
20.......	0.000	0.000	0.000	−0.004	−0.004

In any year in which there are variations from expected in two or more experience factors, the total effect on the gain due to the change in $A\%$ should be allocated among the various sources. The rather mechanical and arbitrary method used herein incorporates the $A\%$ used in the calculation of the *DAC* at the end of the prior period. To do the current valuation, actual mortality information is substituted. The effect of the variation in current mortality from expected is calculated and stored. Next, actual withdrawal experience is used in the valuation, along with actual mortality experience. The difference in the total effect from that for mortality alone is calculated and stored as the effect of withdrawal. Successive valuations are run by adding actual expense experience and interest experience.

An alternative method is to change one experience factor in each of four valuation runs and use a fifth valuation run with actual values for all experience factors. This alternative method requires the calculation of a "combination" factor equal to the difference between the total effect and the sum of the effects of the individual experience factors.

Catch-up

The substitution of actual experience for expected experience results in an entirely new amortization schedule and the recalculation of the prior-year's *DAC*. The difference between the recalculated *DAC* and that actually reported is defined as the catch-up adjustment. The formula below gives the calculation.

$$\text{Catch-up Adjustment} = DAC^C_{t-1} - DAC^R_{t-1}$$

As was the case with the change in $A\%$, this catch-up adjustment is allocated by source. A calculation similar to the one for $A\%$ is used (in fact, it is done concurrently).

Table E shows the resulting catch-up adjustments by source.

These catch-up adjustments produce the *DAC* we would have reported at the prior period, had we known what we know now and had we adjusted our future assumptions to anticipate actual experience.

Because the effect of the catch-up adjustment is a change in the beginning-of-period *DAC* value, there will also be a change in the interest factor applied to the beginning-of-year *DAC*. This is calculated according to the formula given below.

$$\text{Interest on Catch-up Adjustment} = r(DAC^C_{t-1} - DAC^R_{t-1})$$

TABLE E

CATCH-UP ADJUSTMENT BY SOURCE DUE TO *DAC* RECALCULATION

Policy Year	*DAC*			Catch-up by Source					Interest on Catch-up by Source				
	Reported	Revised	Catch-up	Mortality	Withdrawal	Expense	Interest	Total	Mortality	Withdrawal	Expense	Interest	Total
0.......	6.000	6.000											
1.......	5.905	5.905	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.......	5.640	5.637	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.......	5.363	5.265	−0.003	−0.003	0.000	0.000	0.000	−0.003	0.000	0.000	0.000	0.000	0.000
4.......	4.835	4.760	−0.098	−0.004	−0.093	0.000	0.000	−0.098	0.000	−0.007	0.000	0.000	−0.008
5.......	4.732	4.614	−0.075	0.000	0.000	−0.075	0.000	−0.075	0.000	0.000	−0.006	0.000	−0.006
6.......	4.637	4.500	−0.118	0.000	0.000	−0.082	−0.036	−0.118	0.000	0.000	−0.007	−0.003	−0.009
7.......	4.513	4.356	−0.137	0.000	0.000	−0.089	−0.049	−0.137	0.000	0.000	−0.007	−0.004	−0.011
8.......	4.359	4.181	−0.157	0.000	0.000	−0.094	−0.063	−0.157	0.000	0.000	−0.008	−0.005	−0.013
9.......	4.176	3.978	−0.177	0.000	0.000	−0.099	−0.078	−0.177	0.000	0.000	−0.008	−0.006	−0.014
10.......	3.975	3.864	−0.198	0.000	0.000	−0.103	−0.095	−0.198	0.000	0.000	−0.008	−0.008	−0.016
11.......	3.728	3.600	−0.111	0.000	0.000	0.000	−0.111	−0.111	0.000	0.000	0.000	−0.009	−0.009
12.......	3.449	3.304	−0.128	0.000	0.000	0.000	−0.128	−0.128	0.000	0.000	0.000	−0.010	−0.010
13.......	3.144	2.982	−0.145	0.000	0.000	0.000	−0.145	−0.145	0.000	0.000	0.000	−0.012	−0.012
14.......	2.809	2.629	−0.162	0.000	0.000	0.000	−0.162	−0.162	0.000	0.000	0.000	−0.013	−0.013
15.......	2.439	2.242	−0.180	0.000	0.000	0.000	−0.180	−0.180	0.000	0.000	0.000	−0.014	−0.014
16.......	2.050	1.836	−0.197	0.000	0.000	0.000	−0.197	−0.197	0.000	0.000	0.000	−0.016	−0.016
17.......	1.613	1.383	−0.214	0.000	0.000	0.000	−0.214	−0.214	0.000	0.000	0.000	−0.017	−0.017
18.......	1.127	0.879	−0.231	0.000	0.000	0.000	−0.231	−0.231	0.000	0.000	0.000	−0.018	−0.018
19.......	0.589	0.326	−0.247	0.000	0.000	0.000	−0.247	−0.247	0.000	0.000	0.000	−0.020	−0.020
20.......	0.000	0.000	−0.263	0.000	0.000	0.000	−0.263	−0.263	0.000	0.000	0.000	−0.021	−0.021

As Table E shows, the various adjustments to the amortization schedule produce a revised value for *DAC* that is lower than the reported amount. This results in a catch-up factor that depresses current earnings. If actual experience had been used, the *DAC* at the beginning of the year would have been lower, and the accumulation of interest on it at the credited rate should also have been lower.

Gain by Source

Table F summarizes the effect of all adjustments on the original expected GAAP profits. As the table shows, in our example, the largest effect on GAAP profits is due to past experience.

Now that all these items have been identified, we can calculate the effect on the expected gain due to actual experience in the current period varying from that assumed in the last valuation.

TABLE F

CALCULATION OF REVISED EXPECTED GAAP PROFIT

Policy Year	Expected GAAP Profit	Past Experience	Change in *A*%	Catch-up	Interest on Catch-up	Revised Expected Profit
1..........	4.561	0.000	0.000	0.000	0.000	4.561
2..........	5.883	0.000	0.000	0.000	0.000	5.883
3..........	5.892	0.000	−0.002	−0.003	0.000	5.887
4..........	4.893	−0.002	−0.036	−0.098	−0.008	4.749
5..........	5.054	−0.566	−0.009	−0.075	−0.006	4.398
6..........	5.101	−0.539	−0.010	−0.118	−0.009	4.424
7..........	5.069	−0.545	−0.009	−0.137	−0.011	4.366
8..........	5.017	−0.550	−0.009	−0.157	−0.013	4.288
9..........	4.936	−0.554	−0.009	−0.177	−0.014	4.183
10..........	4.766	−0.549	−0.008	−0.198	−0.016	3.996
11..........	4.492	−0.534	−0.005	−0.111	−0.009	3.833
12..........	4.493	−0.537	−0.005	−0.128	−0.010	3.813
13..........	4.433	−0.530	−0.005	−0.145	−0.012	3.741
14..........	4.379	−0.524	−0.005	−0.162	−0.013	3.674
15..........	4.335	−0.520	−0.005	−0.180	−0.014	3.616
16..........	4.156	−0.493	−0.004	−0.197	−0.016	3.446
17..........	4.177	−0.498	−0.004	−0.214	−0.017	3.444
18..........	4.182	−0.501	−0.004	−0.231	−0.018	3.427
19..........	4.164	−0.501	−0.004	−0.247	−0.020	3.391
20..........	4.129	−0.500	−0.004	−0.263	−0.021	3.341

Table G shows the gains by source for each experience factor. In general, the calculation of the effect is given by the formula below.

Change in GAAP Profit Due to Change in a Specific Source Gain

$$= (1 - A\%^{L})\,(G^{A} - G^{P}) = VG_t$$

To illustrate the effects, I walk through the first few variations on the page.

TABLE G

SOURCE-OF-EARNINGS ANALYSIS REFLECTING ALL VARIANCES FROM EXPECTED

Policy Year	Revised Expected Profit	Gain by Source					Actual GAAP Profit
		VGM	*VGW*	*VGE*	*VGI*	Total	
1	4.561	0.000	0.000	0.000	0.000	0.000	4.561
2	5.883	0.000	0.000	0.000	0.000	0.000	5.883
3	5.887	−0.120	0.000	0.000	0.000	−0.120	5.768
4	4.749	−0.126	1.749	0.000	0.000	1.623	6.372
5	4.398	0.000	0.000	−1.362	−0.136	−0.148	2.900
6	4.424	0.001	0.008	−1.287	−0.799	−2.076	2.348
7	4.366	0.001	0.008	−1.214	−0.900	−2.105	2.261
8	4.288	0.002	0.006	−1.145	−0.994	−2.132	2.157
9	4.183	0.002	0.005	−1.080	−1.083	−2.156	2.027
10	3.996	0.002	0.003	−1.018	−1.165	−2.178	1.818
11	3.833	0.003	0.000	0.000	−1.155	−1.152	2.680
12	3.813	0.003	0.000	0.000	−1.233	−1.230	2.583
13	3.741	0.004	0.000	0.000	−1.306	−1.302	2.440
14	3.674	0.005	0.000	0.000	−1.372	−1.367	2.307
15	3.616	0.006	0.000	0.000	−1.433	−1.427	2.189
16	3.446	0.007	0.000	0.000	−1.488	−1.481	1.965
17	3.444	0.008	0.000	0.000	−1.537	−1.529	1.915
18	3.427	0.009	0.000	0.000	−1.582	−1.572	1.855
19	3.391	0.010	0.000	0.000	−1.621	−1.611	1.780
20	3.341	0.012	0.000	0.000	−1.657	−1.645	1.696

The first variation from expected comes in the third year due to higher-than-expected mortality. From Table A, we can identify the mortality expected in the prior year's valuation (\$2.971) and the actual experience (\$2.836). From Table C, the $A\%$ used in the prior valuation is 10.9453 percent. The effect on gain is then given in the calculation below.

$$VGM_3 = (1 - 0.109453)(2.836 - 2.971) = -0.120$$

The effect of the poor mortality on gain is different from that calculated by Tan, because here the amortization schedule absorbs some of the change.

The resulting profit of \$5.768 is higher than that shown in Tan's Table 9. In my work, the poorer mortality experience has been partially offset by a reduction in amortization during the year.

In the fourth year, both mortality and withdrawal experience are worse than expected. As Table B shows, the poorer mortality in the third year is reflected by a reduction in the expected gain from mortality of \$0.002. Substituting the current actual mortality and withdrawal into the fourth year changes $A\%$ and the catch-up factor, to the detriment of profitability. The gain by source for the various items is now calculated with respect to the revised projection for mortality and withdrawal gains made at the end of the third year. Below is the calculation of the Table G numbers in terms of numbers taken from Tables A and C.

$$\begin{aligned} VGM_4 &= (1 - 0.109680)(2.380 - 2.521) \\ &= -0.126 \\ VGW_4 &= (1 - 0.109680)(2.946 - 0.982) \\ &= 1.749 \end{aligned}$$

Note that the higher withdrawal rate (an unfavorable event) causes earnings to increase. The increase, however, is dampened by the effect of the amortization factor. About 11 percent of the additional surrender charge is used to amortize *DAC*. This accounts for most of the difference between the actual GAAP profits reported by Tan (\$6.714) and me (\$6.372).

The higher profits reported in the current period because of adverse lapse experience must be paid back. Part of the higher gains is paid back through the catch-up adjustment that reduces the prior year-end's *DAC* and by the fact that the $A\%$ factor increases. With $A\%$ higher, a larger portion of each future gain will be used for amortization. Therefore, the substitution of unfavorable actual lapse experience for the more favorable expected experience may give a somewhat illogical result. However, most of the current higher income will be repaid in future periods. In effect, the *FAS 97* methodology is allowing us to spread out the loss due to the higher withdrawal rate.

Calculations for the effects of other experience factors in later years can be performed in a manner similar to that given above.

Unfortunately, there is some crossover; that is, the interest variations in years 6 and later do affect mortality gains. This is due to the interaction of the account value and the net amount at risk. With the higher crediting interest rate, there is a lower net amount at risk than was assumed at the beginning of the year. This leads to a smaller gain due to mortality. The mortality and cost of insurance rates have not changed, but the net amount at risk has.

Actual GAAP Profits

Table H summarizes the actual GAAP profits reported by Tan and those calculated above. The product Tan has designed is very profitable. From my experience, annuity products have an $A\%$ in the range of 30 percent to 50 percent, and universal life products have an $A\%$ of 70 percent to 85 percent. A more realistic product would show more variation between the two sets of actual GAAP profits given in Table H.

TABLE H

COMPARISON OF GAAP PROFITS

Policy Year	Tan Paper	Table G	Difference
1	4.561	4.561	0.000
2	5.883	5.883	0.000
3	5.757	5.768	−0.010
4	6.714	6.372	0.343
5	2.749	2.900	−0.151
6	2.180	2.348	−0.168
7	2.121	2.261	−0.140
8	2.045	2.157	−0.112
9	1.942	2.027	−0.084
10	1.760	1.818	−0.058
11	2.688	2.680	0.008
12	2.604	2.583	0.021
13	2.473	2.440	0.033
14	2.353	2.307	0.046
15	2.249	2.189	0.060
16	2.037	1.965	0.072
17	2.001	1.915	0.087
18	1.956	1.855	0.102
19	1.896	1.780	0.116
20	1.825	1.696	0.129

Other Experience Variations

For illustration, consider three other scenarios in which actual experience is better than that assumed. Table I considers a favorable lapse variation in year 3, with a lapse rate of 5 percent instead of the expected 10 percent. This favorable variation leads to a reduction in GAAP profit because the surrender charges are lower than anticipated. This reduction, however, is tempered by the decrease in $A\%$ due to more anticipated future profits and the catch-up adjustment, which causes a write-up in the DAC. With more business in-force in succeeding years, profits in the later years are higher than originally expected. Essentially, the workings of *FAS 97* have spread out the favorable effect of the lower lapse rate.

TABLE I

SOURCE-OF-EARNINGS ANALYSIS WHEN ACTUAL WITHDRAWAL RATE (w) IS 5% (VERSUS 10% EXPECTED) IN YEAR THREE

Policy Year	Revised Expected Profit	Gain by Source					Actual GAAP Profit
		VGM	*VGW*	*VGE*	*VGI*	Total	
1.......	4.561	0.000	0.000	0.000	0.000	0.000	4.561
2.......	5.883	0.000	0.000	0.000	0.000	0.000	5.883
3.......	5.948	0.000	−0.726	0.000	0.000	−0.726	5.223
4.......	5.186	0.000	0.000	0.000	0.000	0.000	5.186
5.......	5.356	0.000	0.000	0.000	0.000	0.000	5.356
6.......	5.406	0.000	0.000	0.000	0.000	0.000	5.406
7.......	5.371	0.000	0.000	0.000	0.000	0.000	5.371
8.......	5.316	0.000	0.000	0.000	0.000	0.000	5.316
9.......	5.231	0.000	0.000	0.000	0.000	0.000	5.231
10.......	5.051	0.000	0.000	0.000	0.000	0.000	5.051
11.......	4.760	0.000	0.000	0.000	0.000	0.000	4.760
12.......	4.761	0.000	0.000	0.000	0.000	0.000	4.761
13.......	4.698	0.000	0.000	0.000	0.000	0.000	4.698
14.......	4.640	0.000	0.000	0.000	0.000	0.000	4.640
15.......	4.593	0.000	0.000	0.000	0.000	0.000	4.593
16.......	4.403	0.000	0.000	0.000	0.000	0.000	4.403
17.......	4.425	0.000	0.000	0.000	0.000	0.000	4.425
18.......	4.430	0.000	0.000	0.000	0.000	0.000	4.430
19.......	4.410	0.000	0.000	0.000	0.000	0.000	4.410
20.......	4.374	0.000	0.000	0.000	0.000	0.000	4.374

Table J shows the effect of lower-than-anticipated maintenance expenses in the fourth year. The immediate effect is higher earnings due to lower expenses and higher earned interest. In succeeding years, there is a small benefit due to the reduction in the percentage of each year's gross profits required to amortize *DAC*, even though those future-year gross profits do not change.

Finally, Table K shows a higher-than-anticipated interest spread in year 6. The higher-than-anticipated spread is due to a higher earned interest rate, while crediting rates remain the same. This change has an interesting effect on gain. First, there is an adverse effect on gain because interest income is assumed to be earned on the net GAAP reserve. With a higher earned rate, there is a reduction in net income because in the calculation of the gain, the earned rate multiplied by the *DAC* balance at the beginning of the year is a reduction in profit.

This reduction, however, is more than offset by the effect of the change in $A\%$, the catch-up adjustment, and the gain from interest. Again, the more favorable experience produces a lower $A\%$ factor for the future and slightly higher reported profits in all future years.

TABLE J

SOURCE-OF-EARNINGS ANALYSIS WHEN ACTUAL EXPENSE IS $1.50 (VERSUS $2.50 EXPECTED) IN YEAR FIVE

Policy Year	Revised Expected Profit	Gain by Source					Actual GAAP Profit
		VGM	*VGW*	*VGE*	*VGI*	Total	
1	4.561	0.000	0.000	0.000	0.000	0.000	4.561
2	5.883	0.000	0.000	0.000	0.000	0.000	5.883
3	5.892	0.000	0.000	0.000	0.000	0.000	5.892
4	4.893	0.000	0.000	0.000	0.000	0.000	4.893
5	5.091	0.000	0.000	0.613	0.061	0.674	5.765
6	5.108	0.000	0.000	0.000	0.000	0.000	5.108
7	5.075	0.000	0.000	0.000	0.000	0.000	5.075
8	5.024	0.000	0.000	0.000	0.000	0.000	5.024
9	4.943	0.000	0.000	0.000	0.000	0.000	4.943
10	4.773	0.000	0.000	0.000	0.000	0.000	4.773
11	4.498	0.000	0.000	0.000	0.000	0.000	4.498
12	4.499	0.000	0.000	0.000	0.000	0.000	4.499
13	4.439	0.000	0.000	0.000	0.000	0.000	4.439
14	4.384	0.000	0.000	0.000	0.000	0.000	4.384
15	4.340	0.000	0.000	0.000	0.000	0.000	4.340
16	4.161	0.000	0.000	0.000	0.000	0.000	4.161
17	4.182	0.000	0.000	0.000	0.000	0.000	4.182
18	4.187	0.000	0.000	0.000	0.000	0.000	4.187
19	4.168	0.000	0.000	0.000	0.000	0.000	4.168
20	4.134	0.000	0.000	0.000	0.000	0.000	4.134

TABLE K

SOURCE-OF-EARNINGS ANALYSIS WHEN ACTUAL EARNED RATE (i) IS 11% (VERSUS 10% EXPECTED) IN YEAR SIX

Policy Year	Revised Expected Profit	Gain by Source					Actual GAAP Profit
		VGM	*VGW*	*VGE*	*VGI*	Total	
1	4.561	0.000	0.000	0.000	0.000	0.000	4.561
2	5.883	0.000	0.000	0.000	0.000	0.000	5.883
3	5.892	0.000	0.000	0.000	0.000	0.000	5.892
4	4.893	0.000	0.000	0.000	0.000	0.000	4.893
5	5.054	0.000	0.000	0.000	0.000	0.000	5.054
6	5.077	0.000	0.000	0.000	0.408	0.408	5.485
7	5.072	0.000	0.000	0.000	0.000	0.000	5.072
8	5.021	0.000	0.000	0.000	0.000	0.000	5.021
9	4.940	0.000	0.000	0.000	0.000	0.000	4.940
10	4.770	0.000	0.000	0.000	0.000	0.000	4.770
11	4.495	0.000	0.000	0.000	0.000	0.000	4.495
12	4.496	0.000	0.000	0.000	0.000	0.000	4.496
13	4.437	0.000	0.000	0.000	0.000	0.000	4.437
14	4.382	0.000	0.000	0.000	0.000	0.000	4.382
15	4.338	0.000	0.000	0.000	0.000	0.000	4.338
16	4.159	0.000	0.000	0.000	0.000	0.000	4.159
17	4.180	0.000	0.000	0.000	0.000	0.000	4.180
18	4.184	0.000	0.000	0.000	0.000	0.000	4.184
19	4.166	0.000	0.000	0.000	0.000	0.000	4.166
20	4.132	0.000	0.000	0.000	0.000	0.000	4.132

Unlocking

Considering the example we have been working with and focusing on the interest margin, what is the effect of changing future assumptions (or unlocking) on the amount and incidence of reported profits? As Interpretation 4 states, unlocking does not include the substitution of actual experience for expected experience. Rather, unlocking is a revision of future expected assumptions independent of the substitution of actual experience for expected experience.

Of course, the actual experience itself may indicate that unlocking is necessary. Several successive years of interest margins less than GAAP assumptions may indicate that, due to a change in company philosophy or competitive pressures, the future interest margin assumptions will not be met and future assumptions should be changed to reflect this.

For the product we are considering, we unlock at the end of the eighth, twelfth, and sixteenth policy years. In each case, assume that the company has taken into account the trend in the interest margins, actual investment results, and competitive pressures. In three cases, the new assumptions increase the assumed credited rate from 8 percent to 9 percent and decrease the assumed earned rate from 10 percent to 9 percent. In a fourth case, the assumed credited rate is set at 8.5 percent and the assumed earned rate at 9.5 percent. Although it is unlikely that a company would continue to credit an interest rate to its universal life policy so that the interest margin is zero, this assumption is made for illustration.

Finally, one calculation assumes perfect foresight: the assumptions and actual experience are the same.

In reviewing the effects of unlocking, the time at which the change in future assumptions is made and the amount of change in those assumptions affect the incidence of profit. In the year in which the change is made, there is an immediate effect on the *DAC*. In the example, this will be a write-down in *DAC* due to a decrease in the assumed margin. An assumption of an increased margin would lead to a write-up of *DAC*.

In the years after the change in assumptions is made, the new assumptions will have an effect on the reported profits. In the example there is a write-down of *DAC* at the change in assumptions, and we can expect that future profits will be higher than if the unlocking had not occurred. If the change in assumptions causes a write-up in *DAC* in the year of change, we would expect lower future profits.

The reported profits resulting from unlocking the interest margin assumption at the end of the eighth, twelfth, and sixteenth policy years are shown in Table L. This table is in a format consistent with that of Table G. Column (1) is the same as that in Table G, while Columns (2) through (6) consider the various unlocking cases described above.

TABLE L

COMPARISON OF GAAP PROFITS UNDER VARIOUS UNLOCKING SCENARIOS

Policy Year	Actual GAAP Profits					
	(1)	(2)	(3)	(4)	(5)	(6)
		Unlock Interest Assumption at				
		Zero Margin			100 BP Margin	
	Base Run	End of 8	End of 12	End of 16	End of 12	Perfect Foresight
1.......	4.561	4.561	4.561	4.561	4.561	4.345
2.......	5.883	5.883	5.883	5.883	5.883	5.611
3.......	5.768	5.768	5.768	5.768	5.768	5.511
4.......	6.372	6.372	6.372	6.372	6.372	6.226
5.......	2.900	2.900	2.900	2.900	2.900	2.886
6.......	2.348	2.348	2.348	2.348	2.348	2.401
7.......	2.261	2.261	2.261	2.261	2.261	2.346
8.......	2.157	1.169	2.157	2.157	2.157	2.275
9.......	2.027	2.043	2.027	2.027	2.027	2.179
10.......	1.818	1.860	1.818	1.818	1.818	2.004
11.......	2.680	2.762	2.680	2.680	2.680	2.762
12.......	2.583	2.690	1.456	2.583	2.054	2.690
13.......	2.440	2.572	2.572	2.440	2.497	2.572
14.......	2.307	2.464	2.464	2.307	2.377	2.464
15.......	2.189	2.371	2.371	2.189	2.272	2.371
16.......	1.965	2.171	2.171	1.137	2.061	2.171
17.......	1.915	2.142	2.142	2.142	2.022	2.142
18.......	1.855	2.103	2.103	2.103	1.974	2.103
19.......	1.780	2.048	2.048	2.048	1.911	2.048
20.......	1.696	1.983	1.983	1.983	1.839	1.983
Catch-up Due to Unlocking						
		−0.988	−1.127	−0.828	−0.529	0.000
Total of GAAP Profits for Policy Years 1–20						
	57.502	58.470	58.084	57.705	57.782	59.089

The amount of the catch-up adjustment in the year of unlocking varies according to when the unlocking occurs. Unlocking at the end of the eighth year, Column (2), causes a catch-up adjustment (write-down of *DAC*) of \$0.988. Unlocking at the end of the twelfth, Column (3), and sixteenth, Column (4), years causes write-downs of \$1.127 and \$0.828, respectively.

After the unlocking has occurred, the profits will be the same on the three unlocking options. For example, the profits in years 13 through 20 in Column (3) are the same as the profits in years 13 through 20 in Column (2). This is because once the unlocking at the twelfth year has occurred in Column

(3), the *DAC* is brought up-to-date and is at the same level as it would have been had the unlocking occurred earlier. Likewise, the profits for years 17 through 20 are the same for Columns (4), (3), and (2).

The profits in each of Columns (2), (3), and (4) are greater than those in Column (1) for the years after the unlocking has occurred. For example, unlocking at the end of the eighth year causes a $\$-0.988$ variance in profit from Column (1) in the eighth year. This, however, is offset by higher profits in each of years 9 through 20. Column (6) of Table L shows the GAAP profits with the assumption of perfect foresight (that is, assumptions equal to actual experience from the date of issue).

Finally, for comparison, consider the situation in which the company unlocks at the end of the twelfth year, but assumes a reduction in the interest margin to 100 basis points, Column (5). The company assumes an earned rate of 9.5 percent and a credited rate of 8.5 percent.

As we might expect, Column (5) shows a write-down in *DAC* of roughly 50 percent of that experienced when the assumed interest margin was reduced to zero in unlocking at the end of the twelfth year, Column (3). The profits after the unlocking are higher than those shown in Column (1).

The results of the unlocking examples indicate that a company must use care in unlocking; the timing affects the amount of catch-up adjustment in the year of unlocking. If a company is able to unlock early in the product's life, the catch-up adjustment will be small. As the years pass by, there will be a point at which the catch-up will have a maximum value. Unlocking at the end of the product's life gives a lower catch-up (because there has been an effective catch-up adjustment on the *DAC* due to the substitution of actual experience for past experience in the earlier years).

SUMMARY

Variations from the expected profit level can be related to deviations in mortality, withdrawal, expense, and interest experience from those assumed. In addition, for each of these sources (mortality, withdrawal, expense, and interest), the variation in profit can be separated into a contribution from the effect of past experience, the effect of the $A\%$ factor used for amortization, the catch-up of prior amortization, and the portion of the deviation from assumed experience that has an immediate effect on the actual profit.

The time at which an unlocking is done and the degree of change in future assumptions have an effect on the level and incidence of actual GAAP profits. The example here indicates that unlocking should be done as soon as possible to avoid large catch-up adjustments.

REFERENCES

1. FINANCIAL ACCOUNTING STANDARDS BOARD. *Statement of Financial Accounting Standards No. 97.* Stamford, Conn.: December 1987.
2. TAN, J.H. "Source-of-Earnings Analysis under *FAS 97* Universal Life Accounting," *TSA* XLI (1989): 443–506.
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APPENDIX

POLICY VALUES AND ASSUMPTIONS

Symbols

q	=	Mortality rate
w	=	Withdrawal rate
m	=	Mortality charge rate
DB	=	Death benefit
AB	=	Account balance
CSV	=	Cash surrender value
MC	=	Mortality charge
FYC	=	Extra first-year expense charge, also called front-end fee
C	=	Nonextra first-year expense charge, including all administrative charges except front-end fee
P	=	Gross premium
FYE	=	Extra first-year expense
E	=	Nonextra first-year expense (administrative expense)
i	=	Earned interest rate
l	=	Survivorship function at time t, that is, units in-force at time t
l_t	=	$l_{t-1}(1 - q_t - w_t)$
r	=	Credited interest rate
$SC/AB\%$	=	Surrender charge as a percentage of account balance

Differences between Actual Experience and Best Estimate Assumptions:

Mortality:	Actual is 110% of best estimate in years 3 and 4
Withdrawal:	Actual is 15% in year 4
Expense:	E is \$5.00 in years 5 through 10
Interest:	$i = r = 9.0\%$ in years 6 through 10

TABLE A1

POLICY VALUES AND ASSUMPTIONS BASED ON BEST ESTIMATE (GAAP ASSUMPTIONS)

Policy Year	$FYC+C$	$FYE+E$	P	r	i	q	w	m	DB	MC	AB	$SC/AB\%$	CSV	$l(t)$
1	14.00	19.00	20.00	0.08	0.10	0.0009533	0.10	0.0050825	1,000	5.08	0.99	100.00%	0.00	0.899047
2	4.00	2.50	20.00	0.08	0.10	0.0013138	0.10	0.0052470	1,000	5.24	12.69	90.00	1.27	0.807961
3	4.00	2.50	20.00	0.08	0.10	0.0017038	0.10	0.0054060	1,000	5.34	25.22	80.00	5.04	0.725788
4	4.00	2.50	20.00	0.08	0.10	0.0020238	0.05	0.0055600	1,000	5.42	38.66	70.00	11.60	0.688030
5	4.00	2.50	20.00	0.08	0.10	0.0023441	0.05	0.0060800	1,000	5.84	52.72	60.00	21.09	0.652016
6	4.00	2.50	20.00	0.08	0.10	0.0027494	0.05	0.0066560	1,000	6.31	67.41	50.00	33.71	0.617622
7	4.00	2.50	20.00	0.08	0.10	0.0031915	0.05	0.0072880	1,000	6.80	82.75	40.00	49.65	0.584770
8	4.00	2.50	20.00	0.08	0.10	0.0035453	0.05	0.0079680	1,000	7.31	98.75	30.00	69.13	0.553458
9	4.00	2.50	20.00	0.08	0.10	0.0038401	0.05	0.0087140	1,000	7.85	115.45	20.00	92.36	0.523660
10	4.00	2.50	20.00	0.08	0.10	0.0042098	0.05	0.0095200	1,000	8.42	132.87	10.00	119.58	0.495272
11	4.00	2.50	20.00	0.08	0.10	0.0047339	0.05	0.0104000	1,000	9.02	151.04	0.00	151.04	0.468164
12	4.00	2.50	20.00	0.08	0.10	0.0053938	0.05	0.0113680	1,000	9.65	169.98	0.00	169.98	0.442231
13	4.00	2.50	20.00	0.08	0.10	0.0062972	0.05	0.0124320	1,000	10.32	189.72	0.00	189.72	0.417335
14	4.00	2.50	20.00	0.08	0.10	0.0072644	0.05	0.0136000	1,000	11.02	210.27	0.00	210.27	0.393436
15	4.00	2.50	20.00	0.08	0.10	0.0082652	0.05	0.0148720	1,000	11.74	231.69	0.00	231.69	0.370512
16	4.00	2.50	20.00	0.08	0.10	0.0099000	0.05	0.0162720	1,000	12.50	254.00	0.00	254.00	0.348319
17	4.00	2.50	20.00	0.08	0.10	0.0108060	0.05	0.0177920	1,000	13.27	277.27	0.00	277.27	0.327139
18	4.00	2.50	20.00	0.08	0.10	0.0118140	0.05	0.0194480	1,000	14.06	301.55	0.00	301.55	0.306917
19	4.00	2.50	20.00	0.08	0.10	0.0129780	0.05	0.0212560	1,000	14.85	326.92	0.00	326.92	0.287588
20	4.00	2.50	20.00	0.08	0.10	0.0142860	0.05	0.0232320	1,000	15.64	353.47	0.00	353.47	0.269100

TABLE A2

POLICY VALUES AND ASSUMPTIONS BASED ON ACTUAL EXPERIENCE

Policy Year	$FYC+C$	$FYE+E$	P	r	i	q	w	m	DB	MC	AB	$SC/AB\%$	CSV	$l(t)$
1	14.00	19.00	20.00	0.08	0.10	0.0009533	0.10	0.0050825	1,000	5.08	0.99	100.00%	0.00	0.899047
2	4.00	2.50	20.00	0.08	0.10	0.0013138	0.10	0.0052470	1,000	5.24	12.69	90.00	1.27	0.807961
3	4.00	2.50	20.00	0.08	0.10	0.0018742	0.10	0.0054060	1,000	5.34	25.22	80.00	5.04	0.725651
4	4.00	2.50	20.00	0.08	0.10	0.0022262	0.15	0.0055600	1,000	5.42	38.66	70.00	11.60	0.615188
5	4.00	5.00	20.00	0.08	0.10	0.0023441	0.05	0.0060800	1,000	5.84	52.72	60.00	21.09	0.582986
6	4.00	5.00	20.00	0.09	0.09	0.0027494	0.05	0.0066560	1,000	6.31	68.04	50.00	34.02	0.552234
7	4.00	5.00	20.00	0.09	0.09	0.0031915	0.05	0.0072880	1,000	6.79	84.20	40.00	50.52	0.522860
8	4.00	5.00	20.00	0.09	0.09	0.0035453	0.05	0.0079680	1,000	7.30	101.26	30.00	70.88	0.494863
9	4.00	5.00	20.00	0.09	0.09	0.0038401	0.05	0.0087140	1,000	7.83	119.28	20.00	95.42	0.468220
10	4.00	5.00	20.00	0.09	0.09	0.0042098	0.05	0.0095200	1,000	8.38	138.31	10.00	124.48	0.442838
11	4.00	2.50	20.00	0.09	0.09	0.0047339	0.05	0.0104000	1,000	8.96	158.43	0.00	158.43	0.418599
12	4.00	2.50	20.00	0.09	0.09	0.0053938	0.05	0.0113680	1,000	9.57	179.71	0.00	179.71	0.395411
13	4.00	2.50	20.00	0.09	0.09	0.0062972	0.05	0.0124320	1,000	10.20	202.20	0.00	202.20	0.373151
14	4.00	2.50	20.00	0.09	0.09	0.0072644	0.05	0.0136000	1,000	10.85	226.01	0.00	226.01	0.351783
15	4.00	2.50	20.00	0.09	0.09	0.0082652	0.05	0.0148720	1,000	11.51	251.25	0.00	251.25	0.331286
16	4.00	2.50	20.00	0.09	0.09	0.0099000	0.05	0.0162720	1,000	12.18	278.02	0.00	278.02	0.311442
17	4.00	2.50	20.00	0.09	0.09	0.0108060	0.05	0.0177920	1,000	12.85	306.48	0.00	306.48	0.292504
18	4.00	2.50	20.00	0.09	0.09	0.0118140	0.05	0.0194480	1,000	13.49	336.80	0.00	336.80	0.274424
19	4.00	2.50	20.00	0.09	0.09	0.0129780	0.05	0.0212560	1,000	14.10	369.19	0.00	369.19	0.257141
20	4.00	2.50	20.00	0.09	0.09	0.0142860	0.05	0.0232320	1,000	14.65	403.88	0.00	403.88	0.240610

DISCUSSION OF PRECEDING PAPER

JOSEPH H. TAN:

I thank Mr. Eckman for extending the source-of-earnings analysis procedure introduced in my paper "Source of Earnings Analysis under *FAS 97* Universal Life Accounting" (*TSA* XLI (1989): 443–506) and for providing valuable insights regarding the profit impact of the timing of unlocking.

Revised Expected Profit

Mr. Eckman observed that in Table 9 of my paper:

- Variation in the gain from mortality is present in the fifth year even though the cost of insurance and the mortality rate experienced in that year are exactly equal to expected.
- Negative variations for withdrawal and interest are present in the fifth year despite the fact that those rates are also equal to expected.

These observations are similar to James Feldman's in his discussion of my paper. Mr. Feldman wrote, "In Table 5 of Mr. Tan's paper, there are negative variances in each margin in year 5 and later due to the excess withdrawals in year 4." In the same discussion, Mr. Feldman then suggests an alternative source-of-earnings analysis formula that is somewhat similar to Mr. Eckman's procedure. In this regard, I am restating my response to Mr. Feldman's discussion here.

My apology to Mr. Eckman, Mr. Feldman, and others who have been misled by the examples (as in Table 5 and Table 9) of my paper. As indicated by the footnotes in Tables 3–10 of my paper, the values shown were based on the original *DAC* schedule throughout, so the reader could follow the calculation and understand the application of my suggested procedure more easily.

I believe the phenomenon Mr. Feldman and Mr. Eckman observed seldom occurs in practice. This is due to the "unlocking" provision of *FAS 97*, which requires that estimated gross profits (and hence expected GAAP profit) be adjusted regularly as warranted by experience or other evidence. In Table 5 of my paper, for example, with the actual withdrawal rate being 15 percent as opposed to 5 percent in year 4, the estimated gross profits and expected GAAP profit will be revised at the end of year 4. The resulting revised estimated gross profits are shown on Table 12 of my paper. When such a revision is implemented, the resulting source-of-earnings analysis will be as shown in Table 5A. Note that the revised source-of-earnings analysis has

TABLE 5A

SOURCE OF EARNINGS ANALYSIS WHEN THE REVISED AMORTIZATION SCHEDULE OF TABLE 12 (WITH 0.15 WITHDRAWAL RATE IN YEAR 4) IS USED FOR YEARS 5 TO 20

Policy Year	Mortality Charge (MC)	Surrender Charge	Admin. Charge (C)	Earned Interest	Death Ben. Less AB Rel.	Admin. Expense (E)	First-Year Expense (FYE)	Credited Interest	Deferable Expense	Amort. of Def. Exp.	Amort. of Unamort. FY Charge	GAAP Profit (Pf)	Expected GAAP Profit: (1−A%) EGP	Expected GAAP Profit: −(i−r)* DAC	Expected GAAP Profit: Total	Variations in EGP Due to: Mort.	Variations in EGP Due to: With.	Variations in EGP Due to: Expense	Variations in EGP Due to: Interest	Variation Due to i on DAC	Total Actual Profit
1	5.08	0.10	4.00	−0.50	0.95	2.50	16.50	0.07	16.00	(0.25)	(0.16)	4.561	4.681	−0.120	4.561	0.000	0.000	0.000	0.000	0.000	4.561
2	4.71	1.03	3.60	1.07	1.17	2.25	0.00	0.85	0.00	(0.71)	(0.44)	5.883	6.001	−0.118	5.883	0.000	0.000	0.000	0.000	0.000	5.883
3	4.31	1.63	3.23	1.88	1.34	2.02	0.00	1.51	0.00	(0.76)	(0.48)	5.892	6.004	−0.113	5.892	0.000	0.000	0.000	0.000	0.000	5.892
4	3.93	2.95	2.90	2.57	1.41	1.81	0.00	2.08	0.00	(0.50)	(0.31)	6.857**	5.000	−0.107	4.893	0.000	1.964	0.000	0.000	0.000	6.857**
5	3.60	0.97	2.46	2.98	1.37	1.54	0.00	2.40	0.00	(0.55)	(0.34)	4.493	4.589	−0.096	4.493	0.000	0.000	0.000	0.000	0.000	4.493
6	3.68	0.98	2.33	3.63	1.50	1.46	0.00	2.91	0.00	(0.61)	(0.38)	4.535	4.627	−0.092	4.535	0.000	0.000	0.000	0.000	0.000	4.535
7	3.75	0.91	2.21	4.25	1.62	1.38	0.00	3.39	0.00	(0.64)	(0.40)	4.506	4.594	−0.088	4.506	0.000	0.000	0.000	0.000	0.000	4.506
8	3.82	0.77	2.09	4.83	1.67	1.31	0.00	3.83	0.00	(0.68)	(0.42)	4.461	4.544	−0.083	4.461	0.000	0.000	0.000	0.000	0.000	4.461
9	3.89	0.57	1.98	5.37	1.68	1.24	0.00	4.23	0.00	(0.70)	(0.44)	4.388	4.466	−0.078	4.388	0.000	0.000	0.000	0.000	0.000	4.388
10	3.94	0.31	1.87	5.87	1.71	1.17	0.00	4.61	0.00	(0.71)	(0.44)	4.238	4.311	−0.073	4.238	0.000	0.000	0.000	0.000	0.000	4.238
11	4.00	0.00	1.77	6.33	1.78	1.11	0.00	4.96	0.00	(0.68)	(0.42)	3.994	4.062	−0.067	3.994	0.000	0.000	0.000	0.000	0.000	3.994
12	4.04	0.00	1.68	6.75	1.87	1.05	0.00	5.27	0.00	(0.73)	(0.46)	3.996	4.058	−0.062	3.996	0.000	0.000	0.000	0.000	0.000	3.996
13	4.08	0.00	1.58	7.13	2.02	0.99	0.00	5.56	0.00	(0.77)	(0.48)	3.943	3.999	−0.057	3.943	0.000	0.000	0.000	0.000	0.000	3.943
14	4.11	0.00	1.49	7.48	2.14	0.93	0.00	5.81	0.00	(0.81)	(0.51)	3.894	3.945	−0.051	3.894	0.000	0.000	0.000	0.000	0.000	3.894
15	4.13	0.00	1.41	7.79	2.23	0.88	0.00	6.04	0.00	(0.86)	(0.54)	3.856	3.900	−0.045	3.856	0.000	0.000	0.000	0.000	0.000	3.856
16	4.14	0.00	1.33	8.07	2.45	0.83	0.00	6.24	0.00	(0.87)	(0.55)	3.697	3.735	−0.038	3.697	0.000	0.000	0.000	0.000	0.000	3.697
17	4.14	0.00	1.25	8.30	2.43	0.78	0.00	6.40	0.00	(0.95)	(0.59)	3.715	3.747	−0.032	3.715	0.000	0.000	0.000	0.000	0.000	3.715
18	4.11	0.00	1.17	8.50	2.41	0.73	0.00	6.54	0.00	(1.02)	(0.64)	3.720	3.745	−0.025	3.720	0.000	0.000	0.000	0.000	0.000	3.720
19	4.08	0.00	1.10	8.67	2.40	0.69	0.00	6.65	0.00	(1.10)	(0.69)	3.704	3.721	−0.017	3.704	0.000	0.000	0.000	0.000	0.000	3.704
20	4.02	0.00	1.03	8.82	2.38	0.64	0.00	6.74	0.00	(1.17)	(0.73)	3.674	3.683	−0.009	3.674	0.000	0.000	0.000	0.000	0.000	3.674

**Excludes the profit impact due to the change in amortization schedule, amounting to $0.35

zero variations in EGP (estimated gross profits) for years 5 and later. This is because the only deviation from the original expected assumption is in the year 4 withdrawal rate.

A similar situation would occur for Table 9 of my paper, which reflects differences between actual experience and best estimate assumptions similar to those listed in the Appendix of Mr. Eckman's paper. However, in this case, since deviation occurs every year (from year 3 onward), the estimated gross profits and hence amortization schedules would be revised at the end of each year, resulting in a sequence of amortization schedules and revised expected profits. Proceeding in this manner, variation in the *EGP* arising from a certain experience factor will be zero whenever actual experience equals the revised expected assumption. For instance, the variations for withdrawal and interest in the fifth year will be zero, because the actual withdrawal and interest rates are equal to the revised expected rates at the beginning of the fifth year.

To summarize, the source-of-earnings analysis procedure I recommended in my paper is as follows:

1. Starting with the latest revised estimated gross profits existing at the end of last year, a latest revised expected profit for the current year is determined.
2. At the end of the current year, a source-of-earnings analysis will be performed using the procedure illustrated in my paper. This analysis will show that the difference between the latest revised expected profit existing at the beginning of the current year and the actual profit reported at the end of the current year is due to:
   - Variation due to gain from mortality
   - Variation due to gain from withdrawal
   - Variation due to gain from expense
   - Variation due to gain from interest, and
   - Variation due to interest earnings on *DAC* existing at the beginning of the year.

If the current-year actual experience turns out to be equal to the revised expected assumption at the beginning of the year, then the variation will be zero. To the extent that the amortization schedule is again revised at the end of the current year, an additional item, variation due to revised *DAC* amortization, would also result.

3. Steps 1 and 2 are repeated for the following year.

Source-of-Earnings Analysis

Source-of-earnings analysis is a tool to help management understand the causes of profit deviations and the various contributions to profit. Various source-of-earnings analysis procedures can be designed. The key is how useful the suggested procedure is to management.

My suggested source-of-earnings analysis procedure starts with a revised expected profit as of the beginning of the year. This revised expected profit could represent the "planned" or "projected" profit that management expects for the coming year if the revised expected assumptions at the beginning of the year are realized. The source-of-earnings analysis procedure measures and explains the difference between the revised expected profit and the actual profit once the year has transpired.

In contrast, the source-of-earnings analysis procedure suggested by Mr. Eckman appears to ignore the revised expected profit existing at the beginning of the year. Mr. Eckman's procedure measures and explains the difference between actual profit and the "revised expected profit" as defined by Mr. Eckman. (We differentiate Eckman's defined "revised expected profit" by enclosing it with quotation marks.) Note that Eckman's "revised expected profit" can only be computed at the end of the current year because it entails retroactively adjusting the expected profit existing at the beginning of the year based on the current year's actual experience. The adjustments can be seen in the following formulas:

(a) The use of $A\%^C$ and G_t^A in the change in profit due to change in $A\%$ item.
(b) The use of DAC_{t-1}^c in the catch-up adjustment item.

Management might have difficulty with Mr. Eckman's source-of-earnings analysis procedure because it does not answer the following question:

> "Given the profit anticipated in the company's financial plan or the profit projected at the beginning of the year, why is the actual profit reported at the end of the year higher (or lower)?"

Other Observations

I disagree with Mr. Eckman's Interpretation 4, which states that unlocking does not include the substitution (truing-up) of actual experience for expected experience. My reason is that paragraph 25 of *FAS 97* (which defines unlocking) is the only paragraph of *FAS 97* I can find that requires truing-up of actual experience. Nevertheless, whether unlocking includes truing-up or not is an academic question, because everyone agrees that *FAS 97* requires truing-up actual experience.

In Table H, Mr. Eckman shows the differences between the actual profits as shown in Table 9 of my paper and Table G of his paper. I suspect that the reason for the differences is that Table 9 of my paper does not reflect the revision of the estimated gross profits and amortization schedule to include actual experience to date. As stated above, my reason for not doing so is for easier understanding of the concepts introduced in my paper. If my suspicion is correct, then the actual profits derived by Mr. Eckman would be more appropriate.

In Table G, Mr. Eckman claims that actual profit is equal to the sum of Eckman's "revised expected profit," *VGM, VGW, VGE* and *VGI*. What about the variation due to interest earnings on *DAC*? As stated in my paper, this variation exists because:

- Invested assets are assumed equal to the net GAAP reserve (that is, account balance less *DAC*).
- Deviation between actual versus expected earning rates can occur.

Does the procedure presented assume this variation is zero or include it in the revised expected profit?

(AUTHOR'S REVIEW OF DISCUSSION)

MICHAEL V. ECKMAN:

I thank Mr. Tan for taking the time to comment on my paper. Of course, I am also indebted to him for writing his original paper on the subject, which prompted my work.

As Mr. Tan points out, my Tables F and G, in which I show the gain by source for the difference between actual profit and revised expected profit, would not be sufficient to answer all of management's questions. The information in my paper, however, allows construction of new summaries that provide management with the information it desires. As Mr. Tan wrote, management might ask, "Given the profit anticipated in the company's financial plan or the profit projected at the beginning of the year, why is the actual profit reported at the end of the year higher (or lower)?"

Table F1 (a revised version of the paper's Table F) shows the development of a projected profit figure. This is the original expected GAAP profit adjusted only for the past experience. Included in this past experience is any

TABLE F1

CALCULATION OF PROJECTED AND REVISED EXPECTED PROFITS

Policy Year	Expected GAAP Profit	Past Experience	Projected Profit	Current Year Effects: Interest on BOYDAC	Change in *A*%	Catch-up	Interest on Catch-up	Revised Expected Profit
1	4.561	0.000	4.561	0.000	0.000	0.000	0.000	4.561
2	5.883	0.000	5.883	0.000	0.000	0.000	0.000	5.883
3	5.892	0.000	5.892	0.000	−0.002	−0.003	0.000	5.887
4	4.893	−0.002	4.890	0.000	−0.036	−0.098	−0.008	4.749
5	5.054	−0.566	4.488	0.000	−0.009	−0.075	−0.006	4.398
6	5.101	−0.586	4.515	0.047	−0.010	−0.118	−0.009	4.424
7	5.069	−0.591	4.477	0.046	−0.009	−0.137	−0.011	4.366
8	5.017	−0.595	4.422	0.045	−0.009	−0.157	−0.013	4.288
9	4.936	−0.597	4.339	0.044	−0.009	−0.177	−0.014	4.183
10	4.766	−0.591	4.176	0.042	−0.008	−0.198	−0.016	3.996
11	4.492	−0.574	3.918	0.040	−0.005	−0.111	−0.009	3.833
12	4.493	−0.574	3.919	0.037	−0.005	−0.128	−0.010	3.813
13	4.433	−0.565	3.868	0.034	−0.005	−0.145	−0.012	3.741
14	4.379	−0.556	3.823	0.031	−0.005	−0.162	−0.013	3.674
15	4.335	−0.548	3.787	0.028	−0.005	−0.180	−0.014	3.616
16	4.156	−0.517	3.639	0.024	−0.004	−0.197	−0.016	3.446
17	4.177	−0.518	3.659	0.021	−0.004	−0.214	−0.017	3.444
18	4.182	−0.517	3.664	0.016	−0.004	−0.231	−0.018	3.427
19	4.164	−0.513	3.651	0.011	−0.004	−0.247	−0.020	3.391
20	4.129	−0.506	3.623	0.006	−0.004	−0.263	−0.021	3.341

effect of the *DAC* interest element due to the restatement of the beginning-of-the-year *DAC*.

In creating Table F1, I have taken the effect of the interest on the beginning of year *DAC* from Table B and split it into two parts. One part is included with past experience because it is dependent upon the prior year's *DAC* being different from the original. The second part is included with the current year's effects because it is a function of the variance of the current year's earned interest rate from that assumed in the most recent projection. In answer to Mr. Tan's question, I included the variation due to interest earnings on the *DAC* in the revised expected profit figure in my original work.

The emphasis in Table F1 is on the Projected Profit column; the Revised Expected Profit figures are shown for information only.

The remaining elements in Tables F and F1 are all due to events in the current year and are shown separately. The interest on beginning-of-year *DAC* column shows the effect of variances of the actual earned interest rate from that assumed to be in effect at the beginning of the year when the projected profits were calculated.

Table G1 shows the source of the differences between the projected profit and the actual GAAP profit. The actual GAAP profit is the same as reported in the paper's Table G. Projected profit is taken from Table F1.

TABLE G1

SOURCE-OF-EARNINGS ANALYSIS REFLECTING ALL VARIANCES FROM PROJECTED

Policy Year	Projected Profit	Gain by Source					Actual GAAP Profit
		VGM	*VGW*	*VGE*	*VGI**	Total	
1........	4.561	0.000	0.000	0.000	0.000	0.000	4.561
2........	5.883	0.000	0.000	0.000	0.000	0.000	5.883
3........	5.892	−0.124	0.000	0.000	0.000	−0.124	5.768
4........	4.890	−0.132	1.613	0.000	0.000	1.481	6.372
5........	4.488	0.000	0.000	−1.452	−0.136	−1.588	2.900
6........	4.515	0.001	0.008	−1.382	−0.793	−2.167	2.348
7........	4.477	0.001	0.008	−1.316	−0.909	−2.217	2.261
8........	4.422	0.002	0.006	−1.252	−1.021	−2.265	2.157
9........	4.339	0.002	0.005	−1.191	−1.128	−2.312	2.027
10........	4.176	0.002	0.003	−1.133	−1.230	−2.358	1.818
11........	3.918	0.003	0.000	0.000	−1.241	−1.238	2.680
12........	3.919	0.003	0.000	0.000	−1.339	−1.336	2.583
13........	3.868	0.004	0.000	0.000	−1.433	−1.429	2.440
14........	3.823	0.005	0.000	0.000	−1.521	−1.516	2.307
15........	3.787	0.006	0.000	0.000	−1.604	−1.598	2.189
16........	3.639	0.007	0.000	0.000	−1.681	−1.674	1.965
17........	3.659	0.008	0.000	0.000	−1.752	−1.744	1.915
18........	3.664	0.009	0.000	0.000	−1.819	−1.810	1.855
19........	3.651	0.010	0.000	0.000	−1.881	−1.871	1.780
20........	3.623	0.012	0.000	0.000	−1.939	−1.928	1.696

*VGI includes effect of change in earned interest rate on *BOYDAC*.

For each of the variations due to mortality, withdrawal, and expense, the gains by source are the sum of the gains due to the change in $A\%$, the catch-up adjustment, the interest on the catch-up adjustment, and the gains by source shown in the paper's Table G. Thus, the figures shown in G1 for each of the gains can be calculated by summing the information from Tables D, E, and G of the paper.

For the variation due to interest, Tables D, E, and G of the paper are combined with the interest on the beginning-of-the-year DAC from Table F1. I find it easier to talk to management about the gain by source in the four categories of mortality, withdrawal, expense, and interest without introducing the concept of interest on the beginning-of-the-year *DAC*.

The information in Tables F1 and G1 provides the answer to management's question concerning the variation of actual GAAP profits from the most recent projection. Tables F1 and G1 also give a source-of-earnings analysis consistent with Mr. Tan's suggestions.

Mr. Tan disagrees with my Interpretation 4, which states that unlocking does not include the substitution (truing-up) of actual experience for expected experience. Mr. Tan does state that everyone would agree that *FAS 97* requires truing-up actual experience.

I included Interpretation 4 in my paper because I had talked to others who were implementing *FAS 97* and who were not planning on truing-up because they did not have the systems capability to do it or they planned to wait until the accumulated effect of several years of actual experience varying from expected experience would force them to both true-up past experience and unlock future assumptions.

In this sense I can agree with Mr. Tan that others do see *FAS 97* as requiring truing-up. The only disagreement is whether it is done on a regular basis or only when absolutely necessary. I believe in doing it on a regular basis so that the amortization schedule does not get far out of line, requiring large catch-up adjustments.

Again, I thank Mr. Tan for his original paper and his discussion. Also, as time goes by and we gain more experience with *FAS 97*, I hope that there will be more research on the workings of *FAS 97* and, in particular, on unlocking.