ESTIMATING THE PREMIUM ASSET ON RETROSPECTIVELY RATED POLICIES

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Abstract

This paper presents a method for estimating the premium asset on retrospectively rated policies, using the functional relationship between the losses and the retrospective premium. This relationship is examined using the historical premium and loss development data and the retro rating parameters sold in the underlying policy. The cumulative ratio of premium development to loss development, when applied to the expected future loss emergence, gives the expected future premium development on the retro rated policies. The sum of all future premium development is the premium asset.

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1. INTRODUCTION

On retrospectively rated policies, premium that the insurer expects to collect based on the expected ultimate loss experience, less the premium that the insurer has already booked, is called the premium asset. Many insurers call this the Earned But Not Reported premium (EBNR). The admitted portion of the premium asset appears on the balance sheet as the "Asset for Accrued Retrospective Premiums."

In recent years, retro rated policies have become popular for several reasons.

1. A retro rated policy returns premium to the insured for good loss experience. This feature is attractive for a customer who anticipates favorable loss experience through loss control and loss management. By offering retro rated policies, the insurer may be able to attract these good customers.

2. A growing number of commercial insurance buyers are taking advantage of the cash flow feature in a retro rated policy. A retro rated policy allows the insured to pay premium as losses are reported or paid, depending on the contract, rather than paying all premiums up front. This allows the insured to hold on to cash longer.

3. Inflation, rate regulations, uncertainty in claims compensability, increasing utilization of the insurance benefits, and growing attorney involvement have made the cost of insurance much harder to predict today than in the past. Since the premium for a retro rated policy varies directly with the insured's actual loss experience, writing retro policies allows an insurer to shift a large portion of the actual risk to the insured. This makes the insurer more willing to write insurance.

As a result of the growth of retro rated policies, estimating the premium asset for them is a growing need for many commercial lines insurers. This asset frequently exceeds 10% of surplus. Despite the growing importance of the premium asset, there have been few articles written on this subject. Berry [1] and Fitzgibbon [2] have presented methods of calculating the "retro reserve," defined as the difference between the *premium deviation to date* and the *ultimate premium deviation*.[1] The retro reserve is the negative equivalent of the premium asset referred

[1]The ultimate premium deviation is the amount by which the ultimate premium for a retro rated policy is expected to differ from the standard premium (manual premium adjusted for experience rating). The premium deviation to date is the amount by which the currently booked premium differs from the standard premium.

to in this paper. Their approach is to analyze the historical relationship between the loss ratio and the premium deviation using statistical techniques, and then apply such a relationship to the projected loss ratio to calculate a projected ultimate premium deviation. This ultimate premium deviation is then reduced by the premium deviation to date to produce the retro reserve. Berry uses a second approach, which is to estimate ultimate premium using the historical premium emergence pattern, and then subtract current premium to get the retro reserve.

While the statistical methods presented in [1] and [2] may be theoretically sound, they lack intuitive appeal, particularly as they relate to how a retro rating formula actually works. On a retro rated policy, premium is calculated as a function of loss. This function is composed of retro rating parameters such as the loss conversion factor, tax multiplier, retro minimum, and retro maximum; they define how much premium an insurer can collect given a certain amount of loss. Therefore, the premium asset on a retro rated policy should be established as a function of reported losses and the reserve for loss development, where this function is defined by the retro rating parameters.

This paper will present, through an example, a method of calculating the premium asset as a function of current losses, expected future loss emergence, and the retro rating parameters. Specifically, the method looks at how premiums develop as losses develop. The relationship can be expressed as the ratio of premium development to loss development, referred to here as the PDLD ratio. There are two methods of calculating the PDLD ratio—from historical premium and loss development data, and from the retro rating parameters. The latter approach will be developed first, and will be followed by the calculation of the PDLD ratios from historical data. Once the relationship between premium and loss is determined, it can be applied to the expected future loss development to get the expected future premium development. The sum of all future premium development is the premium asset.

This method applies only to retro rated polices (or similar loss sensitive rating plans), and not to prospectively rated policies. There may be a premium asset on prospectively rated polices due to changes in exposure, but this topic will not be discussed here. This method is intended to be applied to an aggregate book of business, or large segment of a book of business, rather than at the individual policy level.

2. THE FORMULA APPROACH TO CALCULATING PDLD RATIOS

The first step is to derive the formula for a PDLD ratio. This starts with the first retro adjustment. On a retro rated policy, the premium calculation is based on a retro formula. A commonly used formula is

$$P_n = [BP + (CL_n \times LCF)] \times TM, \tag{2.1}$$

where

P_n = Premium at the n^{th} retro adjustment,

BP = Basic premium,

CL_n = Capped loss at the n^{th} adjustment[2],

LCF = Loss conversion factor, and

TM = Tax multiplier.

For example, P_1 denotes the premium computed for the first retro adjustment; P_2 denotes the premium computed for the second retro adjustment. Note that BP, LCF, and TM typically stay the same throughout all retro adjustments. For a more thorough discussion of the retro rating formula, see Gillam and Snader [3].

Using formula (2.1) and denoting L_1 as the amount of loss developed for the first retro adjustment, the first PDLD ratio

[2]Losses that contribute to additional premium: these are total losses subject to a minimum and a maximum amount corresponding to the plan minimum and maximum premiums. Individual claims may also be capped by a per accident limitation, which limits the adverse impact of any single large claim on the premium calculation.

can be stated as follows:

$$P_1/L_1 = [BP + (CL_1 \times LCF)] \times TM/L_1$$
$$= [(BP/L_1) \times TM] + [(CL_1/L_1) \times LCF \times TM]. \quad (2.2)$$

The first term of this formula is $(BP/L_1) \times TM$. This is basic premium divided by the loss emerged for the first retro adjustment times the retro tax multiplier. One can approximate this as

$$BP \times TM/(SP \times ELR \times \%Loss_1), \quad (2.3)$$

where

SP = Standard premium,[3]

ELR = Expected loss ratio

= Expected ultimate loss divided by standard premium, and

$\%Loss_1$ = Expected percentage of loss emerged for the first adjustment.

Formula 2.3 is equivalent to $(BP/SP) \times TM/(ELR \times \%Loss_1)$, which is the basic premium factor in a retro rating formula times the tax multiplier, divided by the expected loss ratio emerged for the first retro adjustment. The expected loss ratio for the first retro adjustment would depend on the ultimate expected loss ratio and the percentage of losses emerged at the first adjustment. Typically, losses emerged as of 18 months are used to compute the first retro adjustment.

In Formula 2.2, the term CL_1/L_1 is the ratio of capped losses to uncapped losses. This ratio is referred to as the *loss capping ratio*. Capped losses are losses that contribute to an additional

[3]Manual premium adjusted for experience rating.

premium. Any change in loss, where total loss exceeds the minimum and is below the maximum, will result in additional premium. Conceptually one can view the difference between the capped loss (CL) and the uncapped loss (L) as the portion of loss outside the boundaries of the retro maximum and minimum. On plans that cap the losses with a per accident loss limit, the capped loss would also exclude the losses exceeding this limit, since they do not contribute to additional premium. The loss capping ratio usually decreases as the data becomes more mature. This is because an increasing portion of the loss development occurs outside of loss limitations. The loss capping ratio can be derived by comparing the capped and the uncapped loss development, if such data are available; often they are not. In this paper, the loss capping ratio is derived using a loss ratio distribution. Because the explanation of this method is somewhat detailed, it is presented after the example of the PDLD ratio calculation, in Section 5.

If the loss data used is already capped (i.e., L_n equals CL_n for all n), then the loss capping ratio will be one. Otherwise, this ratio will have to be estimated. The example assumes that the loss capping ratio is 0.85 for losses developed through the first retro adjustment. This means that 15 percent of the losses developed through the first retro adjustment are eliminated by the net effect of the retro maximums, minimums, and per accident limitations.

To show how Formula 2.2 can be used to estimate the PDLD ratio, the example assumes the following retro rating parameters:

$$\text{Basic premium factor} = 0.20$$

$$\text{Expected loss ratio} = 0.70$$

$$\text{Loss conversion factor} = 1.20$$

$$\text{Tax multiplier} = 1.03$$

$$\%\text{Loss}_1 = 78.4\%.$$

These retro rating parameters may be computed as the average of the sold retro parameters. Substituting these values into Formula 2.2, one gets a PDLD ratio for the first retro adjustment of

$$[0.20 \times 1.03/(0.70 \times 78.4\%)] + (0.85 \times 1.20 \times 1.03) = 1.426.$$

The PDLD ratio for the second retro adjustment period refers to the *incremental premiums* developed between the first and the second retro adjustments, divided by the *incremental losses* developed between these two adjustments. Typically, successive retro adjustments occur at one year intervals. One can view the PDLD ratio for the second retro adjustment period as the ratio of the *change in premium* divided by the *change in loss*. Algebraically, this equals

$$\begin{aligned}(P_2 - P_1)/(L_2 - L_1) &\\ &= (CL_2 - CL_1) \times LCF \times TM/(L_2 - L_1)\\ &= [(CL_2 - CL_1)/(L_2 - L_1)] \times LCF \times TM. \qquad (2.4)\end{aligned}$$

This example assumes an incremental loss capping ratio of 0.58 for the second retro adjustment period. Substituting this loss capping ratio and the retro rating parameters into Formula 2.4, one gets a PDLD ratio of $0.58 \times 1.20 \times 1.03 = 0.717$. The PDLD ratios for the third and subsequent retro adjustments are calculated in a similar manner.

The advantage of using the retro formula to estimate the PDLD ratio is that it responds to changes in the retro rating parameters that are sold, whereas the PDLD ratios derived from the historical data may not be indicative of the future PDLD ratios. If the retro rating parameters change significantly over time, one should give more weight to the PDLD ratios derived by formula than those derived from the historical data. A summary of the formula PDLD ratios is shown in Exhibit 4, Part 2.

When possible one should retrospectively test the PDLD ratios derived by formula against actual emergence in the subsequent retro adjustment periods to determine if any bias exists. A possible source of bias is the use of average parameters for the LCF, tax multiplier, maximum, minimum, and per accident limitation. One should study the appropriateness of the selections and adjust them as necessary. Such a study could lead to better parameter selections and more accurate premium estimates.

3. THE EMPIRICAL APPROACH TO CALCULATING PDLD RATIOS

The use of empirical data is another way to calculate the PDLD ratios. Two types of data are needed for the empirical approach: booked premium development and reported loss development.[4] For the example presented in this paper, premium booked by policy effective quarter by valuation quarter is displayed in Exhibit 6 and reported loss data is shown in Exhibit 7. The calculation of the PDLD ratios is shown in Exhibit 4. The PDLD ratio after the sixth retro adjustment is selected at zero, which assumes that there are no further retro adjustments.[5]

Data should be segregated into homogeneous groups by size of account and by the type of rating plan sold. When appropriate, other criteria should be used in grouping the data. Policies are grouped based on the calendar quarter in which they became effective. These groups will be referred to as policy effective quarters. The first policy effective quarter of 1994 will be

[4]Booked premium on a retro rated policy is the premium computed using the retro rating formula and the most recent loss valuation. Reported loss is the amount of loss that has been reported to the insurer. It does not include future loss development for unreported claims, for such losses are often not entered into the premium calculation.

[5]The NCCI and ISO retrospective rating manuals prescribe a maximum premium adjustment period of 3 to 4 years. The actual maximum adjustment period varies from one retro policy to another. A maximum premium adjustment period of six years is common among major commerical line retro policies. However, due to increasing uncertainty of loss costs and growing usage of cash flow financing of premiums, retro policies will probably be written with longer premium adjustment periods in the future.

denoted as 1994.1, the second quarter will be denoted as 1994.2, and so on.

The first retro premium computation is usually based on losses developed through 18 months. However, it takes time to do the retro calculation and to record adjusted premiums. This paper assumes that due to time lags in processing and recording, premiums are recorded 3 to 9 months following the recording of losses. Therefore, it is assumed that premiums booked through 27 months are the result of the first retro adjustment. Since retro adjustments are usually done in annual intervals, premiums recorded through 39 months would be the result of the second retro adjustment, using losses evaluated at 30 months. Premiums recorded through 51 months would be the result of the third retro adjustment, using losses evaluated at 42 months, and so on. In practice, the actual length of the retro adjustment period and the premium booking lag may vary from one insurer to another.

The PDLD ratio for the first retro adjustment equals premiums booked through 27 months divided by losses reported through 18 months. At the first retro adjustment period, the PDLD ratio indicated by an overall average of the historical data is 1.460 (see Exhibit 4, Part 1). However, there is an upward trend in the responsiveness of premium to loss over the latest several policy quarters and these PDLD ratios are higher than the historical average. Such a trend could be the result of more liberal retro rating parameters (higher maximum, minimum, or per accident limitation), but this is probably not the case here since the PDLD ratio calculated by formula is 1.426 and it reflects the plan parameters currently being sold. A more likely explanation for the trend is an improvement in loss experience, either due to chance or to known changes in the system such as workers compensation reform. A larger portion of the loss is within the boundaries of the retro maximum and the per accident limitation, resulting in more additional premium per dollar of loss. The formula approach will not reflect a change in loss

experience unless the formula is revised. (This revision is discussed in Section 5.) In recognition of these changing conditions, a PDLD ratio of 1.750 was selected for the first adjustment.

The PDLD ratio for the second retro adjustment period is the *incremental premiums* developed between the first and the second retro adjustments divided by the *incremental losses* developed between these two adjustments. It is assumed that losses developed through 30 months are used to calculate the premiums for the second retro adjustment and that the resulting premiums are booked at the 39 month valuation. The selected PDLD ratio from historical data is 0.700, which is close to the formula ratio of 0.717. The PDLD ratios from the two methods also compare closely at the third adjustment.

The historical PDLD ratios may fluctuate significantly after the first retro adjustment period. This is because the premium and loss development on a few policies can be a large component of the total incremental development on policy quarter data. Historical PDLD ratios for an individual policy quarter could even be negative in spite of upward aggregate loss development—this could happen when there is upward development in high loss layers (resulting in no additional premium) and downward development (and return premium) on layers that are still within loss limitations. Where the historical PDLD ratios fluctuate significantly, one should use an average of as many historical data points as possible. In situations like this, the PDLD ratios derived by formula may provide a better indication of the relationship between premium and loss.

In the example, the historical and formula PDLD ratios begin to diverge after the third retro adjustment period. Several factors could be contributing to this. First, since the historical ratios are lower than the formula ratios, worse than expected loss experience during the mid-1980s may have caused a larger portion of the loss to be outside the boundaries of the retro maximum and the per accident limitation than the formula approach would

predict. This is the opposite situation from the one described at the first retro adjustment period above. Second, average retrospective rating parameters may be changing over time. In the case of shifting parameters over time, a single selected PDLD ratio may not be the best estimate of development for all exposure periods. As with loss development analysis, the actuary must decide how best to develop each period to "square the triangle." For the fourth through sixth adjustment periods, the PDLD ratios were selected between those indicated by the two methods.

4. CUMULATIVE PDLD RATIOS

The ultimate goal of this method is to estimate the premium asset, which is the sum of all future premium adjustments based on the expected future loss emergence. As shown before, the relationship between premium and loss can be expressed by the PDLD ratios. However, the PDLD ratios are incremental factors. To estimate how much premium can be expected based on all future loss development, one needs to calculate the cumulative PDLD ratios, or the CPDLD ratios.

A CPDLD ratio is the average of the PDLD ratios in all subsequent retro adjustment periods, weighted by the percentage of losses to emerge in each period. For instance, the CPDLD ratio at the second retro adjustment is the average of the PDLD ratios for the second and subsequent retro adjustment periods, weighted by the percentage of losses emerged in each period. The CPDLD ratio at the third adjustment is the average of the PDLD ratios for the third and subsequent retro adjustment periods, weighted by the percentage of losses emerged in each period. The loss emergence pattern is shown at the bottom of Exhibit 7.

Using the loss emergence pattern derived from the loss development data in Exhibit 7 and the selected PDLD ratios from Exhibit 4, one can calculate the CPDLD ratios. For example, the

first CPDLD ratio equals 1.492, which is computed as follows:

$$\frac{(1.750 \times 78.4\% + 0.700 \times 9.3\% + 0.550 \times 4.4\% + 0.450 \times 2.9\% + 0.400 \times 3.0\% + 0.350 \times 1.6\%)}{(78.4\% + 9.3\% + 4.4\% + 2.9\% + 3.0\% + 1.6\% + 0.4\%)}.$$

The second CPDLD ratio is 0.556, which is computed as follows:

$$\frac{(0.700 \times 9.3\% + 0.550 \times 4.4\% + 0.450 \times 2.9\% + 0.400 \times 3.0\% + 0.350 \times 1.6\%)}{(9.3\% + 4.4\% + 2.9\% + 3.0\% + 1.6\% + 0.4\%)}.$$

The calculation of the remaining CPDLD ratios is shown in Exhibit 3.

The CPDLD ratio tells how much premium an insurer can expect to collect for a dollar of loss that has yet to emerge. For instance, the first CPDLD ratio is 1.492, which means that each dollar of loss emerged provides the insurer one dollar and 49 cents of premium. The second CPDLD ratio is 0.556, which means that after the first retro adjustment, each additional dollar of loss provides the insurer 56 cents of premium.

The relationship of premium development to loss development is usually greater than unity at the first retro adjustment. This is because the basic premium is included in the first retro premium computation, and because only a small portion of loss is limited by the retro maximum or per accident limitation at this early maturity. The application of the loss conversion factor and the tax multiplier results in more than a dollar of premium per dollar of loss. As time goes on, however, a decreasing portion of incremental loss development results in additional premium. Incremental premium, equal to the loss capping ratio times LCF and TM, will generally be less than loss and hence the CPDLD ratios should be less than 1.0 at the later adjustments.

Having calculated the CPDLD ratios, the next step is to multiply these ratios by the expected future loss emergence to get the expected future premiums. Adding future premiums to

the booked premiums gives ultimate premiums. For example, at 12/31/94, policy effective quarters 1993.1 through 1994.4 have not yet had the first retro adjustment (they are all less than 27 months old). The expected loss amount for these policy effective quarters, as computed in Exhibit 2, is $280,844,000 ($196,767,000 from 1993, plus $84,077,000 from 1994). Since the marginal premium per dollar of loss is $1.492, this means $280,844,000×1.492 or $419,019,000 of future premium is expected. Since there was no prior retro adjustment, the expected ultimate premium for these policy effective quarters is $419,019,000.

At 12/31/94, policy quarters 1992.1 through 1992.4 have had one retro adjustment (they are older than 27 months but not yet 39 months old). For these policy periods, the expected amount of loss yet to emerge is $50,747,000 (see Exhibit 2). Exhibit 3 shows that for each dollar of loss emerged after the first retro adjustment, the insurer can expect $0.556 of premium. This means the insurer can expect to collect $50,747,000×0.556 or $28,216,000 in additional premium. Adding this to the $328,778,000 of premium booked from the first retro adjustment (the premium for 1992.1 through 1992.4 evaluated as of 27 months), gives an expected ultimate premium of $356,993,000. Exhibit 1 shows the calculation of the ultimate premium for each policy period.

The final step is to subtract premium booked as of 12/31/94 from the estimated ultimate premium to get the premium asset as of 12/31/94. The sum of the premium assets for all policy periods as calculated in Exhibit 1 is $43 million.

Note that the premiums booked as of 12/31/94 (Column (7) of Exhibit 1) are close to but not equal to the premiums booked from the prior retro adjustments (Column (5) of Exhibit 1). This may be due to differences in the timing of retro adjustments, minor premium adjustments, or interim premium booking that occurs between the regularly scheduled retro adjustments.

5. LOSS CAPPING RATIO

We now return to the subject of the loss capping ratio. The loss capping ratio, CL/L, is the ratio of capped loss development to uncapped loss development. This term is essential to the calculation of the PDLD ratio, which expresses the relationship between premium development and loss development on a retro rated policy. Capped loss development includes the effect of the retro maximum and minimum, and the per accident loss limit. It is often difficult to obtain capped loss development data, especially as it pertains to losses eliminated by the retro maximum and minimum. Hence, it may be necessary to use a Table M[6] approach to estimate the impact of the retro plan maximum and minimum on loss development. If a per accident limit is purchased, the treatment of the losses eliminated by the limit is similar to that for losses eliminated by retro maximum and minimum.

The loss capping ratio can be solved for using the relationship

$$\text{CLR} = \text{LR}(1 - \chi - \text{LER}),$$

where

χ = Table M net insurance charge
= Table M charge at max − Table M savings at min,
LER = Percent of losses eliminated due to the per accident limitation,
CLR = capped loss ratio
= capped loss divided by standard premium, and
LR = uncapped loss ratio
= uncapped loss divided by standard premium.

[6]Also called the Table of Insurance Charges. Table M is used to calculate the insurance charge associated with a retro plan's maximum and minimum. Gillam and Snader [3] give a detailed description of this table.

The loss capping ratio is then:

$$\text{CLR/LR} = (1 - \chi - \text{LER}). \tag{5.1}$$

To calculate the loss capping ratio, one needs the net insurance charge at each retro adjustment period. The insurance charge is typically determined from the values of the retro rating parameters sold under the plan and the presumed loss ratio distribution underlying Table M. However, the percentage of losses actually affected by the retro maximum or minimum will differ from expected due to the random nature of insurance losses and the fact that losses are not at their ultimate valuation. Therefore, the charge and savings computed at each retro adjustment period should be a function of the actual loss ratio as opposed to the expected ultimate loss ratio under the plan.

If it is assumed that the loss ratio probability distribution function has the same shape throughout all development stages, then at each retro adjustment one may enter Table M by defining two entry ratios:

Entry ratio at the max = (loss ratio at max/actual loss ratio), and

Entry ratio at the min = (loss ratio at min/actual loss ratio).

Loss ratios at the retro maximum and minimum should be estimated from the sold retro rating parameters. The loss ratio at maximum is the standard premium loss ratio at which the net retro premium reaches the maximum premium; for this example, we assume it is 1.200. Similarly, the loss ratio at minimum is the standard premium loss ratio at which the net retro premium reaches the minimum premium; for this example, we assume it is 0.100.

The actual loss ratio may be computed by dividing the actual loss at each retro adjustment period by the standard premium. Alternatively, it can be estimated as the expected loss ratio (expected ultimate loss divided by standard premium) times the expected percentage of losses emerged at each retro adjustment. For instance, if the expected loss ratio is 0.700 and 78.4% of

losses emerge by the first retro adjustment, one can estimate the actual loss ratio at the first retro adjustment to be $0.700 \times 78.4\%$, or 0.549.

If actual loss experience differs from the expected experience underlying Table M, one should multiply the estimate of the actual loss ratio by a factor representing the relationship between actual and expected losses. For example, if the original expected loss ratio was 0.700 but actual loss experience produces an average loss ratio of 0.800, multiply 0.549 by a factor of 0.800/0.700. Such an adjustment factor is needed to calculate the correct entry ratios for Table M.

The two entry ratios for the first retro adjustment can be computed as:

$$\text{Entry ratio at the max} = (1.200/0.549) = 2.19, \text{ and}$$

$$\text{Entry ratio at the min} = (0.100/0.549) = 0.18.$$

Table M also requires one to estimate the average size of the accounts insured by the retro rated policies. For this example, the average size is assumed to be $750,000 in standard premium. This may be estimated from the sold policy information. The use of the average policy size is another potential source of bias between the PDLD ratios calculated using the formula method and the PDLD ratios that actually emerge. One way to reduce this bias is by grouping the data according to policy size. The net insurance charge for a $750,000 account at 2.19 and 0.18 entry ratios is calculated to be 0.109. This is shown in Exhibit 5.

In the event that a per accident loss limit is sold, losses eliminated by such limit divided by total losses should also be considered in the calculation of the loss capping ratio. Furthermore, the Table M insurance charge should be adjusted to reflect the per accident loss limit. One method of making such an adjustment is presented by Robbin [4]. In this example we assume that 4.2% of losses are eliminated by the per accident limitation as of the first retro adjustment. Thus, the loss capping ratio at

the first retro adjustment is one minus 0.109 (the net insurance charge) minus 0.042 (the per-accident loss elimination ratio), or 85%. Loss capping ratios for the second and subsequent retro adjustment periods are calculated in Exhibit 5.

By using Table M to calculate the loss capping ratios, one major assumption is that the loss ratio probability distribution function underlying Table M is appropriate for all retro adjustment periods. This may not be true. The procedure can be refined by using a loss ratio distribution that is more appropriate for each retro adjustment period. Such distributions may be calculated from empirical data at the proper evaluation dates, and be used to replace or modify the Table M distribution, depending on the credibility of the empirical data.

Thus far the loss capping ratios calculated are those developed as of each retro adjustment. Since the PDLD ratios are incremental, one needs to calculate the incremental loss capping ratios, using the loss capping ratios developed through each retro adjustment. This is done by algebraic manipulation. For example, the incremental loss capping ratio for the second retro adjustment period is $[(CL_2 - CL_1)/(L_2 - L_1)]$ which may be stated as

$$\frac{[(CL_2/L_2) \times (ELR \times \%Loss_2) - (CL_1/L_1) \times (ELR \times \%Loss_1)]}{[(ELR \times \%Loss_2) - (ELR \times \%Loss_1)]}. \tag{5.2}$$

Note L_n is the amount of losses emerged as of the nth retro adjustment, and CL_n/L_n is the loss capping ratio developed as of the nth retro adjustment. The ELR is the expected loss ratio, and $\%Loss_n$ is the expected percentage of losses emerged as of the nth retro adjustment. The incremental loss capping ratios are calculated in Exhibit 5.

6. FURTHER ISSUES

The method described in this paper can be used to calculate the premium asset for all types of loss-sensitive rating plans,

as long as the rating formula reflects what is being sold to the insured. Further issues to think about are:

1. The definition of loss may include allocated loss adjustment expense (ALAE). Frequently, retro rated policies are written with ALAE included in the definition of loss. This allows the insurer to pass on to the insured not only losses, but attorney expenses as well. The loss data used in computing the PDLD ratios should be consistent with that used in the rating plan.
2. Changes in the mix of business may change the PDLD ratio. Changes in the mix of business by state, industry group, or even geographical region can alter the average rating parameters sold and the underlying claim frequency and claim severity. This will in turn affect how sensitive the premium is to loss.
3. Collectibility of premium should be considered. When the premium asset is secured, there is little question as to its collectibility. If a portion of the premium asset is not secured, then a provision should be made to anticipate bad debt.

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EXHIBIT 1

CALCULATION OF FUTURE PREMIUM EMERGENCE AND PREMIUM ASSET

(dollars in thousands)

Policy Periods (1)	Expected Future Loss Emergence (2)	CPDLD Ratios (3)	Expected Future Premium (2)x(3) (4)	Premiums Booked from Prior Adjustment (5)	Estimated Total Premium (4)+(5) (6)	Premium Booked as of 12/94 (7)	Premium Asset (6)-(7) (8)
1987.1 to 1987.4	-262	0.000	0	494,927	494,927	494,927	0
1988.1 to 1988.4	3,282	0.285	935	467,388	468,324	467,796	528
1989.1 to 1989.4	9,146	0.354	3,238	460,660	463,897	460,716	3,181
1990.1 to 1990.4	21,347	0.390	8,325	453,525	461,850	452,520	9,331
1991.1 to 1991.4	25,397	0.447	11,352	336,654	348,007	337,966	10,041
1992.1 to 1992.4	50,747	0.556	28,216	328,778	356,993	330,216	26,777
1993.1 to 1994.4	280,844	1.492	419,019	0	419,019	425,590	-6,570
					3,013,018	2,969,730	43,288

Notes:

(2) From Exhibit 2, Column (7a).

(3) From Exhibit 3, Column (7).

(5) From Exhibit 4.

(7) From the latest diagonal of Exhibit 6.

EXHIBIT 2

LOSS PROJECTIONS

(dollars in thousands)

Policy Eff. Quarter (1)	Losses Reported as of 12/94 (2)	Loss Develop. Factors (3)	Percent Earned as of 12/94 (4)	Ultimate Losses (2)x(3)x(4) (5)	Annual Total (5a)	Losses Reported at Prior Retro Adjust. (6)	Annual Total (6a)	Expected Loss Emer-gence (5)-(6) (7)	Annual Total (7a)
1987.1	102,064	1.000	100%	102,064		102,059		5	
1987.2	65,339	1.000	100%	65,339		65,264		75	
1987.3	155,738	1.000	100%	155,738		155,950		-212	
1987.4	94,067	1.000	100%	94,067	417,208	94,197	417,470	-130	-262
1988.1	88,908	1.001	100%	89,040		87,781		1,259	
1988.2	57,763	1.002	100%	57,880		58,054		-174	
1988.3	152,121	1.004	100%	152,683		151,031		1,652	
1988.4	96,809	1.010	100%	97,734	397,337	97,189	394,055	545	3,282
1989.1	81,384	1.010	100%	82,203		80,475		1,728	
1989.2	55,898	1.012	100%	56,582		55,541		1,041	
1989.3	131,539	1.020	100%	134,190		130,944		3,246	
1989.4	91,423	1.030	100%	94,189	367,164	91,058	358,018	3,131	9,146
1990.1	89,715	1.032	100%	92,599		87,639		4,960	
1990.2	56,032	1.039	100%	58,239		54,473		3,766	
1990.3	118,268	1.052	100%	124,399		117,202		7,197	
1990.4	73,037	1.063	100%	77,660	352,897	72,236	331,550	5,424	21,347
1991.1	60,399	1.067	100%	64,424		57,620		6,804	
1991.2	34,136	1.068	100%	36,459		33,064		3,395	
1991.3	60,696	1.085	100%	65,883		58,493		7,390	

EXHIBIT 2

PART 2

Policy Eff. Quarter (1)	Losses Reported as of 12/94 (2)	Loss Develop. Factors (3)	Percent Earned as of 12/94 (4)	Ultimate Losses (2)x(3)x(4) (5)	Annual Total (5a)	Losses Reported at Prior Retro Adjust. (6)	Annual Total (6a)	Expected Loss Emer-gence (5)-(6) (7)	Annual Total (7a)
1991.4	61,068	1.100	100%	67,187	233,953	59,380	208,556	7,807	25,397
1992.1	53,455	1.107	100%	59,152		49,161		9,991	
1992.2	37,393	1.114	100%	41,652		33,060		8,592	
1992.3	62,118	1.140	100%	70,830		53,069		17,761	
1992.4	50,766	1.166	100%	59,188	230,822	44,785	180,075	14,403	50,747
1993.1	39,519	1.184	100%	46,799		0		46,799	
1993.2	30,286	1.215	100%	36,793		0		36,793	
1993.3	51,005	1.276	100%	65,093		0		65,093	
1993.4	34,516	1.393	100%	48,082	196,767	0	0	48,082	196,767
1994.1	21,189	1.661	90%	31,672		0		31,672	
1994.2	11,381	2.416	70%	19,245		0		19,245	
1994.3	14,339	4.397	45%	28,372		0		28,372	
1994.4	1,862	12.856	20%	4,788	84,077	0	0	4,788	84,077
TOTAL	2,118,031			2,247,065	2,196,148	1,889,725	1,889,725	357,340	306,423

Notes:

(2) Figures on the latest diagonal of the loss data in Exhibit 7.

(3) Derived from loss development data in Exhibit 7.

(4) These earning ratios reflect the fact that policies written in the latest four quarters are not fully earned.

(6) These represent losses recorded as of prior retro adjustments (Exhibit 7). Policy effective quarters 1993.1 through 1994.4 would not have had any retro adjustments as of 12/31/94; therefore, the losses recorded are 0. Policy effective quarters 1992.1 through 1992.4 would have had one retro adjustment; therefore, losses evaluated at 18 months were entered into this column.

EXHIBIT 3

CPDLD RATIO CALCULATION

Retro Adjustment Periods (1)	Selected PDLD Ratios (2)	% Loss Emerged (3)	PDLD Ratio x Loss Emg (2)x(3) (4)	Upward Cumulative of Col. (4) (5)	Upward Cumulative of Col. (3) (6)	CPDLD Ratios (5)/(6) (7)
First	1.750	78.4%	1.371	1.492	100.0%	1.492
Second	0.700	9.3%	0.065	0.120	21.6%	0.556
Third	0.550	4.4%	0.024	0.055	12.3%	0.447
Fourth	0.450	2.9%	0.013	0.031	7.9%	0.390
Fifth	0.400	3.0%	0.012	0.017	4.9%	0.354
Sixth	0.350	1.6%	0.006	0.006	2.0%	0.285
Subsequent	0.000	0.4%	0.000	0.000	0.4%	0.000

Notes:
(2) From Exhibit 4.
(3) From Exhibit 7.

EXHIBIT 4

PART 1

PDLD RATIO CALCULATION

(dollars in thousands)

Policy Eff. Quarter	First Retro Adjustment Loss 0-18	Prem 0-27	PDLD Ratio	Second Retro Adjustment Loss 19-30	Prem 28-39	PDLD Ratio	Third Retro Adjustment Loss 31-42	Prem 40-51	PDLD Ratio
1983.3	42,461	52,436	1.235	5,515	4,012	0.727	4,533	2,351	0.519
1983.4	20,151	26,222	1.301	2,738	2,722	0.994	1,480	576	0.389
1984.1	23,076	29,189	1.265	2,142	1,927	0.900	2,076	1,086	0.523
1984.2	19,243	23,422	1.217	1,032	1,904	1.844	507	740	1.461
1984.3	54,927	69,310	1.262	8,900	6,371	0.716	3,804	3,432	0.902
1984.4	33,393	43,305	1.297	4,308	3,189	0.740	2,819	1,274	0.452
1985.1	46,100	59,203	1.284	3,384	3,349	0.990	2,312	1,347	0.583
1985.2	27,696	38,717	1.398	2,679	2,120	0.791	2,675	1,687	0.631
1985.3	96,041	133,094	1.386	9,717	7,926	0.816	6,465	3,054	0.472
1985.4	49,481	66,351	1.341	7,193	4,063	0.565	4,268	2,560	0.600
1986.1	63,095	87,173	1.382	5,865	4,249	0.724	4,045	2,298	0.568
1986.2	42,163	57,654	1.367	3,904	2,283	0.585	3,882	1,981	0.510
1986.3	115,105	160,838	1.397	12,006	10,917	0.909	12,037	7,932	0.659
1986.4	58,712	84,641	1.442	6,627	3,536	0.534	3,737	3,579	0.958
1987.1	77,373	103,693	1.340	7,879	8,776	1.114	4,795	2,987	0.623
1987.2	49,770	68,397	1.374	4,867	3,467	0.712	4,029	993	0.246
1987.3	120,053	171,434	1.428	15,117	9,858	0.652	8,909	4,189	0.470
1987.4	73,502	101,483	1.381	7,479	5,701	0.762	5,101	2,290	0.449
1988.1	71,999	98,806	1.372	6,083	4,745	0.780	4,138	1,006	0.243
1988.2	45,861	63,885	1.393	5,253	2,688	0.512	3,392	853	0.252
1988.3	115,461	161,154	1.428	13,462	6,642	0.652	7,128	2,854	0.470
1988.4	79,063	109,253	1.382	7,723	3,974	0.515	5,082	2,604	0.512

EXHIBIT 4

PART 1—PAGE 2

1989.1	71,471	99,777	1.396	3,744	913	0.244	4,462	2,131	0.478
1989.2	49,486	67,553	1.365	2,976	2,923	0.982	2,834	1,906	0.672
1989.3	108,330	153,443	1.416	12,886	6,525	0.506	6,733	5,732	0.851
1989.4	72,082	104,838	1.454	10,903	8,693	0.797	7,288	4,224	0.580
1990.1	76,452	107,468	1.406	8,989	7,055	0.785	2,199	319	0.145
1990.2	46,393	70,127	1.512	6,513	5,695	0.874	1,566	1,159	0.740
1990.3	102,035	158,027	1.549	13,486	6,788	0.503	1,682	901	0.536
1990.4	57,548	91,918	1.597	8,522	2,840	0.333	6,166	1,227	0.199
1991.1	54,037	81,901	1.516	3,583	2,595	0.724			
1991.2	30,240	54,045	1.787	2,824	666	0.236			
1991.3	55,325	94,797	1.713	3,168	2,552	0.805			
1991.4	54,302	97,650	1.798	5,078	2,448	0.482			
1992.1	49,161	82,057	1.669						
1992.2	33,060	59,279	1.793						
1992.3	53,069	99,074	1.867						
1992.4	44,785	88,367	1.973						
Selection Based on Historical Averages									
Average All			1.460			0.730			0.556
Weighted Average All			1.455			0.680			0.532
Selected			1.750			0.700			0.550
Selection Based on Retro Formula									
LCF			1.20			1.20			1.20
TM			1.03			1.03			1.03
Loss Capping Ratio			85%			58%			45%
Implied PDLD Ratio			1.426 *			0.717			0.556
Final Selection			1.750			0.700			0.550

* Also assumes a basic premium factor of 0.2, an expected loss ratio of 0.7, and an expected loss emergence of 78.4% at first adjustment.

EXHIBIT 4

PART 2

PDLD RATIO CALCULATION

(dollars in thousands)

Policy Eff. Quarter	Fourth Retro Adjustment Loss 43-54	Prem 52-63	PDLD Ratio	Fifth Retro Adjustment Loss 55-66	Prem 64-75	PDLD Ratio	Sixth Retro Adjustment Loss 67-78	Prem 76-87	PDLD Ratio
1983.3	1,925	763	0.397	2,057	712	0.346	1,170	75	0.064
1983.4	1,078	662	0.615	64	56	0.867	525	186	0.355
1984.1	1,139	883	0.776	827	526	0.636	1,123	-103	-0.092
1984.2	1,137	573	0.504	906	593	0.655	165	15	0.088
1984.3	2,949	1,159	0.393	2,619	635	0.243	2,475	137	0.055
1984.4	1,424	206	0.145	1,378	46	0.033	1,329	86	0.065
1985.1	1,538	267	0.173	2,265	120	0.053	528	615	1.165
1985.2	2,026	773	0.381	1,730	189	0.109	1,072	210	0.196
1985.3	6,525	2,670	0.409	6,604	2,611	0.395	3,566	155	0.043
1985.4	3,049	1,196	0.392	2,194	1,091	0.497	2,533	958	0.378
1986.1	1,700	1,243	0.731	3,519	874	0.248	1,477	621	0.421
1986.2	2,480	63	0.025	1,476	888	0.601	1,969	194	0.099
1986.3	5,380	2,703	0.502	8,623	1,693	0.196	4,364	1,601	0.367
1986.4	3,316	561	0.169	3,032	728	0.240	1,907	84	0.044
1987.1	5,508	1,796	0.326	4,720	1,522	0.322	1,784	69	0.039

EXHIBIT 4

PART 2—PAGE 2

1987.2	2,521	207	0.082	2,970	869	0.293	1,107	416	0.375
1987.3	7,089	2,571	0.363	3,589	2,532	0.705	1,191	-320	-0.268
1987.4	4,456	1,199	0.269	3,277	572	0.175	381	226	0.593
1988.1	3,267	1,498	0.458	2,294	82	0.036			
1988.2	2,461	894	0.363	1,086	102	0.094			
1988.3	6,284	3,014	0.363	8,696	108	0.012			
1988.4	4,351	2,528	0.581	970	698	0.720			
1989.1	798	339	0.425						
1989.2	245	147	0.601						
1989.3	2,996	1,043	0.348						
1989.4	785	472	0.601						

Selection Based on Historical Averages			
Average All	0.400	0.340	0.222
Weighted Average All	0.385	0.266	0.182
Selected	0.400	0.300	0.200
Selection Based on Retro Formula			
LCF	1.20	1.20	1.20
TM	1.03	1.03	1.03
Loss Capping Ratio	40%	40%	40%
Implied PDLD Ratio	0.494	0.494	0.494
Final Selection	0.450	0.400	0.350

EXHIBIT 5

PART 1

LOSS CAPPING RATIO CALCULATION

(with per accident limitation)

Retro Adjustment (1)	Ultimate Standard Premium Loss Ratio (2)	Percent of Total Losses Emerged (3)	Emerged Loss Ratio (2)x(3) (4)	Loss Ratio at Retro Maximum (5)	Loss Ratio at Retro Minimum (6)	Entry Ratio at Retro Maximum (5)/(4) (7)	Entry Ratio at Retro Minimum (6)/(4) (8)
First	0.700	78.4%	0.549	1.200	0.100	2.19	0.18
Second	0.700	87.7%	0.614	1.200	0.100	1.95	0.16
Third	0.700	92.1%	0.645	1.200	0.100	1.86	0.16
Fourth	0.700	95.1%	0.665	1.200	0.100	1.80	0.15
Fifth	0.700	98.0%	0.686	1.200	0.100	1.75	0.15
Sixth	0.700	99.6%	0.697	1.200	0.100	1.72	0.14
Subsequent	0.700	100.0%	0.700	1.200	0.100	1.71	0.14

EXHIBIT 5

PART 2

LOSS CAPPING RATIO CALCULATION

(with per accident limitation)

Retro Adjustment (1)	Insurance Charge at Retro Maximum (9)	Insurance Saving at Retro Minimum (10)	% of Losses Eliminated by Retro Max/Min (9)-(10) (11)	Loss Elimination Ratio from Per Accident Limitation (12)	Cumulative Loss Capping Ratios 1.0-(11)-(12) (13)	Incremental Loss Capping Ratios (14)	Selected Incremental Loss Capping Ratios (15)
First	0.113	0.004	10.9%	4.2%	84.9%	84.9%	85.0%
Second	0.133	0.003	13.0%	5.0%	82.0%	58.0%	58.0%
Third	0.142	0.003	13.9%	5.9%	80.2%	45.0%	45.0%
Fourth	0.148	0.003	14.5%	6.5%	79.0%	39.6%	40.0%
Fifth	0.154	0.003	15.1%	7.1%	77.8%	38.7%	40.0%
Sixth	0.156	0.002	15.4%	7.4%	77.2%	41.7%	40.0%
Subsequent	0.158	0.002	15.6%	7.5%	76.9%	3.3%	0.0%

Notes:

(2) By judgment.

(3) Based on loss development pattern. See Exhibit 7.

(5),(6) Based on the retro rating values on the policies sold.

(9),(10) From NCCI Table of Insurance Charges, assuming $750,000 standard premium at the entry ratios listed in Columns (7) and (8), with losses used for loss group estimation adjusted for the per accident limitation.

(12) From a study of the percentage of losses eliminated due to per accident limitation.

(14) = [(13)x(4) - (Prior 13)x(Prior 4)] / [(4) - (Prior 4)].

(15) By judgment.

EXHIBIT 6

PART 1

BOOKED PREMIUM

(dollars in thousands)

POL EFF	EVALUATED AT (MONTHS)													
QUARTER	3	6	9	12	15	18	21	24	27	30	33	36	39	42
1983.3	18,087	23,481	33,550	40,867	45,075	49,911	50,174	50,629	52,436	52,388	52,428	53,735	56,448	56,442
1983.4	7,545	10,684	15,697	19,696	22,407	24,608	25,438	25,367	26,222	26,135	26,109	26,653	28,944	28,886
1984.1	7,930	13,516	19,135	24,101	25,408	28,018	28,777	28,947	29,189	28,967	28,960	29,563	31,116	32,031
1984.2	6,277	10,386	14,770	18,422	20,366	22,441	22,258	23,261	23,422	23,608	23,714	24,239	25,326	25,319
1984.3	20,221	31,438	45,913	56,490	61,851	66,697	67,910	68,094	69,310	69,648	69,804	73,363	75,681	75,727
1984.4	9,581	21,089	29,224	38,056	41,299	43,344	43,489	43,897	43,305	43,851	43,794	44,982	46,495	46,645
1985.1	15,110	28,734	40,623	49,872	52,336	57,881	58,742	56,075	59,203	59,164	59,814	60,692	62,552	62,780
1985.2	9,345	19,304	26,189	33,115	37,010	37,650	39,114	40,131	38,717	38,855	39,247	39,753	40,836	40,780
1985.3	43,187	69,712	99,219	120,931	128,832	138,488	138,401	132,641	133,094	134,019	134,241	138,147	141,020	141,198
1985.4	18,627	36,106	51,122	61,567	63,169	67,119	68,046	67,651	66,351	67,117	67,131	68,357	70,414	70,703
1986.1	27,390	46,053	62,065	76,616	79,958	83,746	88,382	83,949	87,173	87,630	87,438	88,964	91,422	91,780
1986.2	15,906	28,997	39,082	48,402	53,764	56,713	59,748	58,482	57,654	57,171	57,156	57,801	59,937	59,994
1986.3	75,944	99,936	128,593	152,088	157,264	167,176	168,696	160,320	160,838	161,506	161,702	167,381	171,755	173,178
1986.4	34,837	47,808	61,795	75,233	79,268	83,931	85,404	82,732	84,641	84,662	83,954	85,334	88,177	89,027
1987.1	43,330	57,756	74,709	90,700	96,064	103,569	105,732	100,641	103,693	105,325	105,992	107,900	112,468	113,333
1987.2	21,776	37,152	46,687	57,190	62,681	67,875	69,209	68,077	68,397	67,799	68,083	70,573	71,863	71,866
1987.3	81,929	97,806	130,510	154,795	165,210	174,935	172,841	172,374	171,434	170,357	170,034	176,167	181,292	181,375
1987.4	40,213	56,338	71,591	88,365	91,969	98,370	99,258	99,738	101,483	101,762	101,940	104,615	107,184	107.014

EXHIBIT 6

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1988.1	42,723	54,489	70,630	85,547	90,156	96,939	97,210	97,349	98,806	99,398	99,426	101,516	103,551	103,824
1988.2	22,257	34,740	43,526	53,014	58,682	62,781	62,671	62,232	63,885	63,771	63,912	66,090	66,573	66,593
1988.3	72,106	88,814	119,264	144,686	150,957	155,317	157,645	157,669	161,154	159,364	159,056	163,070	167,796	167,503
1988.4	39,617	54,419	70,154	90,176	96,199	100,143	101,400	103,318	109,253	109,553	109,928	111,601	113,227	113,259
1989.1	39,587	52,001	70,440	86,851	90,443	92,953	95,370	95,048	99,777	99,118	98,874	99,321	100,691	100,996
1989.2	22,202	34,226	45,230	58,091	61,548	63,860	65,452	65,312	67,553	67,514	67,325	68,442	70,476	70,691
1989.3	65,381	87,768	116,546	143,674	150,281	154,254	155,500	153,310	153,443	152,289	151,898	153,635	159,968	162,505
1989.4	39,328	59,317	79,875	101,224	107,600	109,565	108,541	107,785	104,838	105,096	106,006	106,285	113,531	113,513
1990.1	41,480	58,906	82,540	101,782	105,099	109,581	107,738	108,319	107,468	108,595	108,481	112,426	114,523	114,013
1990.2	24,980	44,112	57,612	69,544	72,525	73,996	74,014	72,759	70,127	71,153	71,796	73,669	75,822	75,729
1990.3	63,128	90,937	124,828	150,974	157,555	164,785	161,333	157,804	158,027	154,559	155,939	161,526	164,815	164,057
1990.4	39,431	56,685	75,859	96,782	102,985	103,811	105,995	102,283	91,918	90,293	89,057	92,789	94,759	94,621
1991.1	33,478	44,023	65,178	77,912	80,929	82,418	85,231	83,748	81,901	81,593	81,741	83,321	84,497	84,444
1991.2	14,280	28,297	40,717	52,368	56,505	57,790	58,229	54,008	54,045	53,647	53,094	54,363	54,711	54,940
1991.3	45,699	57,962	76,470	90,684	94,509	99,243	96,431	97,296	94,797	95,483	95,037	95,884	97,348	97,351
1991.4	40,472	55,839	71,234	96,004	103,650	110,764	108,317	107,345	97,650	97,275	97,453	98,816	100,098	
1992.1	33,004	48,424	63,007	77,569	80,923	83,160	82,743	79,426	82,057	81,207	82,305	83,654		
1992.2	15,320	28,687	42,953	55,414	59,215	59,989	61,432	62,709	59,279	59,531	59,450			
1992.3	43,587	62,778	79,724	96,319	102,225	102,001	100,433	101,661	99,074	98,745				
1992.4	39,809	55,591	64,921	84,643	91,176	95,711	95,421	96,272	88,367					
1993.1	23,915	33,188	43,949	53,188	56,028	57,200	57,259	57,304						
1993.2	18,976	30,311	39,234	46,519	49,357	50,776	50,887							
1993.3	45,269	55,794	70,411	84,974	87,886	89,838								
1993.4	28,913	40,173	51,901	64,487	69,025									
1994.1	24,902	33,572	41,305	49,737										
1994.2	20,642	28,772	34,494											
1994.3	42,916	55,331												
1994.4	18,975													

EXHIBIT 6

PART 2

BOOKED PREMIUM

(dollars in thousands)

POL EFF	EVALUATED AT (MONTHS)														
QUARTER	45	48	51	54	57	60	63	66	69	72	75	78	81	84	87
1983.3	56,698	57,448	58,799	58,904	58,875	59,306	59,562	59,301	59,335	59,492	60,275	60,309	60,321	60,221	60,350
1983.4	28,923	29,122	29,520	29,490	29,463	29,492	30,182	30,048	30,048	30,204	30,238	30,172	30,164	30,041	30,424
1984.1	31,993	31,896	32,202	32,473	32,489	32,513	33,085	32,997	33,046	33,223	33,612	33,612	33,612	33,735	33,509
1984.2	25,433	25,717	26,066	26,095	26,330	26,365	26,639	26,622	26,944	26,961	27,232	27,241	27,070	27,086	27,247
1984.3	76,163	77,812	79,113	79,140	79,358	79,730	80,272	79,940	80,017	80,328	80,907	80,813	80,850	80,934	81,044
1984.4	46,535	47,080	47,768	47,815	47,798	47,833	47,974	47,844	47,424	47,527	48,020	47,977	47,971	47,873	48,106
1985.1	62,880	63,239	63,899	64,075	64,072	63,911	64,166	63,818	63,785	63,794	64,286	64,360	64,348	64,502	64,901
1985.2	41,156	41,412	42,523	42,446	42,635	42,814	43,296	42,989	42,975	43,080	43,485	43,517	43,371	43,682	43,695
1985.3	141,185	143,140	144,073	144,137	144,236	145,032	146,743	146,395	146,591	147,980	149,354	149,163	149,109	149,224	149,509
1985.4	70,606	71,420	72,974	72,741	73,185	73,342	74,170	73,882	73,688	74,169	75,261	75,226	74,893	75,060	76,219
1986.1	91,767	92,532	93,720	94,000	93,988	94,319	94,963	94,514	94,611	94,869	95,837	95,762	95,762	96,108	96,458
1986.2	60,463	61,202	61,919	61,909	61,941	61,664	61,982	61,909	62,439	62,630	62,869	63,097	63,109	63,093	63,064
1986.3	173,315	174,277	179,686	179,875	180,311	181,404	182,390	181,594	181,531	181,942	184,082	184,903	184,896	185,286	185,683
1986.4	89,240	90,156	91,756	91,817	91,734	91,698	92,317	92,091	91,988	92,023	93,045	93,071	93,055	92,899	93,129
1987.1	113,294	114,273	115,455	115,468	115,768	116,457	117,251	116,837	116,912	117,887	118,773	118,924	118,864	118,536	118,843
1987.2	71,824	72,598	72,856	73,264	73,165	72,941	73,063	72,576	72,622	73,138	73,933	74,079	74,081	74,175	74,348

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1987.3	181,456	183,852	185,481	185,695	185,960	185,921	188,052	188,062	187,991	188,412	190,584	190,639	190,735	190,555	190,265
1987.4	106,769	108,691	109,474	109,590	109,674	109,553	110,673	110,406	110,472	110,766	111,245	111,243	111,236	111,279	111,472
1988.1	103,719	103,937	104,557	104,769	104,822	104,662	106,055	105,656	105,466	105,683	106,137	106,218	106,230	106,292	
1988.2	66,453	66,542	67,426	67,585	67,579	68,302	68,320	68,055	67,964	67,923	68,422	68,448	68,462		
1988.3	167,536	168,059	170,650	172,206	172,539	172,583	173,664	172,956	172,995	172,960	173,772	173,984			
1988.4	113,847	114,158	115,831	115,967	115,909	116,218	118,360	117,566	117,541	117,189	119,058				
1989.1	101,165	102,126	102,822	102,919	102,750	102,955	103,161	103,367	103,574	103,781					
1989.2	70,687	72,016	72,382	72,362	72,385	72,457	72,529	72,602	72,675						
1989.3	162,799	163,947	165,700	166,040	165,811	165,390	166,743	166,034							
1989.4	113,494	115,806	117,754	117,872	117,990	118,108	118,226								
1990.1	114,032	114,738	114,842	113,920	113,959	113,443									
1990.2	75,670	76,523	76,981	77,086	76,983										
1990.3	164,447	164,886	165,716	166,107											
1990.4	94,655	94,805	95,986												
1991.1	84,616	85,643													
1991.2	54,874														

EXHIBIT 7

PART 1

REPORTED LOSSES

(dollars in thousands)

POL EFF QUARTER	EVALUATED AT (MONTHS) 3	6	9	12	15	18	21	24	27	30	33	36	39	42
1983.3	5,121	15,662	24,950	36,667	41,044	42,461	44,191	45,528	46,321	47,976	48,898	49,439	50,413	52,508
1983.4	1,336	5,853	10,153	15,218	18,928	20,151	21,293	21,821	22,244	22,889	23,270	23,466	23,802	24,369
1984.1	2,746	6,798	11,408	17,227	20,523	23,076	23,954	24,351	24,730	25,218	25,765	26,065	26,897	27,294
1984.2	1,393	5,284	8,929	14,264	18,651	19,243	20,080	20,759	20,954	20,276	20,143	20,504	20,549	20,782
1984.3	6,618	17,632	31,538	46,077	51,318	54,927	58,153	59,814	61,636	63,827	65,053	65,301	66,273	67,631
1984.4	2,417	9,115	17,939	24,030	30,204	33,393	35,277	36,237	36,887	37,701	38,636	39,640	39,583	40,520
1985.1	3,847	13,981	22,898	34,132	41,523	46,100	46,809	47,718	48,853	49,485	50,490	50,804	50,748	51,796
1985.2	2,164	6,559	12,772	20,433	26,052	27,696	28,720	29,155	29,654	30,375	31,281	31,597	32,095	33,051
1985.3	11,514	34,201	57,070	84,782	92,911	96,041	98,225	101,501	103,660	105,758	106,336	108,721	110,196	112,223
1985.4	4,252	14,692	28,032	38,282	46,101	49,481	52,737	54,006	55,152	56,674	58,126	59,382	59,953	60,942
1986.1	6,670	20,522	32,059	46,939	56,233	63,095	63,724	65,044	65,887	68,960	69,613	70,511	71,368	73,005
1986.2	3,531	10,917	19,770	31,772	40,050	42,163	43,055	43,374	44,117	46,067	46,648	47,551	47,994	49,949
1986.3	14,331	38,985	63,615	99,612	109,338	115,105	118,102	121,840	124,300	127,112	129,821	131,477	133,952	139,149
1986.4	4,768	17,534	32,808	45,213	54,351	58,712	61,941	62,548	63,559	65,340	66,158	66,925	67,544	69,077
1987.1	8,142	23,354	38,500	56,764	67,709	77,373	79,521	81,580	83,222	85,252	86,910	87,978	88,660	90,047
1987.2	4,329	13,671	25,907	37,740	49,263	49,770	50,940	52,428	53,018	54,637	56,396	56,994	57,460	58,666
1987.3	13,373	36,138	63,600	101,166	113,655	120,053	124,721	128,107	130,850	135,171	137,613	139,866	141,475	144,080
1987.4	6,190	20,923	41,460	56,846	67,724	73,502	76,331	76,489	78,388	80,981	82,914	84,044	84,277	86,082
1988.1	6,916	20,545	34,772	50,554	63,347	71,999	73,728	74,396	75,834	78,082	79,412	80,223	80,531	82,220
1988.2	4,087	11,179	21,183	34,005	44,314	45,861	46,854	47,968	49,482	51,114	52,248	53,089	53,407	54,507
1988.3	12,952	35,571	63,806	98,684	110,159	115,461	120,036	123,446	124,724	128,922	131,384	133,661	134,948	136,050
1988.4	5,451	22,014	40,250	57,358	71,190	79,063	85,346	85,263	86,493	86,786	88,053	88,746	89,616	91,868

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PART 1—PAGE 2

1989.1	7,869	21,725	34,204	50,512	62,907	71,471	71,946	72,275	72,442	75,215	76,405	77,279	77,522	79,677
1989.2	3,615	12,348	23,914	36,257	46,573	49,486	50,566	50,507	51,567	52,462	54,081	54,467	54,940	55,296
1989.3	11,397	33,593	61,655	92,142	102,949	108,330	112,488	116,584	119,203	121,216	124,649	125,375	126,285	127,949
1989.4	4,842	19,715	39,063	52,236	64,224	72,082	76,852	78,864	80,320	82,985	87,691	88,199	88,955	90,273
1990.1	9,511	25,559	39,469	56,952	68,215	76,452	78,668	79,502	81,249	85,440	86,905	86,250	86,565	87,639
1990.2	3,836	12,606	22,351	33,833	42,925	46,393	48,984	50,954	52,012	52,906	53,893	53,431	53,847	54,473
1990.3	11,677	32,321	57,374	83,863	94,633	102,035	106,144	109,426	112,652	115,521	116,449	116,762	116,920	117,202
1990.4	5,196	14,997	30,880	42,939	52,459	57,548	62,316	63,183	64,537	66,070	70,479	70,789	71,707	72,236
1991.1	7,133	19,024	29,513	39,914	47,837	54,037	56,184	56,093	56,697	57,620	59,265	59,537	59,577	60,025
1991.2	2,129	6,883	13,419	20,833	28,953	30,240	31,317	32,484	32,779	33,064	33,768	33,584	33,779	33,771
1991.3	5,053	14,983	30,591	47,533	53,959	55,325	55,647	57,417	57,666	58,493	59,106	59,916	59,814	60,696
1991.4	3,797	14,259	28,024	40,545	48,147	54,302	58,775	58,620	58,270	59,380	59,800	60,963	61,068	
1992.1	6,135	16,850	27,327	36,669	43,512	49,161	51,595	52,060	51,888	52,340	53,333	53,455		
1992.2	3,052	8,282	16,036	24,417	31,064	33,060	35,210	35,543	36,320	36,680	37,393			
1992.3	4,619	15,383	31,122	45,310	50,764	53,069	55,737	59,254	60,047	62,118				
1992.4	3,596	12,562	23,922	33,822	41,006	44,785	47,814	49,581	50,766					
1993.1	3,786	12,318	18,973	26,870	31,880	34,297	36,340	39,519						
1993.2	2,091	7,172	12,834	20,247	24,915	27,847	30,286							
1993.3	5,349	14,393	25,756	40,138	46,561	51,005								
1993.4	2,881	10,585	20,030	27,906	34,516									
1994.1	6,241	9,031	14,755	21,189										
1994.2	1,357	6,287	11,381											
1994.3	5,083	14,339												
1994.4	1,862													
Wt'd Avg 16	2.924	1.820	1.454	1.192	1.092	1.050	1.026	1.016	1.022	1.024	1.007	1.006	1.014	1.016
Selected	2.924	1.820	1.454	1.192	1.092	1.050	1.026	1.016	1.022	1.024	1.007	1.006	1.014	1.016
Cumulative	12.856	4.397	2.416	1.661	1.393	1.276	1.215	1.184	1.166	1.140	1.114	1.107	1.100	1.085
% Emerged	7.8%	22.7%	41.4%	60.2%	71.8%	78.4%	82.3%	84.4%	85.8%	87.7%	89.8%	90.4%	90.9%	92.1%

EXHIBIT 7

PART 2

REPORTED LOSSES

(dollars in thousands)

POL EFF	EVALUATED AT (MONTHS)														
QUARTER	45	48	51	54	57	60	63	66	69	72	75	78	81	84	87
1983.3	53,010	52,952	52,987	54,433	54,844	54,908	55,464	56,489	56,740	56,907	56,968	57,660	58,013	58,319	58,893
1983.4	24,713	24,840	25,085	25,447	25,598	25,913	25,430	25,511	25,527	25,784	25,905	26,036	26,257	26,439	26,396
1984.1	27,873	28,168	28,054	28,433	28,783	28,888	28,887	29,261	29,942	29,959	29,857	30,384	30,332	30,414	30,496
1984.2	21,110	21,056	21,408	21,919	22,129	22,130	22,260	22,825	22,942	22,721	22,697	22,990	23,351	23,331	23,639
1984.3	68,177	68,656	69,571	70,581	70,598	70,630	70,699	73,199	73,429	73,673	74,127	75,675	76,027	76,207	76,291
1984.4	41,687	41,786	41,658	41,944	42,229	42,602	42,760	43,323	43,870	44,107	44,278	44,652	45,046	45,296	45,746
1985.1	52,028	52,557	52,925	53,334	54,047	54,796	55,246	55,600	55,619	55,744	55,635	56,128	56,031	56,762	56,822
1985.2	33,713	33,797	34,161	35,077	35,629	35,888	35,816	36,806	37,422	37,734	37,721	37,878	37,977	38,073	38,029
1985.3	113,596	114,633	115,792	118,749	120,458	121,027	121,826	125,352	126,865	127,252	127,387	128,918	129,448	129,815	130,355
1985.4	61,543	62,769	63,048	63,992	64,759	65,053	65,140	66,186	67,419	68,036	68,140	68,719	69,068	69,417	69,467
1986.1	73,711	73,961	73,350	74,704	76,207	76,344	77,005	78,223	79,734	80,044	80,055	79,700	79,828	80,048	80,598
1986.2	50,459	50,798	51,492	52,429	52,185	52,937	53,475	53,905	54,533	54,659	54,858	55,874	55,290	55,033	55,170
1986.3	141,803	141,276	142,446	144,528	148,673	149,820	150,424	153,151	154,266	155,533	156,039	157,514	158,046	157,870	158,282
1986.4	70,913	71,454	71,585	72,392	73,624	73,956	74,188	75,425	76,073	76,103	76,481	77,332	77,791	77,708	77,451
1987.1	91,273	91,974	92,426	95,555	96,936	97,662	98,212	100,275	100,547	100,919	101,009	102,059	102,416	102,215	102,064
1987.2	59,490	59,750	60,308	61,187	62,269	62,746	62,840	64,157	64,589	64,652	64,690	65,264	65,408	65,176	65,339
1987.3	146,880	148,007	148,826	151,169	152,187	152,686	153,406	154,758	155,466	155,732	156,009	155,950	156,064	155,915	155,738
1987.4	88,294	89,146	89,288	90,538	92,262	92,860	92,825	93,815	93,787	93,977	93,987	94,197	94,251	94,124	94,067

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PART 2—PAGE 2

1988.1	83,299	83,605	84,078	85,487	85,962	86,393	86,795	87,781	89,697	89,780	89,457	89,473	89,042	88,908	
1988.2	55,421	55,937	56,157	56,968	57,732	57,913	57,606	58,054	58,287	58,285	57,871	57,691	57,763		
1988.3	139,179	139,464	140,598	142,334	145,198	150,268	150,526	151,031	151,733	151,487	151,590	152,121			
1988.4	92,734	93,316	94,645	96,219	97,757	97,788	97,436	97,189	97,467	97,076	96,809				
1989.1	80,263	79,879	79,483	80,475	81,137	81,113	80,897	81,253	81,546	81,384					
1989.2	55,591	55,467	55,322	55,541	55,780	55,751	55,663	55,652	55,898						
1989.3	129,957	129,598	129,944	130,944	131,516	131,650	131,233	131,539							
1989.4	91,621	91,261	91,296	91,058	91,020	91,296	91,423								
1990.1	91,080	90,996	90,437	89,844	89,689	89,715									
1990.2	55,529	55,502	55,535	55,556	56,032										
1990.3	117,673	117,528	117,746	118,268											
1990.4	73,643	73,101	73,037												
1991.1	60,440	60,399													
1991.2	34,136														
Wt'd Avg 16	1.001	1.003	1.011	1.012	1.007	1.002	1.010	1.008	1.002	1.000	1.006	1.002	1.001	1.001	
Selected	1.001	1.003	1.011	1.012	1.007	1.002	1.010	1.008	1.002	1.000	1.006	1.002	1.001	1.001	Tail
Cumulative	1.068	1.067	1.063	1.052	1.039	1.032	1.030	1.020	1.012	1.010	1.010	1.004	1.002	1.001	1.000
% Emerged	93.6%	93.8%	94.0%	95.1%	96.2%	96.9%	97.1%	98.0%	98.8%	99.0%	99.1%	99.6%	99.8%	99.9%	100.0%