Title: THE RESERVE FOR UNRECOVERABLE REINSURANCE

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Abstract:

The estimation of reserves, established by the ceding company, for known and potential reinsurers in liquidation requires a digest of reinsurance placements, a ceded claim data capture capability, an accounting of known ceded claims and the corresponding accounts receivable, methods for evaluating the expected ultimate liability in the ceded layers (including development of known direct claims and IBNR claims), and an evaluation of potential creditor recovery of funds upon distribution of reinsurers' assets.

This paper primarily describes methods for evaluating the expected ultimate liability for unrecoverable reinsurance, and we discuss several issues and considerations regarding these methods and the evaluation process in total. In order to put the calculation methods in perspective, we provide a description of financial reporting and data capture of ceded losses and a discussion of issues regarding these topics.

The methods for calculating the reserve for uncollectible reinsurance are also appropriate for estimating the liabilities for commutations and novation agreements.

THE RESERVE FOR UNRECOVERABLE REINSURANCE

INTRODUCTION

Reinsurer insolvencies have become a fact of life in the insurance business. Insurance companies that have ceded business to these reinsurers can expect to recover only a small portion of the losses that they would have recovered if the reinsurer had remained in business. Novation agreements and the commutation of reinsurance contracts are also becoming more common as reinsurers retrench from the last underwriting cycle and attempt to remain solvent.

For many insurers, published reinsurance recoverables are greater than surplus, and a reinsurer in liquidation can have a significant impact. Prudent management requires that the ceding insurer's financial reports be adjusted to reflect an estimate of unrecoverable amounts. The size of this problem has increased in recent years and, because of the concentration of reinsurance in long-tail lines, the problem will exist well into the future.

There has been little published on appropriate techniques to adjust ceding company financial reports or to estimate unrecoverable amounts. Most discussions of this issue include a straightforward technique for the recognition of known ceded claims that are unrecoverable, but only briefly mention IBNR.

Our purpose is to describe techniques to estimate the reserve, established by the ceding company, for unrecoverable ceded amounts for known and potential reinsurers in liquidation. This reserve is available for both adjusting financial reports and for filing with the liquidators of specific reinsurers. The techniques discussed are also appropriate for estimating reserves for unrecov-

erable amounts due to novation agreements, and for estimating ceded liabilities to be transferred back to the ceding insurer by commutation agreements. We concentrate on unrecoverable loss amounts and not on unearned premiums, contingent commissions or other receivables.

In a sense, we are discussing reinsurance loss reserving techniques, but from the perspective of the ceding insurer not the reinsurer. The ceding insurer's perspective is very different with respect to the availability of data and the corresponding availability of reserving techniques utilizing this data. Several approaches are discussed as are the issues particularly relevant to the calculation of this reserve. In any reserve analysis, a variety of the basic issues need to be addressed. We do not repeat them here and refer the reader to Berquist and Sherman [1].

We recommend a mix of approaches to calculate the total reserve. Different techniques are appropriate based on the amount of information available and the potential for unrecoverable loss. In addition, a high level of refinement may only have a payoff for commutation agreements. As background, we first describe the processing of ceded claims, from the identification of a ceded claim to the receipt of reimbursement from the reinsurer. This discussion is an introductory description of this process and only the relevant details are included.

CEDED CLAIM PROCESSING

We assume the existence of basic recordkeeping procedures that both serve fundamental accounting requirements and provide for access to data including ceded claim information and reinsurance contract information. We do not mean to minimize the establishment and maintenance of these procedures and the databases associated with them and we discuss particular problems, in a limited fashion, throughout this paper.

For ease of discussion, we consistently refer to databases containing accounts receivable and ceded (and direct) loss information by claim, and a database of reinsurance placements. A smaller insurer may have some manual reporting instead of these databases. However, the essential claim processing steps should be the same for large or small insurers.

Ceded claim processing involves (1) the identification of direct or assumed claims which are reinsured, (2) the calculation of the ceded amount for each claim, (3) the processing of the notices and bills to the reinsurers and (4) the reporting of the ceded amounts to the financial and data processing systems (including both accounts receivable and loss systems).

Identification

The identification of direct or assumed claims which are reinsured requires a digest of reinsurance placements and a system for comparing each direct and assumed claim against the key criteria of the appropriate reinsurance placement.

Facultative Excess: For a facultative, per occurrence, excess of loss placement, we compare the incurred loss amounts of the direct claims with the attachment point of the reinsurance agreement. Since facultative placements generally apply to only one insured for one policy period, only the losses of that insured are compared against the criteria of the facultative placement. Typically, all claims associated with the reinsured policy are first identified on the loss database, and then only these claims are tested against the attachment point.

Treaty Excess: A treaty placement applies to more than one insured, either all insureds or a well defined category of insureds (e.g., an insurer's agency produced business). The initial match of direct claims with the treaty is usually by size of loss for all claims resulting from the underlying, reinsured policies. In addition, a treaty can be written on a losses occurring, risks attaching or claims made basis. Losses occurring means that all losses are reinsured where the date of loss occurs during the life of the treaty. Risks attaching means that the losses from all policies written during the life of the treaty are reinsured no matter when the loss occurred. And, claims made treaties reinsure any claim reported during the life of the treaty. The direct claims are matched to these various types of treaties based on accident date, policy effective date or date claim made, respectively.

Proportional Reinsurance: Proportional reinsurance can provide coverage to a single insured or many insureds on a facultative or treaty basis. All claims from a well defined category of insured policies are identified as covered on a pro-rata share basis.

Certain types of direct claims can be difficult to identify as ceded depending on the way direct claims are stored on the loss database. Ceded claim identification problems can arise when more than one line of business is involved for a single direct occurrence, when more than one claimant is involved on a single occurrence, and when the direct claim is large enough where coverage is provided by both a primary policy and an excess or umbrella policy. For example, if a single occurrence results in several claims, these claims need to be combined in order to be properly identified (and the ceded amount correctly calculated). Catastrophe claims are a common example of this, although, smaller occurrences involving multiple claimants or lines are typically more difficult to identify.

Workers' Compensation tabular claims should be identified as ceded based on a deferred annuity calculation (assuming the reinsurance placement is on an undiscounted basis). Not all tabular claims can be identified as ceded by applying the attachment point to undiscounted amounts on the direct loss database since these amounts are still discounted for mortality. The deferred annuity calculation identifies the ceded amount as the monthly payment stream remaining after the initial monthly payments (up to the amount of the attachment point) are paid by the insurer.

If there are coverage stipulations on the reinsurance contract, the direct claims that exceed the attachment point have to be checked to ensure coverage. Coverage stipulations exclude coverage for certain locations, causes of loss, etc. even though coverage is provided under the primary policy.

In addition, when an aggregate extension clause is included in the reinsurance contract, individual direct claims (associated with the reinsured policies)

must be combined to determine if they exceed the attachment point. An aggregate extension clause results in coverage for the sum of all claims, when this amount exceeds the attachment point, provided that the underlying policy is written with an aggregate limit. This provision most commonly applies to products liability, but the new ISO Commercial General Liability policy provides aggregate limits on other coverages in addition to products.

Calculation of the Amount Ceded

For a straightforward excess of loss placement, each direct incurred loss over the attachment point is a reinsured loss and the ceded incurred loss amount is equal to the amount over the attachment point times the reinsurer's participation percentage.

The example below is for an excess of loss placement with reinsurance in two layers at different participation rates. The first layer, up to a $1,000,000 is not reinsured, the second layer, from $1,000,000 to $2,000,000, is reinsured at 80% and the third, from $2,000,000 to $5,000,000, is reinsured at 90%. As shown in the example, these layers are normally described as $3M xs $2M, etc. In the top layer, the $2,000,000 is the attachment point and the $3,000,000 is the limit of the layer. In addition, throughout this paper we refer to the sum of the attachment point and the limit as the upper bound of the layer ($5,000,000 in the top layer of this example). For a per occurrence excess of loss placement, the attachment point and limit apply to each claim.

Reinsurance for a Single Claim
(000's)

Layer	Ground-Up Loss	Participation Percentage	Ceded Loss	Insurer's Retention
Retention	$ 1,000	0%	$ 0	$ 1,000
$1M xs $1M	1,000	80%	800	200
$3M xs $2M	1,500	90%	1,350	150
Total Loss	3,500		2,150	1,350
ALAE	1,000		614	386
Total Loss and ALAE	$ 4,500		$ 2,764	$ 1,736

The total claim above is $4,500,000, $3,500,000 loss and $1,000,000 allocated loss adjustment expense (ALAE). This placement layers the loss as shown above and pro-rates the ALAE. Although not shown, the ALAE is pro-rated to layer and to each reinsurer on the layer.

It is not uncommon for the insurer to participate in each layer as we have displayed. It is uncommon for the entire 80% and 90% participation rates to be placed with one reinsurer. Each layer usually has several reinsurers, and the individual reinsurers may participate in both layers. The unrecoverable amount for this claim is based only on the participation rates of the liquidating reinsurers on these layers.

For a single claim, the calculation of the ceded amount for a treaty excess of loss placement is similar. In addition, the calculation of the ceded amount for proportional reinsurance can be described by setting the attachment point to zero and the percentage participation to the reinsurers' pro-rata share.

We assume, throughout this paper, that the claims are net of salvage and subrogation. We also assume in this paper that the ALAE is included in the reinsur-

ance agreement on a pro-rata basis. The other common method for including ALAE is to include it with the loss before applying the attachment point. A third method for handling ALAE is to not reinsure it at all. The reserve calculation techniques we describe can be modified to handle ALAE for both these latter methods by simply ignoring the pro-rata adjustment we include in our calculations (and assume ALAE is either included in, or excluded from, the loss).

Notification of Reinsurers and Internal Recording

Notices and bills are produced and sent to the appropriate reinsurers after the identification of a reinsured claim and the calculation of the ceded amount. Notices inform the reinsurer of the total ceded incurred loss, representing the current adjusters estimate of the claim. When the direct paid losses exceed the attachment point, bills are sent to the reinsurers requesting reimbursement.

The ceded loss information including ceded paid and incurred loss amounts are reported to the insurer's financial and loss information systems. Both ceded incurred and paid losses should be established shortly after the direct or assumed losses are established. We assume that the ceded amounts are available in a loss system for each claim, including coding identifying reinsurer, layer, line of business, placement, etc.

At the same time ceded paid losses are recorded, bills are mailed and receivables for the ceded paid amounts are established for each reinsurer on the claim, since the cash has not yet been received from the reinsurer. (This is in contrast to direct loss accounting where the paid losses are generally booked only after a check has been issued.) When the cash is received from the reinsurer, the receivable is taken down and the cash account is credited.

Continuing our example from above, the table below displays the reinsurers on the $1M xs $1M layer. We also assume that the ceded paid in this layer is $320,000. We ignore expense in this example.

Reinsurance for a Single Claim
$1M xs $1M Layer Only
(000's)

	Reinsurer			
	#1	#2	#3	Total
Layer Loss				$ 1,000
Participation	40%	20%	20%	80%
Ceded Incurred Loss	$ 400	$ 200	$ 200	$ 800
Ceded Paid Loss	160	80	80	320
Ceded Outstanding	240	120	120	480
Ceded Paid Loss	$ 160	$ 80	$ 80	$ 320
Reimbursements	120	60	5	185
Receivable	40	20	75	135

Each reinsurer shares in both the incurred, paid and outstanding amounts based on its participation rate. The receivables vary depending on the actual reimbursements received.

RESERVE CALCULATION

Summary of Approach

Our goal is to establish a reasonable reserve including (1) an accurate identification of all known ceded losses and (2) an IBNR reserve that accurately estimates the potential future claims. One of our primary requirements is to ensure that we identify all of the placements where there is a large potential for IBNR, especially if negotiating the price for the commutation of a contract. Analysis and issues to pursue include:

1) Examine all placements made with reinsurers both in liquidation and with the potential for liquidation.
   a) Familiarization of coverage provided by placements.
   b) Based on knowledge of the reinsured business and layer limits, identify placements likely to be generating losses or which have potential to generate future losses.
2) Review the calculation of known ceded losses.
   a) To ensure they are consistent with the reading of the placements.
   b) Identify any reinsured claims not currently being ceded to claims processing area.
   c) Review all Workers' Compensation tabular claims, the types of tabulars and the amount of discount.
3) Calculate the reserve for unrecoverable known ceded claims.
4) Calculate the reserve for IBNR. Identify placements where the IBNR potential is large.
   a) Including placements with aggregate extension clauses.
   b) Placements that cover known or potential catastrophic losses.

c) Placements covering insureds with a large exposure to loss.

d) Review cumulative injury losses and placements covering insureds with known or potential cumulative injury losses.

5) Consider offsets and the future distribution of the reinsurer's assets.

6) Apply a liquidation probability to the reserve of each reinsurer with only the potential for liquidation.

We discuss appropriate analysis and issues in the sections that follow.

Reserve Definition

The reserve for unrecoverable reinsurance includes:

1) A reserve for both paid and outstanding known ceded claims that have been processed and are included on the accounts receivable and loss databases.

2) An IBNR reserve for claims which have not yet been processed as ceded and for fluctuations in known ceded adjusters. More specifically, this IBNR reserve includes:

a) Fluctuations in adjusters estimates on known ceded claims. As the direct claim amounts fluctuate, so will the ceded amounts.

b) Direct claims that have been reported and will eventually develop over the retention.

c) Direct claims that have not yet been reported and will develop over the retention.

Note that our definition of ceded IBNR is based on corresponding direct claims that can be either known claims or IBNR claims. A known direct claim is not processed as ceded until the amount develops over the attachment point. We also include development of known adjusters as well as pure IBNR in the above definition. The methods discussed below forecast both types of development on a combined basis.

Known Ceded Claims

The reserve for unrecoverable known ceded claims can be calculated based on the information stored in the accounts receivable and ceded loss databases. Each ceded claim not yet fully reimbursed (i.e., final billed and paid) by the liquidating reinsurer is included in this reserve. For each ceded claim, the unrecoverable amount is the uncollected ceded paid on accounts receivable and the ceded outstanding amount on the loss database. In our example above, if reinsurer #3 is in liquidation, the uncollected ceded paid is $75,000 and the ceded outstanding amount is $120,000 for a total unrecoverable amount of $195,000 for this claim (excluding ALAE).

The Workers' Compensation tabular claims on the ceded loss database should be correctly calculated as a deferred annuity. The amount of discount on these claims should be consistent with the discount of the direct and ceded losses on financial reports of similar purpose (e.g., statutory versus GAAP) or a negotiated discount rate for commutations.

The calculation of the reserve for known ceded claims cannot be considered complete without a review of the accuracy of the claims on the ceded database. The processing of a ceded loss is a complex procedure, often requiring manual

intervention to an automated process to ensure accuracy. Processing errors will be made, especially with respect to tabular claims or where unusual coverages exist. A reconciliation of placement coverage to ceded claims and unpaid balances should be performed. If processing errors are occurring, this is the time to catch them (especially for commutations).

IBNR Reserve

The calculation of the unrecoverable IBNR reserve is more complicated than the reserve for known losses and very dependent on the sophistication of the insurer's data capture capability and desire for accuracy. We discuss reserving techniques and the issues particularly relevant to this reserve.

We first identify placements that have the potential to generate large IBNR amounts. Review the placements and both the direct and ceded losses associated with the placements. Placements with large IBNR potential include those with current ceded losses already recorded, those with aggregate extension clauses, those where the underlying insureds have the potential for Workers' Compensation tabular claims or large losses in other reinsured lines.

The first reserve calculation technique described below is a ground-up loss development technique. For each reinsurance placement, we assume the data is available as follows: (1) inception to date direct and ceded losses are available at a common valuation date and (2) the direct and ceded losses are in balance, i.e., each direct loss that satisfies the criteria in order to be ceded has been processed as ceded (except for a month or two lag). There is an adjustment for claims in transit that must be made since the ceded loss processing lags the direct loss processing. We assume that this lag is not seriously large.

1. Ground-Up Method

For facultative reinsurance, the most straightforward method for calculating IBNR is at an even finer level of detail than individual placement. An individual placement is generally defined by a covernote or contract and may include several lines of business at separate retentions. The parameters associated with our calculation of IBNR include named insured (covered policies only), policy period, line of business (or subline), retention and limit, and participation percentage. Exhibit I is an example of the calculation of IBNR for a single placement at this level of detail.

This exhibit is based on a per occurrence excess of loss facultative placement reinsuring the direct liability losses of the LOL Manufacturing Company. Reinsurance coverage is provided for General Liability (GL) and Automobile Liability (AL). For this example, we assume the GL losses are all products losses. OL&T or M&C losses would be developed separately. The liquidating reinsurer (RIP RE) is participating on only one layer for each line of business at the participation rates shown.

The ultimate loss amount in the reinsured layer is calculated from the ground-up direct losses. Undeveloped, ground-up losses are limited first to the attachment point and then to the upper bound of the layer. Each claim is limited on a per occurrence basis, and the exhibit displays the sum of all limited claims.

These ground-up losses are developed to ultimate using appropriate loss development factors (LDF). The difference between these two developed loss amounts is equal to the ultimate loss amount in the layer. For GL, the ultimate layer loss is $921,000 = $2,606,000 - $1,684,000.

Per Occurrence Excess of Loss Placement

Exhibit 1

Ground-Up Method

Losses valued 6/1/87
All amounts in 000's.

RIP RE
LOL Manufacturing Co.
Facultative Placement

Policy Effective Date	Line	Retention	Limit	Participation Percent	Ground-Up Limited Losses: Retention	Ground-Up Limited Losses: Upper Bound	Ground-Up Limited Losses: Policy Limit	ALAE	Layer Loss	Layer ALAE	Layer Loss & ALAE
09/1/84	GL	$ 100	$ 400	30.0%							
			Undeveloped loss		$ 1,160	$ 1,450	$ 1,620	$ 480	$ 290	$ 86	$ 376
			LDFs		1.452	1.797	1.852	1.901			
			Ultimate Loss		$ 1,684	$ 2,606	$ 3,000	912	$ 921	$ 280	$ 1,202
			Layer IBNR						$ 631	$ 194	$ 826
			Unrecoverable IBNR						$ 189	$ 58	$ 248
09/1/84	AL	$ 100	$ 200	25.0%							
			Undeveloped loss		$ 830	$ 1,240	$ 1,340	$ 210	$ 410	$ 64	$ 474
			LDFs		1.117	1.157	1.191	1.205			
			Ultimate loss		$ 927	$ 1,435	$ 1,596	$ 253	$ 508	$ 80	$ 588
			Layer IBNR						$ 98	$ 16	$ 114
			Unrecoverable IBNR						$ 24	$ 4	$ 28
Grand Total			Undeveloped loss		$ 1,990	$ 2,690	$ 2,960	$ 690	$ 700	$ 150	$ 850
			Ultimate Loss		$ 2,611	$ 4,040	$ 4,596	$ 1,166	$ 1,429	$ 361	$ 1,790
			Layer IBNR						$ 729	$ 211	$ 939
			Unrecoverable IBNR						$ 214	$ 62	$ 276

Layer allocated LAE (ALAE) is calculated by developing direct, total limits ALAE to ultimate and then pro-rating this amount between the layer ultimate losses and total limits ultimate losses. The ultimate GL layer ALAE is $280,000 = $912,000 x ($921,000/$3,000,000).

Layer IBNR is calculated by subtracting undeveloped loss and ALAE in the layer from the ultimate loss and ALAE. Unrecoverable IBNR is RIP RE's participation percentage times the layer IBNR. Exhibit I displays GL unrecoverable IBNR of $248,000.

The AL excess of loss calculation is similar. And, the total reserve for unrecoverable IBNR is $276,000. This amount is combined with the reserve for known claims to obtain the total reserve for unrecoverable reinsurance placed with RIP RE, for the LOL Manufacturing reinsurance placement only.

Note that a proportional reinsurance placement can be described by simply setting the attachment point to zero and the participation percentage to the proportion reinsured.

An aggregate extension clause dramatically changes the calculation of the losses in the reinsured layer. If the contract includes an aggregate extension clause, the sum of the individual losses, each limited to the policy limits, is compared to the attachment point. Any amount over the attachment point is ceded to the reinsurer. The reinsurer assumes only the aggregate amount up to the reinsurance limit. (Just as the aggregate limit on the primary policy protects the insurer, the limit of the reinsurance agreement protects the reinsurer.)

The first example in Exhibit II displays a typical aggregate calculation. On a per occurrence basis the layer includes only $279,000 ($1,863,000 - $1,584,000) of ultimate incurred losses (before application of the participation percentage). On an aggregate basis $863,000 ($1,863,000 - $1,000,000) is covered. The aggregate extension clause generally affords more coverage to the insurer. However, for a particular reinsured layer the clause may provide less coverage.

For example, the second calculation on Exhibit II uses the same data as the first example on Exhibit I. For the $400,000 xs $100,000 layer, the limit on the aggregate is $400,000, much less than the $921,000 of per occurrence excess losses on Exhibit I. Of course, if the insurer has reinsured above $500,000, then the difference between the $922,000 and the $400,000 is moved to the next layer of the aggregate coverage. Note that even though the $400,000 loss fills the layer, future development of the ALAE will change the total loss and ALAE layer amount.

Adjustments

Claims in Transit: We have not used the current valuation of the ceded losses to calculate the IBNR reserve. The ground-up calculation assumes that the layer loss and ALAE calculated from the undeveloped direct loss amounts equals the layer loss and ALAE on the ceded loss system. This assumption can easily be validated by simply comparing the total direct layer loss and ALAE to the total ceded loss and ALAE for this placement. We require the current valuation of the ceded losses to first make this comparison and then to calculate the adjustment for claims in transit, if the comparison shows direct layer and ceded losses out of balance.

Excess of Loss Placement - Aggregate Extension Clause

Exhibit II

Ground-Up Method

Losses Valued 6/1/87
All amounts in 000's.

Policy Effective Date	Line	Retention	Limit	Participation Percent	Ground-Up Limited Losses: Retention	Upper Bound	Policy Limit	ALAE	Layer Loss	Layer ALAE	Layer Loss & ALAE
Example 1 ----											
03/1/83	GL	$ 1,000	$ 1,000	20.0%							
			Undeveloped Loss		$ 1,214	$ 1,390	$ 1,390	$ 403	$ 390	$ 113	$ 503
			LDFs		1.305	1.340	1.340	1.380			
			Ultimate Loss		$ 1,584	$ 1,863	$ 1,863	$ 556	$ 863	$ 258	$ 1,120
			Layer IBNR						$ 473	$ 145	$ 617
			Unrecoverable IBNR						$ 95	$ 29	$ 123
Example 2 - LOL Manufacturing Co.											
09/1/84	GL	$ 100	$ 400	30.0%							
			Undeveloped Loss		$ 1,160	$ 1,450	$ 1,620	$ 480	$ 400	$ 119	$ 519
			LDFs		1.452	1.797	1.852	1.901			
			Ultimate Loss		$ 1,684	$ 2,606	$ 3,000	$ 912	$ 400	$ 122	$ 522
			Layer IBNR						$ 0	$ 3	$ 3
			Unrecoverable IBNR						$ 0	$ 1	$ 1

This adjustment is required since there is normally a lag between the recording of a direct loss and the recording of the corresponding ceded amount. Any direct losses that have recently satisfied the ceding criteria and have not yet been processed into the ceding system should be included in the reserve. Besides simply assuming that the difference between the direct layer and ceded losses is due to these claims, a report of direct claims that have recently had changes, or that are new, and that satisfy the ceding criteria can be compared against the ceded loss file (claim by claim) to verify they have or have not been processed.

Stipulations: We suggest a claim by claim comparison, above, because any out of balance between the direct layer and ceded loss amounts could also be due to stipulation agreements. If there are any stipulations in the reinsurance agreement that would exclude some direct losses from coverage under the placement, these losses should be excluded from the ground-up losses used to calculate IBNR. Removing these losses can require an even finer level of loss coding originally assumed above.

Tabular Claims: Average ground-up LDFs applied to total limits, discounted Workers' Compensation claims can give an inaccurate forecast of the ultimate total limits losses (undiscounted). If the proportion of discounted tabular cases is not the same as the proportion contemplated by the LDFs, the amount of interest accrual contemplated by the LDFs can be too much or too little.

The same problem is true for limited, discounted tabular claims. The difference between the ultimate ground-up losses (at the attachment point and upper bound) can be an inaccurate forecast of ultimate in the layer. The calculation

of the undiscounted, known adjusters in the layer (on a deferred annuity basis) will be larger than the ultimate forecast, if there are many more tabular cases than contemplated by the LDFs.

The ultimate losses limited to the attachment point and the ultimate losses limited to the upper bound must be calculated consistent with the calculation of known claims on a deferred annuity basis. This requires ground-up development factors that are calculated consistent with the deferred annuity basis.

It is beyond the scope of this paper to discuss this topic in depth, however, if a large proportion of tabular cases exist we recommend separate identification of these tabular losses on an undiscounted basis to ensure the ultimate loss is not understated. For many placements, simply identifying the known tabular cases can significantly increase the forecast of ultimate.

Cumulative Injury Losses: These losses generally develop much differently than losses which are not cumulative injury. In addition, the ultimate must be forecast consistent with the applicable theory of liability (manifestation, exposure or other). If cumulative injury (CI) losses represent a large proportion of the total losses, we recommend separate ground-up LDFs be applied.

If individual claimants are considered one claim (versus grouping claimants on one claim), it is not uncommon for many CI claims to settle for amounts well underneath most attachment points. In this case, CI losses will contribute to coverage under an aggregate extension clause only.

Treaty IBNR

The ground-up technique is also appropriate for calculating the IBNR reserve for a treaty placement. As previously mentioned, treaty placements apply to more than one insured, either all insureds or a well defined category of insureds, so the initial match of direct claims with the treaty is usually by size of claim for the reinsured lines of business.

The adjustments for claims in transit, stipulations and tabular claims all apply to the calculation of IBNR for a treaty. In addition, we require the assumption that any facultative placements (either quota share or excess of loss) on layers underneath the treaty are considered to be included in the net retained line of the insurer for purposes of application of the treaty. If facultative placements have been made that inure to the benefit of the treaty, then the effective attachment point of the treaty is increased for these losses. For example, a $5M xs $1M treaty normally provides coverage for each loss excess of $1,000,000. If a facultative placement of $750,000 xs $250,000 is obtained, then the effective attachment point of the treaty is moved to $1,750,000. The $5,000,000 treaty limit still applies. An example is displayed below for a $1,500,000 loss.

Treaty Excess of Loss for a Single Claim
(000's)

Coverage	Layer	Loss	Ceded Loss	Insurer's Retention
Without Facultative				
None	Retention	$ 1,000	$ 0	$ 1,000
Treaty	$5M xs $1M	$ 500	$ 500	$ 0
	Total Loss	$ 1,500	$ 500	$ 1,000
With Facultative				
None	Retention	$ 250	$ 0	$ 250
Facultative	$750 xs $250	$ 750	$ 750	$ 0
None	$750 xs $1M	$ 500	$ 0	$ 500
Treaty	$5M xs $1.75M	$ 0	$ 0	$ 0
	Total Loss	$ 1,500	$ 750	$ 750

The insurer purchases facultative protection to reduce total retained losses. Since there are fewer claims in the higher layers, a larger percentage of the total losses (as well as for this particular claim, above) will be reinsured. The reader is referred to Wiser [2] for a more detailed explanation of mixing reinsurance and, in particular, the cost of mixing.

If facultative placements exist that protect the treaty, the ground-up technique requires that the ground-up direct losses be partitioned by effective attachment point. (This significantly increases the complexity of the loss identification process.) Losses are then developed to ultimate both limited to the effective attachment point and to the new upper bound of the treaty layer. Separate and different LDFs are required for each of these partitions.

Application of Technique

We have described this straightforward, ground-up technique to highlight the issues that need to be considered for the calculation of the reserve for unrecoverable reinsurance. This technique makes many of the same assumptions as those required by a standard direct loss reserving technique, e.g., appropriate LDFs need to be selected. Many additional assumptions that are typically required for a reinsurance reserve are not needed. This technique explicitly considers the (1) distribution of retentions and limits, (2) participation percentages, (3) stipulations, (4) effective data of the placements, (5) aggregate extension clauses, etc.

Confidence: Depending on the number and size of the direct and ceded claims, the source of our LDFs and the maturity of our loss experience, we have a certain degree of confidence in our forecast of the ultimate loss as an estimate

of the actual ultimate loss. If we have a small number of claims at an immature valuation, our degree of confidence is very low, and vice-versa. It is clear that with a small number of claims, the partitioning of the data by placement, etc. will not be possible. There is a balance required between the homogeneity of the data and the amount of data in each grouping.

Recommendations: In addition to the above consideration, this technique quickly becomes unwieldy if there are many individual placements. We recommend this technique in three instances: (1) for the calculation of IBNR for aggregate losses where coverage is triggered under an aggregate extension clause, (2) for facultative or treaty placements where there are a large number of known losses that have exceeded the attachment point or an unusual situation where an explicit, detailed study is desired, and (3) for stoploss reinsurance where an entire portfolio of direct business has to be evaluated in the aggregate.

It is worth noting that, if loss experience is very immature, increased limit factors (ILF) may be used in place of LDFs at the upper bound. Appropriate ILFs are applied to the ultimate losses at the attachment point to obtain the ultimate losses at the upper bound. We do not discuss this approach in detail, since all of the issues discussed above also apply to this technique. This approach is not appropriate for more mature claim groups since ILFs assume an average proportion of large losses and not the actual proportion developing in a mature group.

In addition, after the application of this technique or the methods discussed below, it is appropriate to compare the ceded losses with the ceded premium. Loss ratios on ceded business can be large and volatile, and we do not specifically describe a loss ratio or premium technique in this paper. However, as a reasonableness test, a comparison is appropriate.

2. Excess Loss Development Method

Exhibit III displays a second technique to develop an IBNR reserve. We first partition our ceded losses by policy year, line of business (or subline), retention and limit. The exhibit shows inception to date layer losses at a single valuation date for the liquidating reinsurer only. All losses from all of the reinsurer's placements are included in the appropriate layer and each loss has had the reinsurer's participation rate applied. In addition, these are per occurrence losses only and exclude any losses resulting from the application of an aggregate extension clause. We develop these losses to ultimate using excess LDFs, and subtract known ceded incurred amounts to obtain unrecoverable IBNR.

A single LDF is applied to each layer to obtain the ultimate incurred loss amount for that layer. The selection of the LDF essentially determines the result for this technique for each grouping of loss data. It is beyond the scope of this paper to describe methods for calculating excess LDFs and we refer the reader to Pinto and Gogol [3]. We do discuss some relevant issues concerning the grouping of the ceded losses and the application of LDFs below.

Proportional placements may be grouped with a retention of $0 and appropriate limits. This technique simplifies to the application of standard ground-up LDFs for proportional placements.

The ceded losses can be partitioned as finely as desired (or as finely as possible based on the amount of data), for example, by policy effective month. At a minimum we recommend the partitions discussed above.

Excess of Loss Placement - Combined Insureds

Exhibit III

Excess Loss Development Method

Losses valued 10/1/87
All amounts in 000's.

General Liability
Policy Year 1982

Line	Retention	Limit	Ceded Undeveloped Losses	LDF	Ceded Ultimate Losses	Unrecoverable IBNR
OL&T	$ 100	$ 150	$ 1,650	1.095	$ 1,807	$ 157
	$ 100	$ 400	$ 862	1.124	$ 969	$ 107
	$ 100	$ 900	$ 1,395	1.143	$ 1,594	$ 199
	$ 250	$ 250	$ 1,162	1.166	$ 1,355	$ 193
	$ 250	$ 750	$ 2,812	1.185	$ 3,332	$ 520
	$ 500	$ 500	$ 258	1.213	$ 313	$ 55
	$ 1,000	$ 1,000	$ 2,084	1.249	$ 2,603	$ 519
Products	$ 100	$ 150	$ 1,967	1.206	$ 2,372	$ 405
	$ 100	$ 400	$ 471	1.232	$ 580	$ 109
	$ 100	$ 900	$ 976	1.248	$ 1,218	$ 242
	$ 250	$ 250	$ 175	1.268	$ 222	$ 47
	$ 250	$ 750	$ 1,085	1.284	$ 1,393	$ 308
	$ 500	$ 500	$ 415	1.307	$ 542	$ 127
Total			$ 15,312		$ 18,301	$ 2,989

This method is not appropriate for aggregate calculations. Aggregate development can vary significantly not only by retention and limit but also based on the exposure (or expected total losses) of each insured. Including consideration of exposure in the selected excess development factors is very difficult and subject to great volatility. The aggregate amounts by layer can be calculated much more effectively using the ground-up method.

This methods does not require an adjustment for claims in transit or stipulations if the excess LDFs are based on losses from the ceded system or a similar database. An adjustment is required if the LDFs are derived from losses from a ground-up database. Tabular cases should be identified and the discount explicitly removed to improve the projections.

This technique makes more assumptions than the ground-up method but is generally easier to apply. The assumptions include:

1) The distribution of participation percentages will not change from the distribution based on the present ceded losses.
2) The distribution of losses by retention and limit will not change except as indicated by applying the LDFs.
3) Any stipulations are accounted for properly.
4) The excess LDFs include consideration of the distribution of placements over a policy year. A partition of the losses by effective month and year will more explicitly account for any change in the distribution of placements.

We recommend this technique for standard facultative or treaty placements where the loss emergence and development patterns are not affected by unusual placements or coverages.

Loss Development Factors

Both methods for calculating IBNR are very dependent on the selection of appropriate LDFs. We assume development factors are available, or data is available to calculate development factors. It is beyond the scope of this paper to describe procedures for the calculation or derivation of development factors. Major issues regarding the appropriateness of development factors for each technique are as follows.

1. Ground-up development factors at various per occurrence limits are required for the first technique. The data used to construct these factors should consist of ground-up claims limited on a per occurrence basis at each stage of development.

   For a facultative placement reinsuring a single insured's annual policy, accident year development factors are appropriate. For very large insureds with large known or potential ceded losses, and historically different than average development patterns, the insureds own experience should be considered in calculating the LDFs.

   Accident year factors are also appropriate for a treaty written on a losses occurring basis. A treaty providing coverage on a risks attaching basis requires the use of policy year LDFs. And, these policy year LDFs should be constructed to include consideration of the timing of the effec-

tive dates of the underlying policies over the policy year. For a treaty on a claims made basis, claims made LDFs are appropriate, which develop only the known losses to ultimate.

2. Excess development factors are required at various attachment points and limits for the second technique. These factors can be constructed from either ground-up or excess loss data. If excess loss data from a ceded claim database is used, claims in transit and stipulation adjustments are not required.

   For the excess technique, either accident year or policy year LDFs are required corresponding to either an accident or policy year partitioning of the data. Both kinds of development factors need to be adjusted to include consideration of the timing of the effective dates of the facultative placements or the policies underlying the treaties.

3. In general, we expect excess loss development to be more volatile than ground-up loss development. There are fewer and larger claims in the excess layers compared to the primary layers, resulting in more opportunity for volatility as new claims are reported or as old claims develop. One of the reasons we recommended the ground-up technique, where a specific detailed analysis of a placement is desired, is because of the greater stability of the ground-up LDFs.

4. In addition, excess LDFs are also generally larger than ground-up LDFs. Loss development is due to both late reported claims and the change in the shape of the claim size distribution at successive valuations. The claim

size distribution tends to become more skewed to large claim amounts as the experience matures, resulting in a proportionately larger increase in excess losses (and greater LDFs) than for ground-up losses.

Ground-up and excess loss development can be conceptually related by considering a decomposition of losses into claim counts and a claim size distribution.

The losses in the layer can be described by

$$E(n)\ [\int_a^b (x-a)f(x)dx + \int_b^\infty (b-a)f(x)dx], \qquad (1)$$

where f(x) is the claim size distribution and E(n) is the expected claim counts over the entire distribution. a is the attachment point and b is the upper bound of the layer.

It can easily be shown that (1) is equivalent to

$$E(n)\ [\int_o^b xf(x)dx + \int_b^\infty bf(x)dx] \ - \ E(n)\ [\int_o^a xf(x)dx + \int_a^\infty af(x)dx] \quad (2)$$

The losses in the layer are seen to be equal to the difference between the ground-up losses limited to the attachment point and then limited to the upper bound of the layer.

Given the empirical observation that the distribution f(x) becomes more skewed as the valuations mature, we can explain the larger excess development factors by noting that as $f_t(x) \rightarrow f(x)$, the losses limited to b will

increase more than the losses limited to a, resulting in larger excess LDFs. $f_t(x)$ is defined as the distribution at valuation date, t.

3. Pareto Curve Method

We can also describe the losses in the layer as the difference between the top-down losses limited to the attachment point and the upper bound of the layer. Formula (1) equals:

$$E(n)\ [\int_a^{\infty} (x-a)f(x)dx - \int_b^{\infty} (x-b)f(x)dx] \qquad (3)$$

A claim size distribution curve fitting technique is appropriate for a more recent treaty or facultative placement that has few losses at the current valuation. Especially if prior years of similar contracts have a reasonable number of losses and can be used to estimate curve parameters. The pareto curve is a natural curve to fit since it models only excess losses. We use the single parameter pareto, as described by Philbrick [4], for ease of calculation. The density function of a pareto is defined, with Philbrick's notation, as

$$f(x) = qx^{-(q+1)} \qquad (4)$$

Exhibit IV displays individual OL&T losses greater than $750,000 for policy year 1981. We want to forecast the losses in the layer $500,000 xs $750,000 for a more recent policy year. These losses can be used to estimate the parameter of a pareto curve to describe the claim size distribution for future policy years. We have estimated a pareto parameter, q = 1.554, using $750,000 as the lower bound of the curve and $4,000,000 as the truncated upper bound.

Pareto Curve Method

Loss amounts in 000's.

General Liability Losses > $750,000
Policy Year 1981

	Losses	Normalized Loss K=750	Ln of Normalized	
				$750 k, the attachment point
	$ 792	1.056	0.054	$1,250 the upper bound
	848	1.131	0.123	$4,000 the truncation point
	900	1.200	0.182	1 a, the normalized attachment point
	958	1.277	0.245	1.6667 b, the normalized upper bound
	972	1.296	0.259	5.3333 t, the normalized truncation point
	958	1.277	0.245	13 n, number of losses
	1,000	1.333	0.288	
	1,260	1.680	0.519	1.5540 q, pareto parameter
	1,475	1.967	0.676	
	1,759	2.345	0.852	0.4449 Normalized layer mean claim size
	1,836	2.448	0.895	$334 Layer mean claim size
	2,235	3,289	1.092	
	2,467	3.289	1.191	
Total	$ 17,460		6.622	

General Liability Losses > $750,000
Policy Year 1986 Forecast

15 Expected number of claims
$334 Layer mean claim size

$5,005 Expected losses in layer

As displayed on Exhibit IV, the losses are normalized by dividing by the lower bound of the pareto curve, k = $750,000, which in our example also corresponds to our attachment point. This results in a normalized pareto distribution. The formula for the average claim size in the layer can be derived from formulas (3) and (4) and is

$$\text{Layer Mean Claim Size} = \frac{1-b^{(1-q)}}{q-1} \qquad (5)$$

Where b = 1.667 and equals the normalized upper bound of the layer ($1,250,000/$750,000). With q = 1.554, the normalized mean claim size equals 0.4449, and the actual mean claim size equals $333,675 (0.4449 x $750,000).

If we expect 15 claims in the treaty for the more recent year, we obtain expected ultimate losses of $5,005,125. We subtract known adjusters from this ultimate to obtain unrecoverable IBNR.

We estimate the parameter q using the maximum likelihood estimate (MLE) of a truncated pareto curve. We have truncated the curve at $4,000,000 since we believe that losses above this amount are extremely rare and not reflected in our policy year 1981 data. For a truncated distribution the MLE of q is

$$q = \frac{n}{\ln x_i + \frac{n(\ln t)}{t^q - 1}} \qquad (6)$$

We solve for q using an iterative technique and obtain q = 1.554.

OTHER ISSUES

Proof of Claim and Distribution of Assets

The proof of claim required by liquidators varies by jurisdiction. Certainly, certificates of insurance, and documentation for both unrecoverable known claims and IBNR is required. All of the calculation methods above can be applied to the placements for a single liquidating reinsurer.

The distribution of the assets of the liquidating reinsurer follows a priority in distribution to creditors. In most jurisdictions, it seems very unlikely that a ceding insurer will receive much, if any, of the reinsurer's assets. The law in some jurisdictions explicitly requires that insurers share in the assets only after claims from primary policyholders. In those jurisdictions that do not specifically differentiate primary policyholders from ceding company policyholders, the expectation is that court interpretations will indicate that primary policyholders will take priority over ceding companies.

State guarantee funds do not cover reinsurance contracts. Insurance exchanges, where reinsurance is placed with member syndicates, do provide security funds to cover the unpaid liabilities of insolvent syndicates. However, the actual availability and adequacy of these security funds, for some exchanges, is currently an open question.

In most liquidations it appears there will be much litigation before any distribution of assets occur. The decision to reduce the reserve for any expected future distribution of assets is a judgemental decision.

Offsets

A more complete picture of the unrecoverable balance includes a review of the amount of offsets, e.g., assets of the reinsurer held by the ceding insurer. Offsets to the unrecoverable loss amounts include collateral specifically for reinsurance placements as well as funds retained by the insurer for other agreements with the reinsurer. Collateral can consist of funds withheld, letters of credit or trust funds.

The availability of any of these funds to offset the unrecoverable ceded losses varies by jurisdiction. All offsets should be reviewed when establishing a reserve for unrecoverable reinsurance, but the ability to offset should be considered before the reserve is reduced.

For example, a strong case can be made for offsetting the unreimbursed ceded paid losses with funds that have been withheld by the insurer specifically for the liquidating placements, and some jurisdictions allow such offsets. A much weaker case is made for withholding funds that the insurer owes the reinsurer for other agreements (e.g., if the reinsurer places retrocession business with a subsidiary of the insurer). Even if collateral is a clean letter of credit, drawdowns can be blocked as representing a preference over other creditors. Accurate recording of offsets and an understanding of the laws in the appropriate jurisdiction is essential.

Reinsurers with Potential for Liquidation

A reserve for unrecoverable reinsurance is also calculated for each reinsurer with only the potential for liquidation. We then assign a subjective liquidation probability to each reinsurer's reserve. The combination, summed across

all reinsurers, yields an expected value estimate of the reserve for reinsurers that will liquidate in the future. We apply this technique only to reinsurers that are near liquidation since it assumes they are no longer reimbursing us for ceded paids. For identification of these potential reinsurers, we refer the reader to Ludwig and McAuley [5].

We have not developed more than a subjective technique for assigning a liquidation probability. Consideration is given to tracking the discriminating ratios discussed in Ludwig and McAuley [5], reviewing the company security committee's recommendations based on more in-depth financial analysis, following activity improving or degrading the reinsurer's financial position, e.g., recent cash infusions from the parent, the potential for a buyout, recent placement in rehabilitation, etc. As the fortunes of the reinsurer changes, the liquidation probability should also change.

The letters of credit, covernotes and other placement documents should be reviewed for completeness for reinsurers with liquidation potential. Commutations should also be considered if the potential recovery of funds is greater than from a likely liquidation.

Commutations and Novation Agreements

Both commutation and novation agreements are techniques that the ceding insurer can use to attempt to minimize exposure to loss for reinsurers with liquidation potential.

A commutation agreement is an agreement to transfer the ceded liabilities from the reinsurer back to the ceding insurer. Once a commutation agreement is com-

plete, ceded claims are no longer sent to the reinsurer. The techniques described for estimating the reserve for unrecoverables can also be applied to estimating the liabilities to be transferred by the commutation agreement. Additional considerations for commutations are identified below but not discussed in this paper:

1. The ultimate ceded losses are invariably commuted on a discounted basis. The known tabular Workers' Compensation cases can be explicitly discounted, but losses from other lines of business and IBNR losses require an assumption of a payment curve. The interest rate used to discount the amounts is negotiated.

2. If losses are discounted, it is appropriate to include a risk load in the estimation of the ultimate liabilities. A market driven price for this business transaction should include (theoretically at lease) potential profit which is released to the bottom line as the losses settle and the uncertainty regarding the transaction diminishes.

3. The commutation raises financial reporting questions. Should the commutation be treated as a distinct business transaction (essentially stop loss reinsurance) and the price paid to the insurer recorded as premium? Should the original ceded reinsurance premium be reversed? In addition, should the amount of the discount be immediately reflected in the underwriting results (direct loss reserves are unchanged, ceded loss reserves are reduced)?

4. The price for a commutation is a negotiated price. Often, the ceding insurer will not be able to obtain a price based on the discounted liabilities with a risk load. This raises additional financial reporting questions. When should this supposed loss be recorded?

A novation agreement is an agreement to substitute a new contract in replacement of an old one. The new contract can be an agreement between the same parties or can include additional parties. In a typical novation agreement, the ceding insurer agrees to accept a partial reimbursement from the reinsurer for each current and future loss ceded. The reinsurance continues but the effective percentage participation of the reinsurer is reduced.

In our example in the claims processing section, we have three reinsurers participating in the layer $1M xs $1M. In particular, reinsurer #3's participation percentage is 20%. The uncollected ceded paid due from Reinsurer #3 is $75,000 and the outstanding loss not yet billed is $120,000. A novation agreement providing for a partial reimbursement of 50% would reduce the paid losses due to $37,500 and future payments on the outstanding loss to $60,000. In addition, any future claim (IBNR) would be reimbursed at a new effective participation percentage of 10%.

This is just one example of a novation agreement. Any contract that replaces the former reinsurance agreement is a novation agreement, although, it often reduces the liability of the reinsurer in some fashion. The techniques described above for estimating the reserve for reinsurers in liquidation can also be applied to estimate the liabilities reduced or transferred by a novation agreement. All of the issues mentioned above for commutations also apply to novation agreements.

CONCLUSION

This paper has described techniques for the estimation of the reserve for unrecoverable reinsurance and the issues and considerations regarding the application of the techniques. These methods are appropriate for calculating the amounts to be filed with the liquidators of a particular reinsurer as well as for adjusting the ceding company financial reports to recognize uncollectible reinsurance. In addition, the liabilities affected by a potential commutation or novation can be estimated, strengthening the ceding company position in any negotiation process.

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