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ADJUSTED BENEFIT RESERVES FOR INDIVIDUAL HOSPITAL AND INDIVIDUAL MAJOR MEDICAL

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ABSTRACT

The purpose of this paper is to demonstrate a simplified method of calculating adjusted benefit reserves for any line of life or health insurance. The simplification consists of lumping together all ages, plans, and riders for a particular issue year and observing the persistency and cash claims experience of each such block. While the method is quite general, it is illustrated with examples of individual hospital and individual major medical insurance.

INTRODUCTION

THE adjusted earnings accounting format requires, among other things, that a life insurance company (1) estimate, with respect to any particular block of issued business, the total cash claims expected to be disbursed in each future accounting year and then (2) substitute for this series of expected cash claims a series of expected incurred claims. The expected incurred claims are defined as a constant percentage of gross premiums expected to be collected in each future accounting year. The substitution of incurred for cash claims is made by establishing an adjusted benefit "reserve." The constant percentage is calculated so that the total incurred claims plus interest credited to the reserve will equal total cash claims over the lifetime of the block. In making up the GAAP statement of adjusted earnings at the end of each accounting year, the claim charge against premium income is equal to incurred claims plus actual cash claims minus tabular claims.

DEFINITIONS

If we let

I = Accounting year of issue,
O = Accounting year of observation,
t = Duration = $O - I$,
i = Interest rate and $v = 1/(1+i)$,
d_t = Cash claims expected to be paid in accounting year t,
l_t = Gross premium expected to be collected in accounting year t,
ω = Longest duration for this particular issue block,

then the constant percentage referred to above is equal to

$$k_0 = \frac{\sum_0^{\omega} v^t d_t}{\sum_0^{\omega} v^t l_t}.$$

The "adjusted benefit" reserve at the end of accounting year of observation O is V_t for business issued in accounting year of issue I; this reserve can then be related to the premiums arising from accounting year of issue I and collected in accounting year of observation O as follows:

$$\frac{V_t}{l_t} = \frac{(1+i)^{1/2}}{v^t l_t} \sum_{t+1}^{\omega} v^t (d_t - k_0 l_t).$$

SUBDIVISIONS

These mathematical relationships are, of course, the same as those used for statutory accounting. However, in statutory accounting it has become customary to approach the reserve calculation by first making a sort of claims and premiums by age and plan. For complex policies with several riders, the statutory reserve process usually involves further breakouts for each element of coverage. Statutory reserves are often divided into active and disabled life portions. The actuary has statutory contingency tables and, in some cases, intercompany data to enable him to make the reserve calculations.

For a company which goes to adjusted accounting, all the expense of making statutory reserve calculations continues. In addition, a second set of calculations, the "adjusted benefit" set, is required. This second set also brings in the persistency contingency, which is not a consideration in statutory reserves. Further, adjusted benefit reserves must be based on the company's own interest, claim, and persistency experience, not on intercompany or statutory tables, and usually the company's own experience is not available in all the detail by age, plan, rider, and so on, used in statutory calculations. Consequently, it is helpful, particularly for lines of insurance which are relatively small and so cannot bear a great deal of extra expense, or which are complicated by a multiplicity of riders, to simplify the adjusted benefit reserve process. The simplification consists of taking a line of policies for a particular issue year; lumping together all ages, all plans, and all riders; and following the aggregate premiums and aggregate claims over the lifetime of the block. All that is required to make such a simplified calculation is a record by accounting year of issue and by accounting year of observation of total gross premiums and total cash claims. If premium waiver is a feature, then waived premiums must be either included in both premiums and claims or excluded from both premiums and claims.

EXAMPLES

In the case of the Paul Revere Life Insurance Company, two lines of insurance, individual hospital and individual major medical, met the criteria of being relatively small and of being complicated by riders. Statistics showing the history of gross premiums and cash claims by calendar year of issue for each observation year from 1967 on were available. No attempt was made to subdivide these cells by age, plan, or coverage element. From these data, historical averages of premium persistency and cash claim rates were calculated (Table 1).

At first blush, it would appear impossible for the premium persistency factor to exceed 1.000, which it does at duration 0. However, it must be

TABLE 1

HISTORICAL AVERAGES

Duration	Premium Persistency, $p_t = l_{t+1}/l_t$		Claim Rate, $r_t = d_t/l_t$							
			Hospital—Year of Issue:				Major Medical—Year of Issue:			
	Hospital	Major Medical	1949–57	1958–65	1966–69	1970–71	1955–62	1963–65	1966–70	1971
0	1.318	1.432	.....	.....	.....	.....	.....	.....	.....	.....
1	0.738	0.851	.....	.....	0.43	0.43	.....	.....	0.09	0.06
2	0.795	0.887	.....	0.46	0.47	.....	.....	0.47	0.25	.....
3	0.815	0.909	.....	0.45	0.48	.....	.....	0.36	0.38	.....
4	0.833	0.920	.....	0.50	0.49	.....	.....	0.60	0.49	.....
5	0.846	0.925	.....	0.51	0.51	.....	0.49	0.61	0.51	.....
6	0.854	0.935	.....	0.56	.....	.....	0.59	0.64	0.67	.....
7	0.867	0.943	.....	0.61	.....	.....	0.69	0.87	.....	.....
8	0.879	0.937	.....	0.61	.....	.....	1.39	0.83	.....	.....
9	0.882	0.909	.....	0.63	.....	.....	0.72	.....	.....	.....
10	0.879	0.921	0.61	0.61	.....	.....	0.82	.....	.....	.....
11	0.888	0.912	0.70	0.69	.....	.....	0.99	.....	.....	.....
12	0.890	0.848	0.81	0.75	.....	.....	1.48	.....	.....	.....
13	0.890	0.939	0.79	0.76	.....	.....	1.45	.....	.....	.....
14	0.887	1.000	0.83	.....	.....	.....	1.53	.....	.....	.....
15	0.889	1.000	0.85	.....	.....	.....	2.50	.....	.....	.....
16	0.886	.....	0.82	.....	.....	.....	1.50	.....	.....	.....
17	0.888	.....	0.91	.....	.....	.....	.....	.....	.....	.....
18	0.889	.....	0.74	.....	.....	.....	.....	.....	.....	.....
19	0.883	.....	0.90	.....	.....	.....	.....	.....	.....	.....
20	0.877	.....	0.77	.....	.....	.....	.....	.....	.....	.....
21	0.857	.....	1.06	.....	.....	.....	.....	.....	.....	.....
22	.....	.....	1.12	.....	.....	.....	.....	.....	.....	.....

remembered that the first accounting year of observation has premiums arising only from duration 0, while each succeeding accounting year of observation has premiums arising from two durations.

In Table 1 the claim rates are subdivided into year-of-issue blocks. The reason for doing this is that major changes in the gross premium structure for new issues were made from time to time; each such change generated a new set of relationships between claims and premiums, and the averaging of all blocks together would have been misleading. It was not found necessary in our own case to make a similar subdivision of the premium persistency rates into year-of-issue blocks.

These historical averages should next be adjusted to reflect the way in which the future must be anticipated to differ from the past. In addition, margins for reasonable conservatism should be introduced. It is in this area that the actuary must exercise his judgment by interpreting trends and by bringing to bear any noncompany experience such as intercompany data in order to fill in the voids of his own company's past experience. Also, this need to change the historical average into a projection of the future limits the extent to which it is practical to lump different ages, plans, riders, and issue years together, since such lumping can mask important trends. Nevertheless, this simplified aggregate approach does have its place for a company faced with a brand new set of additional reserve calculations.

It is quite unlikely that the historical data will include any issue years which have seen the last survivor terminate. It is necessary, therefore, to project the premiums and claims, or, more precisely, the persistency rates and claim rates, to the longer durations. Here again, the actuary must use a great deal of judgment: a mere extrapolation of past trends is not enough, since important changes such as an increasing average age or inflation can be affecting any closed issue block. Again, where the line is a relatively new one for the company, heavy reliance will have to be placed on intercompany experience. The reserve level will be extremely sensitive to these persistency and claim rate projections. Of course, if too much conservatism is used, earnings will be unnecessarily deferred, and if not enough conservatism is used, the reserves will eventually have to be strengthened. We made the projections shown in Table 2. With claim rates and persistency established, it is possible to carry out the adjusted benefit reserve calculation (Table 3). These reserves are the sum of active life and claim reserves. To the extent that the underlying statistics include rider claims, the reserves are equally inclusive.

By applying the reserve factors to the distribution by year of issue of

TABLE 2

PROJECTIONS

DURATION	PREMIUM PERSISTENCY		CLAIM RATE							
			Hospital—Year of Issue:				Major Medical—Year of Issue:			
	Hospital	Major Medical	1949–57	1958–65	1966–69	1970–71	1955–62	1963–65	1966–69	1971
1										
2						0.30				0.24
3						0.35				0.30
4						0.38				0.35
5						0.41				0.40
6					0.53	0.43				0.46
7					0.56	0.46			0.66	0.51
8					0.58	0.48			0.73	0.56
9					0.60	0.49		0.81	0.80	0.62
10					0.62	0.51		0.90	0.89	0.69
11					0.64	0.52		0.99	0.98	0.76
12					0.66	0.54		1.09	1.08	0.83
13					0.68	0.55		1.19	1.17	0.91
14				0.75	0.70	0.57		1.29	1.27	0.98
15				0.77	0.71	0.58		1.39	1.37	1.06
16		0.945		0.78	0.72	0.59		1.49	1.47	1.14
17		0.945		0.80	0.74	0.61	1.92	1.59	1.57	1.21
18		0.945		0.81	0.75	0.61	2.05	1.69	1.67	1.29
19		0.945		0.83	0.77	0.63	2.17	1.79	1.77	1.37
20		0.942		0.84	0.78	0.64	2.30	1.90	1.88	1.45
21		0.940		0.85	0.79	0.65	2.42	2.00	1.97	1.53
22	0.825	0.935		0.86	0.80	0.65	2.54	2.10	2.07	1.60
23	0.820	0.930	0.93	0.88	0.82	0.67	2.66	2.20	2.17	1.68
24	0.810	0.925	0.95	0.89	0.82	0.68	2.78	2.30	2.20	1.76
25	0.800	0.915	0.96	0.90	0.83	0.68	2.91	2.40	2.37	1.83
26	0.793	0.910	0.97	0.91	0.84	0.69	3.03	2.50	2.47	1.91
27	0.782	0.900	0.98	0.92	0.85	0.70	3.15	2.60	2.57	1.98
28	0.770	0.892	0.99	0.93	0.86	0.71	3.28	2.71	2.67	2.07
29	0.760	0.880	1.00	0.94	0.87	0.71	3.41	2.82	2.78	2.15
30	0.745	0.870	1.01	0.95	0.88	0.72	3.55	2.93	2.89	2.24
31	0.735	0.855	1.02	0.96	0.89	0.73	3.68	3.04	3.00	2.32
32	0.720	0.835	1.03	0.97	0.90	0.74	3.83	3.16	3.12	2.41
33	0.700	0.820	1.04	0.98	0.91	0.74	3.97	3.28	3.24	2.50
34	0.685	0.800	1.04	0.98	0.91	0.74	4.13	3.41	3.37	2.60
35	0.670	0.775	1.05	0.99	0.92	0.75	4.30	3.55	3.50	2.71
36	0.650	0.750	1.06	1.00	0.93	0.76	4.48	3.70	3.65	2.82
37	0.635	0.725	1.06	1.00	0.93	0.76	4.66	3.85	3.80	2.94
38	0.620	0.700	1.06	1.00	0.93	0.76	4.84	4.00	3.95	3.05
39	0.600	0.660	1.07	1.01	0.94	0.77	5.02	4.15	4.10	3.17
40			1.08	1.02	0.95	0.77	5.14	4.25	4.19	3.24

actual premiums collected in a particular observation year, the total adjusted reserve emerges. As a practical matter, the current year's distribution of premiums by year of issue may not be available in time for the statement deadline. If this is so, a close estimate can be calculated by projecting the premium distribution of the previous observation year using the persistency factors, adding an estimate of the current issues, ratioing up to reflect total actual premiums, and applying the reserve factors to this assumed distribution.

TABLE 3

ILLUSTRATIVE EXAMPLE OF ADJUSTED BENEFIT RESERVE PER DOLLAR OF PERSISTING PREMIUM

(4 Per Cent Interest)

Duration	Premium Persistency	Cash Claim Rates	Reserve at End	Duration	Premium Persistency	Cash Claim Rates	Reserve at End
0	1.318	0.27	0.24	21	0.857	0.90	1.61
1	0.738	0.36	0.34	22	0.825	0.91	1.55
2	0.795	0.42	0.57	23	0.820	0.93	1.52
3	0.815	0.49	0.76	24	0.810	0.95	1.48
4	0.833	0.53	0.95	25	0.800	0.96	1.43
5	0.846	0.57	1.12	26	0.793	0.97	1.39
6	0.854	0.61	1.27	27	0.782	0.98	1.34
7	0.867	0.64	1.41	28	0.770	0.99	1.29
8	0.879	0.67	1.53	29	0.760	1.00	1.24
9	0.882	0.69	1.62	30	0.745	1.01	1.18
10	0.879	0.71	1.70	31	0.735	1.02	1.13
11	0.888	0.73	1.79	32	0.720	1.03	1.06
12	0.890	0.75	1.85	33	0.700	1.04	0.99
13	0.890	0.78	1.88	34	0.685	1.04	0.93
14	0.887	0.80	1.90	35	0.670	1.05	0.86
15	0.889	0.82	1.91	36	0.650	1.06	0.77
16	0.886	0.83	1.90	37	0.635	1.06	0.67
17	0.888	0.85	1.88	38	0.620	1.06	0.55
18	0.889	0.86	1.84	39	0.600	1.07	0.34
19	0.883	0.88	1.77	40	....	1.08	0.00
20	0.877	0.89	1.70				

GROSS PREMIUM INADEQUACY

By setting d_t equal to capitalizable first-year and renewal expenses rather than cash claims, and by setting ω equal to the duration at which initial capitalized expenses are to be fully amortized, a new type of k called C_0 can be calculated:

$$C_0 = \frac{\sum_0^\omega v^t d_t}{\sum_0^\omega v^t l_t}.$$

C_0 is then the fraction of the gross premium needed to amortize capitalized first-year and renewal expenses. V_t is the capitalized expense account at the end of the year.

By setting d_t equal to all uncapitalizable first-year and renewal expenses—essentially items such as flat renewals, collection fees, renewal expenses, and premium and income taxes—a third type of k, which we can label E_0, can be calculated.

A test can next be made of the adequacy of the gross premium. If $k_0 + C_0 + E_0$ is less than 1, then the gross premium is adequate, and there is a margin for profit. If $k_0 + C_0 + E_0$ is greater than 1, then the excess over 1 is the premium inadequacy:

$$I_0 = k_0 + C_0 + E_0 - 1 .$$

If there is an inadequacy for a particular line or block, the test should be made for all blocks to be sure that, on a weighted average basis, there is no gross premium inadequacy. If there is, then the premium deficiency reserve which must be set up is related to the premium as follows:

$$\frac{V_t}{l_t} = \frac{(1+i)^{1/2}}{v^t l_t} I_0 \sum_{t+1}^{\omega} v^t l_t .$$

REVISION OF ASSUMPTIONS

Once the initial set of persistency and claim rates has been determined, it must be re-examined annually to be sure that emerging experience still justifies continued use. If new experience emerges in quantity sufficient to be statistically reliable, it may indicate a need to change the assumptions. External factors—for example, the passage of a nationalized health scheme—may dictate a change in the assumptions. It is then necessary to use a new set of l_t's, d_t's, and perhaps a new i for durations n and later. Also required is a recalculation of k, the fraction of the gross premium needed to pay future incurred claims:

$$k' = \frac{\sum_{t=n}^{\omega} v'^t d'_t - v'^{(n-1/2)} V_{n-1}}{\sum_{t=n}^{\omega} v'^t l'_t} .$$

Subsequent reserves are calculated as before, using the new value of k and the new persistency, claim rates, and interest. For $t \geq n$,

$$\frac{V'_t}{l'_t} = \frac{(1+i)^{1/2}}{v'^t l'_t} \sum_{t+1}^{\omega} v'^t (d'_t - k' l'_t) .$$

It is essential to examine the emerging experience annually in order to identify important trends early. However, if reasonable conservatism has been built into the original assumptions, it should not be necessary to develop new factors oftener than every five years. At the time of testing a new calculation, the key indicator is whether or not the new value of k, namely, k', when taken together with a similar analysis of the other charges against gross premium, indicates an over-all remaining profit margin of reasonable size. Only if the remaining profit margin appears to be dangerously thin or nonexistent should a new set of reserve factors be introduced; their introduction will prevent the drawing down of current profits in the face of probable future losses. If the analysis, on the other hand, indicates a probable marked escalation in future profit margins, the reserve factor for previously issued business should not be tampered with. It is in order to use the new information to develop more appropriate factors for current and future issues.