"ESTIMATING INCURRED CLAIMS"

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Discussion

by

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Mr. Benedikt uses "chain relatives" based on the incurred claim totals included in Part 5 of Schedule "P" of the annual statement required for fire and casualty companies in the United States. Each total is for the losses as developed to end of calendar year (j) for claims incurred because of accidents in calendar year (i). Each total is the sum of the actual payments made before the end of year (j) plus the reserve for estimated payments to be made after the end of year (j) for claims incurred in year (i). The "chain relatives" are ratios. The "chain relative" $a_{i,j}$ is the ratio of developed losses to end of $(j + 1)$ to the developed losses at the end of year (j).

Each total of Part 5 of Schedule "P" equals the sum of the total payments to date plus the total reserves for future payments for the corresponding classification of claims. Separate totals for these amounts are given in Part 1 of Schedule "P". The totals of Part 5 are not secured directly from Part 1 because Part 1 gives totals by policy year of issue only and Part 5 separates the totals by policy of issue by calendar year in which claims are incurred. The two parts are prepared from the same basic claim information and agree in total.

The accumulated total paid losses for most casualty lines increase with passage of time. This accumulated total for paid losses can be reduced only if there are recoveries for losses previously paid, such as can occur for auto collision. For auto collision, the insurance company for this insurance can pay the insured for the damage to his car and then later recover from the insurance company that

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provided the liability insurance for another car involved in the same accident. Such substantial recoveries normally do not occur for auto liability insurance for bodily injury and property damage.

The writer is somewhat surprised by the variations from subsequent year to subsequent year for each year of occurrence as shown in Tables 1 and 2 of the paper. Since these totals represent total incurred liability for both payments made in the past and payments to be made in the future, it is not clear why this total for year of occurrence 1957 changes from 432 at the end of 1957 to 772 at the end of 1959 and then to 402 at the end of 1961. Since the accumulated total for payments to date is an accounting fact, the variations must be due to incorrect estimates of the liability for future payments for incurred claims.

The procedure of the paper combines the paid losses which are known with the reserves for future payments which are estimated. This is essentially the same basic procedure as used by Mr. Masterson (Reference No. 1 of the paper).

The writer suggests that this combining of an established total with an estimated total unnecessarily complicates the problem. The problem is the reliability of the estimate of future payments for incurred claims.

The writer has used a method for securing this reserve liability for future payments, using totals for payments made before valuation date. The method uses ratios similar to Mr. Benedikt's "chain relatives," except that annual payment amounts are used and these totals are limited to a recent period of time. The use of recent figures only eliminates old figures that might not apply to current conditions.

The method used for one illustration involved ratios based on claim payments during the four calendar years 1962 to 1965, inclusive, for a valuation as of December 31, 1965. The payment totals were for amounts paid in each calendar year (j) for claims incurred in each calendar year (i). The four-year period is, of course, reduced to three years for claims incurred in 1963, to two years for claims incurred in 1964, and to one year for claims incurred in 1965. The calculations are made separately for each major classification of insurance risks.

For a classification of risks, the totals available are for the payments made in each of the calendar years 1962, 1963, 1964, and 1965 for each of the calendar years of 1965 and before in which the claims were incurred. The symbol used for each payment total is as follows:

P_i^j = Payments in calendar year (j) for claims incurred in calendar year (i).

$(j - i) = n$

The basic ratio is for payments for curtate duration (n) to payments for curtate duration $(n + 1)$ for claims incurred in year (i). This ratio is expressed as follows:

$$P_i^j \div P_i^{j+1} = P_n$$

The payment totals for four years are used, giving ratios based on totals for three years for each of the two "P" amounts in the left-hand side of this expression. This can be expressed as follows:

$$\frac{P_{63\text{-}n}^{63} + P_{64\text{-}n}^{64} + P_{65\text{-}n}^{65}}{P_{63\text{-}n}^{62} + P_{64\text{-}n}^{63} + P_{65\text{-}n}^{64}} = P_n$$

The values of p_n secured from these calculations were not entirely regular, particularly for years and benefits with small amounts of payments. The crude p_n values were therefore changed to a smooth series. The smooth p_n values were then used to construct a payment experience table. This table gives the distribution by calendar year of payment for benefits paid for claims incurred in one calendar year. The table is based on a radix of 100,000 units of currency for payments in the calendar year in which the claims are incurred (for curtate duration 0).

The smooth values of p_n can be tested by application of the smooth values to the original totals for P_i^j to secure totals to compare with the original totals for P_i^{j+1}.

Direct automobile property damage is used as an example for this paper.

Table 1 includes the payment totals used to determine the crude ratios (p_n'), lists values of p_n' and p_n, and gives the estimated totals for the p_{x-n}^{x+1} secured by applying the smooth ratios to the experience totals for p_{x-n}^{x}.

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Table 1

n	Experience ΣP^{x}_{x-n}	Experience ΣP^{x+1}_{x-n}	Crude p'_{n+1}	Smooth p_{n+1}	Estimated ΣP^{x+1}_{x-n}
0	$ 5,733,689	$ 2,899,152	.5056	.5056	$ 2,898,953
1	2,600,534	402,649	.1548	.1548	402,563
2	387,308	174,489	.4505	.4505	174,883
3	166,792	62,093	.3723	.4050	67,551
4	56,545	27,003	.4775	.4050	22,901
5	23,881	11,783	.4933	.4050	9,672
6	11,394	3,218	.2824	.4050	4,615
7	5,098	2,209	.4333	.4050	2,065
8	1,797	1,416	.2315	.4050	728
9	1,459	513	.3516	.4050	591
Total	$ 8,988,497	$ 3,584,522			$ 3,584,522

The experience table calculated with the smooth values for p_n is given in Table 2. Using the experience table, the ratio of payments for future years to payments during the previous four years was calculated for the claims incurred in one accident year. The ratios secured were applied to the actual totals by year claims were incurred for the payments made in 1965 and the three prior years. The results gave the estimated future payments.

The determination of the incurred claim liability for future payments was made assuming no discount for delayed payments and was also made assuming discount at $3\frac{1}{2}\%$ a year compounded annually. Table 2 includes commutation factors for each of these two assumptions.

Table 2

		No Interest		Interest $3\frac{1}{2}\%$			
n	p_{n+1}	P_n	MP_n	${}_{3\frac{1}{2}}P_n$	${}_{3\frac{1}{2}}MP_n$	$(1.035)^n \times {}_{3\frac{1}{2}}MP_n$	$TP_{n:\overline{4}\rceil}$
0	.5056	100,000	164,307	100,000	161,377	161,377	100,000
1	.1548	50,560	64,307	48,850	61,377	63,525	150,560
2	.4505	7,827	13,747	7,307	12,527	13,419	158,387
3	.4050	3,526	5,920	3,180	5,220	5,788	161,913
4	.4050	1,428	2,394	1,244	2,040	2,341	63,341
5	.4050	578	966	487	796	945	13,359
6	.4050	234	388	190	309	380	5,766
7	.4050	95	154	75	119	151	2,335
8	.4050	38	59	29	44	58	945
9	.4050	15	21	11	15	20	382
10		6	6	4	4	6	154

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Explanation of Symbols:

$P_{n+1} = P_n \times p_{n+1}$; $P_0 = 100{,}000$

MP_n (no interest) $= \sum_{n-n}^{n-10} P_n$

${}_{3\frac{1}{2}}P_n = v^n P_n$

${}_{3\frac{1}{2}}MP_n = \sum_{n-n}^{n-10} {}_{3\frac{1}{2}}P_n$

$TP_{n:\overline{4}|} = \sum_{n-a}^{n-n} P_n$ $\quad a = (n\text{-}3)$ but not less than 0.

$MP_n \div TP_{n:\overline{4}|} = r_n$

${}_{3\frac{1}{2}}MP_n \div TP_{n:\overline{4}|} = {}_{3\frac{1}{2}}r_n$

The values of r_n and ${}_{3\frac{1}{2}}r_n$ appear in Table 3.

The last column of Table 2 represents the total payments during year n and the three years immediately preceding, except for the first three values. Obviously, the first value is only for one year's payments, the second for two years' payments, and the third for three years' payments. This corresponds to the facts for the actual payments made.

Table 3 shows the ratios calculated with totals from Table 2

Table 3

Incurred Claim Liability December 31, 1965

Year of Accident	Payments 1962-1965	*Present Value of Future Payments* — *No Discount* r_n	*No Discount* *Amount*	$3\frac{1}{2}\%$ *Discount* ${}_{3\frac{1}{2}}r_n$	$3\frac{1}{2}\%$ *Discount* *Amount*
1965	$ 2,455,622	.64307	$ 1,579,137	.63525	$ 1,559,934
1964	3,033,541	.09131	276,993	.08913	270,380
1963	2,970,368	.03738	111,032	.03654	108,537
1962	2,980,149	.01479	44,076	.01446	43,093
1961	842,487	0.1525	12,848	.01492	12,570
1960	195,215	.02904	5,669	.02845	5,554
1959	92,620	.02671	2,474	.02619	2,426
1958	29,723	.02527	751	.02484	738
1957	9,580	.02222	213	.02116	203
1956	3,251	.01571	51	.01571	51
Totals	$12,612,556		$ 2,033,244		$ 2,003,486
	$ 2,003,486 × .98295 = $ 1,969,327				

and the determination of the reserve liability for future benefit payments for incurred claims. The total for the discount factors is multiplied by 0.98295 to allow for an additional half-year's discount on the assumption of an even distribution of payments over the calendar year.

The totals of Table 3 are for all future payments for incurred claims regardless of whether the claims are reported or unreported. The same procedure can be used to determine the reserve liability for future payments for unreported claims. The principal change is that the total payments in one year for incurred claims of one year must be subdivided by year in which the claim was first reported to the insurance company.