ALLOCATED LOSS EXPENSE RESERVES

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Little, if any, reference to the problems and methodology of reserving for loss expense has appeared in the *Proceedings* of the Casualty Actuarial Society. In addition to initiating the publication of some information on the subject, this paper offers a device for the development of formula type allocated loss expense reserves for use in ratemaking. Directed primarily to those casualty lines of business which traditionally require the submission of allocated loss expense with loss in the ratemaking procedure, the theory presented is equally applicable to the determination of statement allocated loss expense reserves for these, as well as other, casualty lines of business where data is of sufficient volume to be credible.

Examination of accident year loss and allocated loss expense development in ratemaking statistics indicates that a significant contribution to the upward development appearing in recent years has been due to inadequate allocated loss expense reserves, which in most cases are probably the sum of the individual estimates of claim examiners.

This analysis not only offers a procedure for establishing more adequate allocated loss expense reserves on a formula basis for ratemaking, but also relieves claim examiners of the task of making individual estimates[1]. Aside from the savings in time and expense, claim men will admit that this is a most difficult area to make accurate estimates, especially at the time of the initial claim reserve creation.

The procedure uses past experience to determine a set of factors which, when applied to the individually estimated loss reserve, produces the corresponding allocated loss expense reserve. In addition, a similar single factor is derived for application to the Incurred But Not Reported (IBNR) loss reserve to provide the IBNR allocated loss expense reserve for statement purposes.

In order to initiate the analysis, the term "loss outstanding" (O/S) is defined as the individually estimated (known) loss reserves, and a "created year" is defined as the year in which the initial individual claim reserve

[1]It is still necessary to make individual estimates of allocated loss expense reserves on certain risks where formula type reserves could be criticized on an individual claim basis; i.e., Retrospective Rating where allocated loss expense incurred on a claim-by-claim basis is included in the rating and other large risks where individual claim experience is subject to inspection by the insured. These estimates are ignored in the compilation of the ratemaking data.

is recorded. "As of" dates are reference points in time with respect to the created year. A created year as of 12 months is as of its 12-31 date; i.e., created year 1970 as of 12 months is as of 12-31-70. Similarly, a created year as of 24 months is as of the 12-31 date of the following year; i.e., created year 1970 as of 24 months is as of 12-31-71, and so on for as of 36, 48, and 60 months. It should be noted that once a created year reaches its 12 months date, a certain block of claims is identified, and future as of dates have reference to that particular block of claims only.

Observation of past experience of the amount of loss still O/S through annual points in time for each of a series of created years is used to predict the future progression in time of the amount of loss O/S, for each created year of the current total loss O/S.

This prediction is shown below in Exhibit I, as it might appear for Automobile Bodily Injury at 12-31-71, for example. Past experience of the amount of loss still O/S by created year at the indicated points in time is shown to the left of the diagonal line. Ratios of the amounts of loss O/S are calculated through the progression in time, and an average of the latest three such ratios is used to predict the future progression in time of the

EXHIBIT I
AUTOMOBILE BODILY INJURY
(000's OMITTED)

	PROGRESSION OF LOSS O/S BY CREATED YEAR						
As Of	1965	1966	1967	1968	1969	1970	1971
12 Months	$50,000	$58,000	$66,700	$76,000	$70,000	$76,000	$80,000
Ratio 24/12	.630	.609	.610	.609	.611	.633	(.618)
24 Months	31,500	35,300	40,700	46,300	42,800	48,100	(49,440)
Ratio 36/24	.619	.575	.590	.633	.605	(.609)	(.609)
36 Months	19,500	20,300	24,000	29,300	25,900	(29,293)	(30,109)
Ratio 48/36	.559	.542	.567	.597	(.569)	(.569)	(.569)
48 Months	10,900	11,000	13,600	17,500	(14,737)	(16,668)	(17,132)
Ratio 60/48	.491	.491	.515	(.499)	(.499)	(.499)	(.499)
60 Months	5,350	5,400	7,000	(8,733)	(7,354)	(8,317)	(8,549)

Total Loss O/S at 12-31-71
$184,500*

*Includes $6,000 loss O/S for created years 1966 and prior

current loss O/S for each created year[2]. This is shown to the right of the diagonal line and appears in parentheses.

The difference in the amount of loss O/S between two successive as of dates is considered as the amount of loss O/S disposed of in that particular 12-month period[3]. Thus, referring to Exhibit I, for created year 1970 the amount of loss O/S disposed of between as of dates 12 and 24 months is $76,000—$48,100 or $27,900. Similarly, the prediction of the future amount of loss O/S to be disposed of between as of dates 12 and 24 months for created year 1971 is $80,000—$49,440 or $30,560, etc.

Utilizing this concept, the future disposition of the loss O/S at 12-31-71 may be arranged in the following format:

EXHIBIT II
AUTOMOBILE BODILY INJURY
(000's OMITTED)

FUTURE DISPOSITION OF LOSS O/S AT 12-31-71

Disposal Interval	Created Year					
	67 & Prior	68	69	70	71	Total
12 to 24 Months	$ xx	$ xx	$ xx	$ xx	$30,560	$ 30,560
24 to 36 Months	xx	xx	xx	18,807	19,331	38,138
36 to 48 Months	xx	xx	11,163	12,625	12,977	36,765
48 to 60 Months	xx	8,767	7,383	8,351	8,583	33,084
Over 60 Months	13,000	8,733	7,354	8,317	8,549	45,953
Total	$13,000	$17,500	$25,900	$48,100	$80,000	$184,500

The disposal intervals shown are a measure of the age (since initial claim reserve creation) of the particular claims at disposal. It might be expected that the amount of allocated loss expense paid per unit of loss O/S disposed would vary with the age at disposal.

In order to determine these relationships, past experience in the form of the allocated loss expense paid by created year is obtained for each of the last three calendar years[4]. By rearranging the amounts of loss O/S

[2]Throughout this analysis, simple averages are used so as not co complicate the text. More sophisticated trending or weighted average procedures may be substituted.

[3]Actually, the amount of loss O/S taken down at settlement or cancellation and the net of changes in estimate.

[4]These relationships do not actually represent the cost in allocated loss expense per unit of loss O/S disposed, except as "disposed" is defined in footnote #3. Since a portion of the allocated expense paid is on loss still O/S at the end of the calendar period, the "F" ratios, as subsequently derived, are only an artificial device in the mechanics of the formula.

disposed of from past experience (left of diagonal line in Exhibit I) and relating the corresponding allocated loss expense paid, a ratio of allocated loss expense paid to the amount of loss O/S disposed, for each of the disposal intervals, can be developed as follows:

EXHIBIT III
AUTOMOBILE BODILY INJURY
(000's OMITTED)

Calendar Year 1969

Created Year	Disposal Interval	Loss O/S Disposed	Allocated Exp. Paid	Ratio
68	12-24 Mo.	$29,700	$2,000	.0673
67	24-36 Mo.	16,700	2,300	.1377
66	36-48 Mo.	9,300	1,400	.1505
65	48-60 Mo.	5,550	990	.1784
64 & Pr.	Over 60 Mo.	5,400*	1,100	.2037

Calendar Year 1970

Created Year	Disposal Interval	Loss O/S Disposed	Allocated Exp. Paid	Ratio
69	12-24 Mo.	$27,200	$1,800	.0662
68	24-36 Mo.	17,000	2,150	.1265
67	36-48 Mo.	10,400	1,600	.1538
66	48-60 Mo.	5,600	950	.1696
65 & Pr.	Over 60 Mo.	5,050*	1,000	.1980

Calendar Year 1971

Created Year	Disposal Interval	Loss O/S Disposed	Allocated Exp. Paid	Ratio
70	12-24 Mo.	$27,900	$1,800	.0645
69	24-36 Mo.	16,900	2,050	.1213
68	36-48 Mo.	11,800	1,800	.1525
67	48-60 Mo.	6,600	1,150	.1742
66 & Pr.	Over 60 Mo.	5,700*	1,200	.2105

*Not obtainable from Exhibit I, but derived from extension of same data.

Designating an average of the above ratios as "F", the following ratios of allocated loss expense paid to loss O/S disposed are determined for each disposal interval:

EXHIBIT IV
AUTOMOBILE BODILY INJURY

Disposal Interval	F
12 to 24 Months	.0660
24 to 36 Months	.1285
36 to 48 Months	.1523
48 to 60 Months	.1741
Over 60 Months	.2041

Recalling Exhibit II, which predicts the future disposition of the current (12-31-71) loss O/S, and applying the appropriate F ratios, the prediction of the future allocated loss expense to be paid (in effect, the allocated loss expense O/S) for each development year is made as follows:

EXHIBIT V
AUTOMOBILE BODILY INJURY
(000's OMITTED)

		Future Disposition of Loss O/S at 12-31-71					
		Created Year					
Disposal Interval	F	67 & Prior	68	69	70	71	All
12 to 24 Months	.0660	$ xx	$ xx	$ xx	$ xx	$30,560	$ 30,560
24 to 36 Months	.1285	xx	xx	xx	18,807	19,331	38,138
36 to 48 Months	.1523	xx	xx	11,163	12,625	12,977	36,765
48 to 60 Months	.1741	xx	8,767	7,383	8,351	8,583	33,084
Over 60 Months	.2041	13,000	8,733	7,354	8,317	8,549	45,953
Total Loss O/S		$13,000	$17,500	$25,900	$48,100	$80,000	$184,500
Allocated Loss Expense O/S		2,653	3,309	4,486	7,491	9,717	27,656
Allocated Loss Expense O/S + Loss O/S		.2041	.1891	.1732	.1557	.1215	.1499

The ratios of allocated loss expense O/S to loss O/S so determined for each created year are designated as "Allocated Loss Expense Reserve Factors." In the compilation of the ratemaking data, each claim's loss O/S is examined with respect to its created year. Application of the proper Allocated Loss Expense Reserve Factor to the loss O/S provides the corresponding allocated loss expense O/S. In the example shown, the procedure relates to the ratemaking data reported at 12-31-71.

Since ratemaking data is normally required at the end of each quarter, it becomes necessary to determine the factors at these interim dates.

Until such time as an additional calendar year's experience (1972 in this example) becomes available, it is reasonable to assume that the factors as derived above at 12-31-71 would be repeated at 12-31-72, offset one created year. That is, the factor for created year 1972 at 12-31-72 would be the same as that of created year 1971 at 12-31-71; the factor for created year 1971 at 12-31-72 would be the same as that of created year 1970 at 12-31-71, etc.

Making this assumption, and using straight line interpolation for the quarterly points (with the exception of the 1972 created year), the factors would appear as follows:

EXHIBIT VI
AUTOMOBILE BODILY INJURY
ALLOCATED LOSS EXPENSE RESERVE FACTOR

	Created Year						
At	67 & Pr.	68	69	70	71	72	All
12-31-71	.2041	.1891	.1732	.1557	.1215	xx	.1499
3-31-72	.2041	.1929	.1772	.1601	.1301	.1144	.1499
6-30-72	.2041	.1966	.1811	.1644	.1386	.1164	.1499
9-30-72	.2041	.2004	.1851	.1688	.1472	.1188	.1499
12-31-72	.2041	.2041	.1891	.1732	.1557	.1215	.1499

The quarterly factors shown for created year 1972 can be determined by awaiting the actual distribution of the loss O/S by created year in 1972, and calculating the factors based on the assumption that the factor for all

created years remains constant throughout the year. Alternatively, these factors can be determined in advance in the same manner by observations of past distribution of the loss O/S by created year at the quarterly points.

As indicated in the opening paragraph of this paper, the theory presented in the preceding analysis may also be used in the determination of statement reserves for the casualty lines of business where sufficient data is available[5]. Thus, in the example as shown in Exhibit V, the application of the All created years' factor of .1499 to the total loss O/S at 12-31-71 produces the corresponding total allocated loss expense O/S of $27,656.

Determination of a similar factor applicable to IBNR loss reserves requires consideration of the manner in which IBNR loss development emerges.

From past experience, observations of IBNR loss payments in the 12-month period immediately following the reserve date, i.e., IBNR loss payments in 1971 on claims incurred but not reported at 12-31-70, may be related to the corresponding IBNR allocated loss expense payments.

Continuing with the example established above, these relationships might appear for the latest three years for Automobile Bodily Injury as follows:

EXHIBIT VII
AUTOMOBILE BODILY INJURY
(000's OMITTED)

IBNR With Respect To	Subsequent 12 Months' Payments		
	Loss	Allocated Loss Exp.	Ratio
12-31-68	$5,500	$205	.0373
12-31-69	5,200	200	.0385
12-31-70	5,700	210	.0368

[5]It may be necessary to treat certain pools, associations and large risks individually.

It is reasonable to assume that an average of these ratios, when applied to that portion of the current 12-31-71 IBNR loss reserve which can be assigned to IBNR paid losses in the immediately following 12 months, produces the corresponding allocated loss expense reserve. For this example, the average is .0375.

The remaining portion of the current IBNR loss reserve is assigned to the amount of loss O/S 12 months from the reserve date on IBNR claim reserve creations during that period, plus the amount of IBNR still unreported at that time.

As indicated, all of this IBNR loss O/S arises in the created year following the reserve date. For this example, it is created year 1972 which will be as of 12 months at that time. It is noted from Exhibit VI, after making the indicated assumption, that the Allocated Loss Expense Reserve Factor for this created year as of 12 months is .1215.

Making the assumption that the still unreported IBNR loss 12 months after the reserve date bears the same factor[6], it is now necessary to determine from past experience the proportional part of the total ultimate IBNR loss development which arises from payments during the first 12 months subsequent to the reserve date. Proper weighting, by proportional parts, of the two factors (.0375 and .1215) as determined above, then produces a single factor for application to the current IBNR loss reserve to obtain the corresponding allocated loss expense reserve.

Continuing the example, suppose it is determined from past experience that the first 12 months' IBNR loss payments subsequent to the reserve date make up 30% of the ultimate IBNR loss development. Then, making use of the proportional parts, as indicated above, the single factor of .0963 ($.30 \times .0375 + .70 \times .1215$) is produced for application to the current IBNR loss reserve to determine the IBNR allocated loss expense reserve.

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[6] The inclusion of the still unreported with the IBNR loss O/S deserves comment. The continuity of the analysis could be maintained by determining the same relationships and proportional parts for IBNR loss and allocated loss expense arising in subsequent 12-month periods; i.e., 12 to 24 months, 24 to 36 months, etc., after the reserve date. Experience indicates that the relationship of allocated loss expense paid to loss paid on claims arising in these periods approximates the factor (.1215 in the example) applicable to the IBNR loss O/S at 12 months. Since the IBNR loss O/S at the end of each of these periods (arising during the periods) would bear the same factor, it is felt that it is permissible to include the still unreported with the IBNR loss O/S at the end of the first 12 months, as indicated in the text.

Although the example presented in the text was made relatively stable for ease of illustration, annual redetermination of the elements of the analysis may reveal trends or dislocations which reflect alteration of practices affecting the continuity of the basic data. For instance, although the formula will produce proper allocated loss expense reserves for a line of business that has been consistently overreserved with respect to loss, a sharp correction of the problem would lead to a surge in the amount of loss O/S disposed in the year of correction. This, in turn, would distort the pattern used to predict future disposal of the current loss O/S and also the most current F ratios. At this point, the success of the procedure would depend upon a knowledgeable adjustment of the past experience to the corrected loss O/S level. This is an extreme example but serves to illustrate the fact that the procedure requires continual monitoring.

In this connection, it should be emphasized that any mathematical system used in the determination of reserves based upon past experience is always subject to variations in both internal and external influences, and should, in the last analysis, be dependent upon judgment based on the currently available knowledge of these factors.

Annual determinations will also allow measurement of the adequacy of previous year-end allocated loss expense reserves. For instance, Exhibit V shows the current still O/S allocated loss expense with respect to 12-31-68 as $3,309 plus $2,653 or $5,962. This O/S, coupled with the proper allocated loss expense paid of $17,640 from Exhibit III, is a current measure of the adequacy of the 12-31-68 reserve.

Although the theories presented are illustrated for Automobile Bodily Injury, they are, as previously indicated, equally applicable to other lines of casualty insurance and, in addition, to sublines and geographical divisions where data is available and in sufficient volume to be credible. The indicated subdivisions are particularly desirable in the ratemaking application.