COMMERCIAL GENERAL LIABILITY

RATEMAKING FOR PREMISES AND OPERATIONS

BY

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ABSTRACT:

Over the last several years, many changes have been made in ratemaking procedures for premises and operations. In this paper, these changes are described in the context of a complete premises and operations review. A detailed explanation of each step of the procedure, along with sample calculations, is provided. Special note is made of major changes that have taken place in the last 9 years, and reasons for these changes are discussed.

The most significant changes discussed include the inclusion of package data, loss development by state, new credibility standards, and the minimum bias procedure for class group relativity calculations.

As a conclusion, further changes that are being considered are briefly discussed.

COMMERCIAL GENERAL LIABILITY:

RATEMAKING FOR PREMISES AND OPERATIONS

Ratemaking is constantly changing. Forces both internal and external to actuarial science are continually influencing the procedures that actuaries use to determine the appropriateness of insurance rates.

It has been almost 10 years since Michael McManus (1) provided us with his update to Jeffrey Lange's (2) "General Liability Insurance Ratemaking", and many changes to the general liability ratemaking procedure have been implemented. While many future changes are already being planned, especially due to the recent implementation of the Commercial General Liability (CGL) program, this seems to be an appropriate time to stop and summarize where we are, and to take an introductory look at where we're headed for the future.

We will be describing in this paper the current procedures used by Insurance Services Office (ISO) to determine adequate rate levels and revised rates for the premises and operations sublines of owners,

landlords and tenants liability (OLT) and manufacturers and contractors(M&C) liability.

To avoid any confusion, we should immediately note that the change in terminology from 'general liability' ratemaking to 'commercial general liability' ratemaking should not imply anything revolutionary to the reader. The general liability ratemaking procedures, with their intrinsic evolutionary changes, are applicable to the commercial general liability (CGL) coverages. Any planned changes resulting directly from CGL will be highlighted after current procedures have been described.

We are limiting ourselves to premises and operations ratemaking so that we can cover these sublines in the detail they deserve, particularly because all of the major changes can be clearly illustrated in this context.

THE CHANGES

Since McManus's update in 1980, at least 5 relatively major changes to the premises and operations ratemaking procedures have been implemented. A short description of each, along with its causes, follows. The details of each are illustrated in the section on ratemaking procedures.

The first of these changes is the inclusion of multiline data in the rate level review. This change was implemented in 1984. It was a result of the implementation of the commercial statistical plan (CSP), under which monoline and multiline data are reported in the same format and detail. The introduction of the CSP made this additional body of data available for analysis.

The ability to look at loss development on a state basis was made possible by this increased volume of data. Differences by state were found to exist and loss development by state was introduced in 1984.

Combining monoline and multiline data presented the question of how to reflect differences in type of policy relativities. Investigation of various methods to do this resulted in the decision to use a Bailey type minimum bias procedure to determine both type of policy and class group relativities.

As a result of the commercial liability availability crisis of the mid-1980's, stability of insurance rate levels had become a very important issue for insurers. The concern about this issue led to an investigation by ISO of credibility standards and the experience period used in determining premises and operations rate levels. As a result of this

study changes were made to both the standards for full credibility by subline and the number of policy years used.

THE RATEMAKING PROCEDURE

There are many steps involved in calculating revised premises and operations basic limits rates. Before a revised class rate can be calculated, an overall rate level change needs to be determined. This is an indication of how premium levels must change to meet anticipated losses and expenses. If calculated properly, it represents how much the present basic limits rates should be changed in order to pay for losses, cover expenses, and earn a fair profit in the future.

After an overall change is determined, it must be equitably distributed among class groups and territories to arrive at revised rates.

The first decision that must be made in an evaluation of rate level is what data to include, and how to organize that data. Before going into the actual calculations, we will make some comments about the data included.

Basic Limits Data

Rate level for the general liability lines of insurance is reviewed on a basic limits basis. Both losses and premiums are calculated at the basic limit. This is done so that the effects of fortuitous large losses will not distort relativities or cause large fluctuations in rate level from year to year.

Inclusion of Multiline Data

One of the major differences between the ratemaking procedures used today by Insurance Services Office, Inc., (ISO) and those outlined in 1980 by Michael F. McManus, in his paper entitled "General Liability Ratemaking: An Update", should be explained in detail. This change is the inclusion of multiline data today. Multiline data reflects the general liability experience of risks written on package policies.

These packages contain coverage for multiple lines of insurance. For example, a beer distributor may need insurance coverage for its trucks under a commercial auto policy, but would also need liability and fire coverage for its premises. These three needed coverages fall across three separate lines of insurance and could be packaged together to form a

multiline policy. The benefit to the insured of purchasing this packaged policy is that he would receive a discount. The insurer would offer the discount because his cost in writing the package is lower than that in writing each of the coverages separately, and because he feels that the risks to whom he offers a package policy are better risks overall.

Multiline data was first included in ratemaking in 1984. The advantages of a combined monoline-multiline data base are many. First, since two-thirds of the data is multiline for OL&T, more stable rate level indications result from the increased data volume for this line. Second, state regulators' concern that only a portion of the data was being used to calculate overall rate level indications is no longer a problem. Third, the increased volume of data, along with the elimination of possible distortions due to shifting volumes of monoline and multiline data, produce more accurate general liability trend factors. Finally, increased data volumes produce more stable loss development factors.

The major concern of combining monoline and multiline data in the ratemaking data base was that monoline rate levels could be distorted if multiline risks represented better than average experience and premiums were not first accurately adjusted for differences in level of risk. These premiums are adjusted, as will be described below.

Calculation of Overall Rate level change

The overall rate level change is calculated for each state separately by subline, and for bodily injury and property damage separately. Each of the steps described is based on the data for the subline being reviewed. Under CGL, bodily injury and property damage will be reviewed on a combined basis.

The best way to explain the overall rate level change is to detail each component of the exhibit below. This exhibits shows an actual calculation of the overall rate level change factor (line 9):

STATE X
PREMISES AND OPERATIONS
SUBLINE CODE 334
MANUFACTURERS AND CONTRACTORS
BODILY INJURY LIABILITY INSURANCE
Development of Indicated Statewide Monoline-Multiline Rate Level Change

All Companies Reporting to ISO

(1) Policy Year Ending	(2) Earned Premium at Current Rate Level	(3) $25,000 Basic Limits Incurred Losses	(4) Loss Ratio at Current Rate Level	(5) Number of Incurred Claims
12/31/85	$40,506,864	$27,167,135	0.671	1098
12/31/86	35,580,928	23,613,968	0.664	1018
12/31/87	30,388,512	19,582,688	0.644	615

(6) Weighted Rate Level Loss Ratio (20% of Policy Year Ending 12/31/85, 30% of Policy Year Ending 12/31/86 and 50% of Policy Year Ending 12/31/87) 0.655

(7) Expected Loss and Loss Adjustment Ratio 0.575

(8) Credibility Based on Latest Three Years Number of Incurred Claims 0.95

(9) Indicated Monoline-Multiline Rate level Change Factor [(6)x(8)+(1.00-(8))x(C)]/(7) .....+14.5%

Premiums

Column (2) contains earned premium at present manual rates by policy year. These premiums are calculated by multiplying both monoline and multiline class exposures by the present monoline rates for each class and territory. These premiums are then summed up across classes and territories by policy year. Premium at present manual rate (PPMR) differs from total limits collected premiums in several respects. First, collected premiums are those premiums charged by member companies for basic limit and excess limit coverages. PPMR is the premium that would be charged for basic limits only. As outlined above, general liability experience is evaluated on a basic limits basis for stability. Also, PPMR represents the ISO manual rate. Individual companies often deviate from that rate to reflect differences in their own experience. The major advantage of using PPMR is that it does not require any adjustments for company deviations or experience rating, since it is already at current ISO manual rate level.

Two other adjustments do need to be made to PPMR. The first is the application of an exposure trend, and the second is an adjustment to the multiline premiums using implicit package modification factors. A description of each of these will follow.

Exposure Trend

The PPMR for manufacturers and contractors liability needs to be adjusted by an exposure trend because the exposure base for M&C is payroll. Since payroll is inflation-sensitive, the PPMR calculated based upon reported exposures is trended to reflect anticipated exposure levels. Both ISO and Data Resources, Inc. (DRI), have developed the econometric models which are used to forecast exposures. The data supplied by DRI provides information for average hourly earnings of manufacturing and construction workers which is used in the econometric model to forecast the exposures. PPMR is trended to one year beyond the anticipated effective date of the rates. This assumes that policies are written for a one year term and that rates will be in effect for one year. Therefore the average date of exposure for the policies written with these rates will be one year beyond the anticipated effective date of these rates.

In the past, owners, landlords and tenants premium was not trended, since the exposure base was generally area and frontage. As data from the CGL program becomes available, OL&T premiums will be trended since the new exposure base is primarily sales. Sales, of course, is inflation-sensitive. Trend factors for OL&T will most likely be based

upon econometric indices for inflation in sales of food, other non-durables, furniture, other durables and clothing.

Implicit Discounts

The second adjustment made is to adjust the premiums generated by multiline exposures to a multiline level. The inclusion of multiline data complicates general liability monoline ratemaking because of the package discount applied in rating these policies. This is compensated for by the use of implicit package modification factors (IPMF). These factors are applied to the multiline premiums to adjust them from a monoline rate level to a multiline level. This adjustment is made since these risks are believed to have different experience from the monoline policy. These IPMF's are based upon how the multiline experience compares with the monoline experience. The use of the IPMF's creates the situation where the multiline and monoline experience for the same coverage tends toward the same expected loss ratio. They are calculated through the use of the minimum bias relativity analysis. The details of this procedure will be discussed later.

IPMF's are not the same as the published package modification factor (PMF) which is used in rating package policies. An IPMF is the discount implied

for a particular coverage written on a package policy that is rated with a given PMF.

Losses

Column (3) exhibits basic limits incurred losses. Again, general liability is reviewed on a basic limits basis for stability. However, the limit is kept high enough to reflect differences in experience by state, territory, and class. The limit for the pre-CGL sublines OL&T and M&C is $25,000 of indemnity per occurrence for bodily injury. The property damage limit for OL&T and M&C is $5,000 of indemnity per occurrence. The basic limit of coverage for premises and operations, under CGL, is currently $25,000 of indemnity per occurrence and $50,000 per year in aggregate. This is a combined single limit for bodily injury and property damage combined.

That portion of any single indemnity loss which is over the basic limit would be considered to be the excess portion of the loss. This excess does not enter into the basic ratemaking formula. However, this does not mean that the maximum value for a liability claim at basic limits is $25,000. Included in basic limits incurred losses are all allocated loss adjustment expenses.

Loss Adjustment Expense (LAE)

There are two types of loss adjustment expense. The first type is allocated loss adjustment expense (ALAE) which is directly allocable to a particular loss. An example of this is lawyers fees or fees paid to doctors for expert medical testimony. These expenses are not subject to the policy limit, and current ratemaking includes their total amount in basic limit losses.

Unallocated expenses are those expenses which cannot be allocated to a particular claim. By their nature, they cannot be reported in class detail. Examples of these might be claims department overhead or claims adjusters' salaries.

The unallocated loss adjustment expense (ULAE) is loaded into the basic limit losses by a factor. This factor is the ratio of losses including ALAE and ULAE expenses to losses with ALAE expenses only. The source for this data is the Insurance Expense Exhibit and a special call for expenses sent out annually by ISO. After this factor is calculated, it is applied to reported losses including allocated expenses, to reflect ULAE for ratemaking purposes.

Losses are not yet ready for ratemaking. Two more adjustments need to be made. The first adjustment is development to an ultimate settlement basis and the second adjustment is trend.

Loss Development

As mentioned earlier, since McManus's paper there have been changes in the application of loss development. At the time of his writing, countrywide loss development factors were applied to the basic limit losses in each state for each year to develop these losses to an ultimate basis.

One major change has been to include individual state data, to the extent credible, in the calculation of the loss development factors for each state. Another change that has been incorporated into this procedure is to add an adjustment for changing proportions of allocated loss adjustment expense and indemnity losses. These changes will be described in detail.

The change to include state data has been made possible with the increased volume of data which is due to the use of multiline data. With this increased volume of state loss experience, it is possible to reflect the state differences in loss development patterns that might result from

differences in pay-out patterns or legislative or judicial trends which are intrinsic to that particular state. Factors affecting these patterns might be back-logged court cases or statutes of limitations which vary by state.

The state losses now are developed incorporating state and countrywide loss development data out to 75 months, and using countrywide only data from 75 months to ultimate. Individual state data is not used on its own for loss development because of credibility considerations. Due to the relatively small volume of individual state data, some of the observed differences from countrywide loss development patterns might result from random fluctuations in the data. In order to reflect real differences in development patterns by state, while avoiding the effects of random fluctuations, the state link ratios are credibility weighted with the countrywide. The first step, therefore, is to calculate the loss development factors on both a countrywide and a statewide basis.

The first evaluation of losses that is used for ratemaking is 27 months after the inception of the policy. This is three months after the end of the policy year. Incurred losses are used in the determination of loss development factors to utlimate. These losses include amounts paid plus

case reserves as of the evaluation date. If these losses were an exact representation of the amount of losses that would ultimately be paid out for that policy year, loss development would not be needed. However, this is not the case. For general liability, incurred but not reported (IBNR) losses, which are not included in the bureau data, make up a large part of the loss development. Also, estimates of case reserves are likely to change over time. Loss development takes estimates of what the incurred losses for the policy year are at a certain point in time, and uses them to develop an estimate of what the ultimate incurred losses will be, reflecting both IBNR and changes in case reserves. The following exhibits represent the four latest years of a both a countrywide and a statewide loss development exhibit for M&C Bodily Injury.

M&C Countrywide - Bodily Injury
$25,000 Basic Limits Incurred Losses (000's) as of:

Policy Year Ending	27 Mos.	39 Mos.	51 Mos.	63 Mos.	75 Mos.
12/31/81				319,079	323,416
12/31/82			392,274	405,826	421,515
12/31/83		419,608	448,764	475,125	487,874
12/31/84	390,557	472,634	528,851	550,043	
12/31/85	401,484	492,464	543,654		
12/31/86	390,889	469,846			
12/31/87	363,504				

Ratios

	39:27	51:39	63:51	75:63
12/31/81				1.014
12/31/82			1.035	1.039
12/31/83		1.069	1.059	1.027
12/31/84	1.210	1.119	1.040	
12/31/85	1.227	1.104		
12/31/86	1.202			
3 Yr. Mean	1.213	1.097	1.044	1.026

Loss Development From:

Policy Year Ending	27 to 39	39 to 51	51 to 63	63 to 75	75 to ULT	Factors
12/31/85			1.044	1.026	1.026	1.099
12/31/86		1.097	1.044	1.026	1.026	1.206
12/31/87	1.213	1.097	1.044	1.026	1.026	1.462

The losses in the above exhibit include allocated loss adjustment expense.

M&C State X - Bodily Injury
$25,000 Basic Limits Incurred Losses as of:

Policy Year Ending	27 Mos.	39 Mos.	51 Mos.	63 Mos.	75 Mos.
12/31/81				4,782,136	5,078,628
12/31/82			4,326,213	4,936,209	5,385,404
12/31/83		4,165,214	4,798,327	5,450,899	5,957,833
12/31/84	3,392,516	4,087,982	4,889,226	5,779,065	
12/31/85	3,678,421	4,542,850	5,537,734		
12/31/86	4,098,326	4,999,958			
12/31/87	4,500,952				

Ratios

	39:27	51:39	63:51	75:63
12/31/81				1.062
12/31/82			1.141	1.091
12/31/83		1.152	1.136	1.093
12/31/84	1.205	1.196	1.182	
12/31/85	1.235	1.219		
12/31/86	1.220			
3 Yr. Mean	1.220	1.189	1.153	1.082

The losses in the above exhibit include allocated loss adjustment expense.

The latest evaluation of the incurred losses and loss adjustment expenses in this exhibit is as of March 31, 1988. Policy year ending 12/31/87 losses include all losses and ALAE paid and outstanding on policies written in 1986 as of March 31, 1988. These losses were evaluated 27 months after the inception of the policy year. Because a policy year includes all losses incurred on policies written in a calendar year, and because policy terms are assumed to be one year, a policy year spans two calendar years: policy year ended 12/31/87 is the same as policy year 1986. The latest losses available in this exhibit for policy years ending 12/31/85 and 12/31/86 are 51 and 39 months after the inception of each of the respective policy years.

Loss development to ultimate is calculated by combining appropriate average link ratios. Link ratios represent growth in losses from period to period for a particular policy year. They are calculated by dividing an evaluation of the losses for the policy year by the first prior evaluation. Three year average link ratios are then calculated. Once these ratios are determined, they are multiplied together to get the total change in losses to ultimate.

As of the date of the exhibit, the most current loss data available for policy year ending 12/31/85 is 51 months after the first policy was written. The estimated change from 51 to 63 months is an increase of 4.4%. The next twelve month period should reflect a change in losses of +2.6% and the remainder of the months to ultimate is also estimated to exhibit a loss change of +2.6%. Therefore, the losses are expected to change by a factor of:

1.044 x 1.026 x 1.026 = 1.099.

One may wonder how the 75 to Ult. factor was selected. It was selected using a method that repeats the last link ratio - in this case the 63 to 75 ratio - and uses it as an estimate of the product of all succeeding link ratios. This can be done once we are far enough out in the loss development tail to be able to assume that the later link ratios will converge to unity in such a way that each succeeding link ratio will be equal to the square root of the previous link ratio.

Of course, when a longer loss development history is available, more link ratios for later evaluation periods can be incorporated, resulting in a better approximation of the remainder of the growth for the later policy years, assuming growth patterns remain constant. At present, loss development history is available out to 135 months.

State Loss Development

Once the link ratios and development factors have been calculated on both a countrywide and a statewide basis, the next step is to compute credibility weighted loss development factors by state.

Since the state's data may not be fully credible, the state's three year average link ratios are credibility weighted with the countrywide average link ratios for development up to 75 months. The resulting credibility weighted link ratios can be used to calculate the individual state's credibility weighted loss development factors.

The credibility assigned to the state link ratio is calculated as follows:

$$Zi = \frac{Li}{Li + K}$$

where:

Zi = credibility for state i,

Li = the three years of losses, at the less mature of the two evaluations, for state i which are used in the calculation of the three year link ratio means,

K = Credibility constant.

The calculation of the credibility constant K, is as follows:

$$K = \frac{\text{Within Variance}}{\text{Between Variance}}$$

The within variance is the variance of the link ratio by state for each of three years around the state's three year average link ratio. The between variance is the variance of each state's average link ratio around the countrywide three year average link ratio. So credibility is assigned based on the relative magnitude of the variance within states as compared to the variance between states. For more detail on this procedure, see Philbrick, "An Examination of Credibility Concepts" (3).

The link ratios for each state that are used in the calculation of K are adjusted to reflect the countrywide level of variation. In other words, an adjustment factor = $\frac{\text{(CW loss development factor for latest year)}}{\text{(CW loss development factor for year j)}}$ is used. This adjustment is made to eliminate some degree of random variation from the state link ratios.

For example, the following link ratios are calculated:

Policy Year Ending	State X 27 to 39	Countrywide 27 to 39
12/31/84	1.205	1.210
12/31/85	1.235	1.227
12/31/86	1.220	1.202
3 Year Mean	1.220	1.212

The following adjustments would be made to the state's link ratios for the 27 to 39 month evaluation:

Policy Year Ending	Adjustment Factor	State X Adjusted Ratio
12/31/84	1.202 ÷ 1.210 = 0.993	1.205 x .993 = 1.197
12/31/85	1.202 ÷ 1.227 = 0.980	1.235 x .980 = 1.210
12/31/86	1.202 ÷ 1.202 = 1.000	1.220 x 1.000 = 1.220

The K constants tend to increase the more mature the data is. This is because at later evaluation periods, the states' link ratios tend more toward the countrywide ratio. At the later evaluations these link ratios are converging to 1.00, on both a state and a countrywide basis. This will decrease the between variance and raise the K constant, which in turn will lower the individual state's credibility. Conversely, the earlier the evaluation period, the less the state's link ratios tend toward the countrywide and the higher the state's credibility.

The more losses that a state has, the higher the credibility assigned to it. Reported losses will tend to increase at the later evaluation

periods. However, this increase in losses will be more than offset by the much larger decrease in the between variance. The between variance gets so small at a certain point, making the K constant so large, that an individual state's credibility approaches zero.

Once credibilities have been assigned to each state for each evaluation period, the credibility weighted link ratios can be calculated for each state. The formula used to accomplish this is:

$$CLR = (Zi \times LRi) + (1-Zi)(LR)$$

where:

Zi = credibility for state i at given evaluation,

LRi = 3 year average state link ratio,

LR = 3 year average countrywide link ratio.

For example, suppose you are given the following data:

State X

Policy Year Ending	27 to 39 months	39 to 51 months
12/31/84	3,392,516	4,087,982
12/31/85	3,678,421	4,542,850
12/31/86	4,098,326	4,999,958
12/31/87	4,500,952	

K constant = 2,792,316

LR = 1.212

We can calculate:

$$LRi = \frac{(4,999,958/4,098,326)+(4,542,850/3,678,421)+(4,087,982/3,392,516)}{3}$$

$$= 1.220$$

$$Li = 3,392,516 + 3,678,421 + 4,098,326 = 11,169,263$$

$$Zi = \frac{Li}{Li+K} = \frac{11,169,263}{11,169,263 + 2,792,316} = .800$$

Therefore, the credibility weighted link ratio for State i is:

$$CLR = (1.220)(.800) + (1-.800)(1.212) = 1.218$$

The credibility weighted link ratios for the 39 to 51 month, 51 to 63 month, and 63 to 75 month evaluations will then be calculated using the same procedure. For evaluation periods past 75 months, the countrywide link ratios are used for each state. This, again, is due to the low level of state credibilities at that point.

The credibility weighted factors to ultimate are then calculated by state. The credibility weighted link ratios for the state are multiplied together for each of the first four evaluation periods. These are then applied to the countrywide 75 month to Ultimate loss development factors to determine the state's loss development factors. For example, the factors for policy years ending 12/31/85, 86, 87 can be calculated in the following manner:

Policy Year Ending	27 to 39	x	39 to 51	x	51 to 63	x	63 to 75	x	75 to Ult	=	Factors
12/31/85					1.101		1.051		1.026		1.187
12/31/86			1.152		1.101		1.051		1.026		1.368
12/31/87	1.218		1.152		1.101		1.051		1.026		1.666

The four evaluation periods prior to the 75 to Ultimate contain the state's credibility weighted link ratios. The 75 to Ultimate factor contains countrywide experience only.

Adjustment for Change in Proportion of ALAE

As standard procedure, all allocated loss adjustment expense is included with the basic limit indemnity losses in the ratemaking calculations. With the recent growth in allocated expenses, and the assumption that ALAE develops differently, and later, than the limited indemnity, there has been concern that combining these expenses with basic indemnity may distort development patterns. The result of this is that historical link ratios may not be indicative of current patterns, because older policy years do not reflect the same mix of indemnity and ALAE as the current years do.

The ultimate solution to this problem is to develop indemnity and ALAE separately. However, because of the limitations of the current ratemaking report systems used by ISO, this is not possible. An alternative method is to make use of the other ISO systems to look at ALAE development separately from indemnity, using the same development procedure as that described above. This enables us to combine the separately developed losses and expenses and to compare this sum to the losses and expenses developed together. This gives us an adjustment factor which is then applied to the "To Ultimate" development factors to adjust for the differences in development patterns. The following exhibit illustrates this method:

PYE	Evaluated as of (Mos.)	Developed B/L Indemnity Losses		Developed Expenses	=	(A) Losses + Expenses Dev. Separately
85	51	$569,932,780	+	$264,085,268	=	$834,018,048
86	39	530,922,535	+	255,057,000	=	785,979,535
87	27	482,408,692	+	232,376,761	=	714,785,453

PYE	Evaluated as of (Mos.)	(B) Losses + Expenses Dev. Together	Adjustment Factor (A)/(B)
85	51	$816,955,786	1.021
86	39	764,747,935	1.028
87	27	693,119,396	1.031

Therefore the adjusted countrywide "To Ultimate" loss development factors are:

	Factors			Factor
PYE	w/o adj. factor	x adj. factor	=	w/adj. factor
85	1.099	1.021		1.122
86	1.206	1.028		1.240
87	1.462	1.031		1.507

This procedure will remain in place only until ratemaking reports are available on a basis which splits indemnity and ALAE. These are the final loss development factors which are used to develop losses to ultimate.

Loss Trend

One more adjustment must be made to the losses before the overall rate level change can be calculated.

Just as exposures need to be trended to reflect anticipated exposure levels, losses need to be trended to reflect anticipated loss levels.

The two types of trend that ISO applies to the general liability losses for ratemaking are frequency and severity. These trends are based upon average incurred claim severity and average incurred claim frequency data in the ratemaking data.

The least squares method is used to construct an exponential curve of best

fit on countrywide data by policy year. Incurred claims are developed to an ultimate basis to be used in both frequency and severity trends. Claim development is based on countrywide triangles, identical to those described above for losses. Incurred losses are also developed to ultimate before calculating average claim sizes for severity curves. PPMR is used in calculating average number of claims per exposure for frequency trends. This is because the exposure bases within each subline are not uniform. Premiums at present manual rate are trended for M&C frequency by using an exposure trend. As OL&T data on a receipts basis becomes available, OL&T PPMR will also be trended for this calculation.

Since this data contains random fluctuations, the minimization of these fluctuations will provide a better estimate of the underlying trend. This is achieved by fitting the data to a curve. An exponential curve is selected because it assumes a constant percentage trend from year to year. The form of this curve is:

$$Y = Ae^{BX},$$

where A and B are constants, X is the unit of time, and Y is the fitted value on the curve.

The exponential curve provides a fairly good estimate of the trend in claim severity. The R-squared is consistently very near 1.00. For claim frequency, on the other hand, this method generally results in very poor R-squareds. The reason for this is that frequency trend appears to be cyclical in nature, thus it cannot be approximated using an exponential trend. In determining the claim frequency, the exponential curve is used in conjunction with an econometric model, as well as actuarial judgment, to choose a reasonable frequency trend.

Once the trends are determined, developed losses are adjusted to reflect these changes in claim severity and frequency. Losses are trended from the average date of coverage to one year beyond the anticipated effective date of the overall rate level change, which is the average anticipated date of coverage. For example, assume the following losses and trends.

Policy Year Ending	Avg. Date of Coverage	Developed Basic Limits Incurred Losses	Annual Severity Trend	Annual Frequency Trend	Anticipated Effective Date
12/31/86	12/31/85	$13,032,569	+10.2%	+2.0%	2/1/90

Losses would be trended from the average date of coverage, in this case 12/31/85, to one year beyond the anticipated effective date. In other words, they would be trended five years and one month. This leads to the following calculation:

$$\$13{,}032{,}569 \times (1.102)^{5.0833} \times (1.02)^{5.0833} = \$23{,}613{,}969$$

Therefore, if the same exposures were written during the one year period 2/1/90-2/1/91 as had been written during policy year ending 12/31/86, then the estimated incurred losses for that period would be $23,613,969. This number represents the trended basic limits incurred losses for policy year ending 12/31/86 in column (3). To calculate the losses for 12/31/85 and 12/31/87, developed losses would be trended 6.0833 and 4.0833 years respectively.

Loss Ratio

The next step in determining the overall rate level change is to calculate projected loss ratios for each year and to weight them together.

Since McManus's update, the weights and the number of years of experience used in the calculation of the weighted loss ratios have changed. Previously, ISO used two years of experience with weights of 70% and 30%, assigning the higher weight to the later year. In 1988, the experience period was changed to three years weighted 50%, 30% and 20% with the highest weight going to the latest year. The current procedure represents the results of nearly a year of credibility studies performed by ISO to determine the weights that would provide an acceptable balance between responsiveness and stability.

Column (4) contains the projected loss ratio at current rate level for each of the three latest policy years. The loss ratio represents that portion of the premium that will be needed to pay for losses and all loss adjustment expenses. The basic limits loss ratio for each policy year is calculated by dividing the basic limits incurred losses, including loss adjustment expenses, by the premiums at present manual rate. These losses and premiums are after all adjustments described above. For example, the

loss ratios shown on the State X exhibit were calculated in the following manner:

Policy Year Ending	Losses	/	Premiums	=	Loss Ratio
12/31/85	$27,167,136	/	$40,506,864	=	0.671
12/31/86	23,613,968	/	35,580,928	=	0.664
12/31/87	19,582,688	/	30,388,512	=	0.644

Given that the losses and premiums have been trended to one year beyond the anticipated effective date of 2/1/90, the loss ratio for each of the respective policy years reflects the anticipated loss ratio for all policies written from 2/1/90-2/1/91 if the same exposures were to be written.

In order to reflect the experience of all three policy years, a weighted rate level loss ratio is calculated in line (6). The weights that have been applied are 50%, 30% and 20% for Policy Years Ending 12/31/87, 12/31/86, and 12/31/85 respectively. The calculation of the weighted ratio is as follows:

$$.50(.644) + .30(.664) + .20(.671) = 0.655$$

Credibility

One more item must be considered before the indicated change is calculated. This is credibility of the experience data. As we all know, a major concern in ratemaking is mitigating large swings in state indications from year to year. These swings can result when the weighted rate level loss ratio for a state receives too much credibility.

Another change that was implemented in 1988 along with the change in number of policy years, was an increase in credibility standards. The old standards for full credibility were based upon assigning full credibility to any state whose experience contained a total number of claims of 683 or more. This standard was based on variation in claim frequency only, and not in claim size. This has proven to be inappropriate, especially with the addition of multiline data to the ratemaking database. With the increase in volume of available data, it became practical to reflect some variation of claim size in the standards for full credibility. Along with the analysis on policy year weights, the effects of various full credibility standards were studied and new credibility standards were selected. The new credibility standards that are used by ISO are:

OL&T BI = 2,500

M&C BI = 3,000

M&C PD = 7,500

These standards were chosen based upon the formula (4):

$$\frac{Z^2}{K^2} \cdot \left(1+\frac{S^2}{M^2}\right)$$

where:

Z = 100 $\frac{1+P}{2}$ th percentile of the standard normal distribution,

K = the width of the confidence interval,

M = the mean of the claim size distribution,

S = the standard deviation of the claim size distribution.

The standards selected were roughly based on a 95% probability of being within 7.5% of the true value.

These new standards, as well as the new policy year weights, were analyzed along with several other options, to determine the impact that they would have on each state's indications. It was noted that these changes would provide more stability than the old standard of 683 claims, based on two

years of data, while still reflecting individual state experience. The result of these studies was the adoption of the new standards and weights.

Partial credibilities are still calculated using the square root rule. The credibility of .95 that was assigned to State X in line (8) was calculated in the following manner:

$$Z = \sqrt{(\text{Total \# of claims in the 3 year period})/(\text{full credibility standard})}$$

$$.95 = \sqrt{(1{,}098 + 1{,}018 + 615)/3{,}000}$$

The number of incurred claims are shown in column (5) for the purpose of calculating the state credibility. These are the actual claims for each policy year. They have not been developed.

Expected Loss Ratio

The expected loss ratio (ELR) represents that portion of each premium dollar that is expected to be available to pay for losses and loss adjustment expense after the insurer has budgeted all of its overhead expenses and targeted profits. Therefore the expected loss ratio is synonymous with the target loss ratio. If the insurer's premiums are exactly adequate, then its weighted loss ratio will be equal to its expected loss ratio.

The ELR is calculated by determining the percentage of each premium dollar which will be needed to cover all overhead expenses, targeted profits, taxes, licenses and fees and subtracting that percentage from unity. All expenses are based upon countrywide data from the Insurance Expense Exhibit, except for the tax provisions. Tax provisions differ by state. In 1989, the provisions used by ISO for premises and operations were:

Total Production Cost Allowance	25.0%
General Expenses	9.5%
Underwriting Profit and Contingencies	5.0%
Taxes, Licenses and Fees	3.0%

Indicated Monoline-Multiline Rate Level Change Factor

The indicated monoline-multiline rate level change factor is determined by comparing the weighted rate level loss ratio (WLR) to the expected loss and loss adjustment ratio (ELR). If the data underlying the experience

loss ratio were fully credible, the indicated rate level change would simply be (WLR)/(ELR).

However, state experience is not always fully credible. The WLR for State X is only 95% credible. The remaining 5% must be assigned to some complement of credibility. The calculation of the credibility weighted experience loss ratio is:

$$(WLR \times .95) + (.05 \times C)$$

Where 'C' is the adjusted expected loss ratio. This is the procedure which is used in any state which is not fully credible. Now the 'C' factor must be explained.

A revised method for calculating the 'C' factor was introduced at the same time that the credibility standards were changed. In the past, the 'C' factor was calculated by trending the current ELR - that ELR underlying the most recent filing - from one year past the date of the last approval in the state to one year beyond the anticipated effective date of the filing. The trend used here is the net trend - (frequency trend X severity trend)/exposure trend. If the last approved change for State X were effective March 1, 1988, and the anticipated effective date of the

filing were February 1, 1990, then the ELR would be trended for 23 months, or 23/12 years. This procedure was modified in 1988 to trending the ELR from one year beyond the date of the last rate review to one year beyond the anticipated effective date of the filing, and adjusting this number to reflect that portion of the indicated rate level change that was not approved by the state. This is to account for a state's relative rate level adequacy in light of the fact that more weight is now being given to the ELR.

For instance, if the assumed effective date of the last review were 2/1/89 and the unapproved portion indicated rate level change - or the 'residual indication' - were +10.0% then the 'C' factor would be calculated by the following:

ELR trended
from the date x 1.10 = C factor
of the last review

If 5% of the 10% was approved then the C factor would be:

ELR trended
from the date x 1.10 / 1.05 = C factor
of the last review

This method gives a better estimate of the truly expected loss ratio that underlies the present rates than the earlier method, since the earlier method did not account for previous rate level inadequacies. For instance, assume the following indication was filed and not approved:

Anticipated Effective Date	Indication
2/1/89	+20.0%

Also assume the net trend was 4.0%, and the ELR underlying the current rates was .575, then the trended ELR using the earlier method would be:

$$.575 \times 1.04^{(35/12)} = .645$$

if the anticipated effective date were 2/1/90 and the last approved date was 3/1/87. This would result in a credibility weighted loss ratio for State X of .655, and an indicated monoline-multiline change of +13.8%.

However, using the new method, the 'C' factor would be:

$$.575 \times 1.04^{(12/12)} \times 1.20 = .718$$

This is the 'C' factor for State X. This results in a credibility weighted loss ratio of .658, and the indication on line (9) of +14.5%. This new method of calculating the 'C' factor prevents the perpetuation of an existing rate level inadequacy.

This new method would prevent the perpetuation of rate level redundancies in the same fashion by using an adjustment to the ELR which is less than

1.00. If, for example, the unapproved indication were -20.0%, the procedure for calculating the 'C' factor would be as follows:

$$\text{'C' factor} = .575 \times 1.04^{(12/12)} \times (1-.20) = 0.478$$

This would result in a credibility weighted loss ratio of .646, and an indication on line (9) of +12.4%.

This new method should be more accurate than the previous method since it is using a loss ratio which is closer to that which we really expect when calculating the 'C' factor.

Once the 'C' factor is calculated and the credibility weighted experience loss ratio is determined, the indicated rate level change is calculated. The indicated change is the ratio of the credibility weighted experience loss ratio to the expected loss ratio. This is shown on line (9).

Indicated Monoline Rate Level Change

The indicated monoline-multiline rate level must then be distributed by type of policy so that the monoline change can be determined. Whether an insurer is writing a monoline policy or whether he is writing a multiline policy and then applying package discounts to that policy, he needs to know the monoline rates associated with that policy. In order to calculate the monoline rate level change factor, one must first determine the monoline relativity. This is accomplished through the use of a Bailey type minimum bias procedure.

The Minimum Bias Procedure

This procedure makes use of an iterative technique to calculate type of policy (TOP) and class group relativities. The TOP relativities are used to price package policies relative to monoline policies and the class group relativities are used to price the classifications for the TOP relative to one another.

When considering various iterative procedures for GL, a minimum bias procedure was ultimately chosen because it tends to be less sensitive to

the experience of individual cells. Using a Least Square procedure, on the other hand, is generally very sensitive to single large indicated loss ratio relativities for given class group/TOP combinations. These relativities could cause this method to provide a poor fit to all of the other class group/TOP relativities. This is an important consideration when not all of the cells have large volume. Many cells have small losses with associated large premiums or heavy losses with relatively light dollars in premium. This phenomenon would not have as great an effect on the stability of results when using the minimum bias procedure as it might have using some other methods.

This analysis makes use of the latest five years of policy year data. The multiline premiums that are used are adjusted by the current implicit package modification factors. Currently losses are not adjusted for development or trend but they eventually will be. In the future, premiums will be adjusted to reflect trend as well.

Once the adjustments to the data are made, five year loss ratios are calculated for each type of policy-class group combination. These ratios are used in determining the relativities to the statewide ratio. A two-way review of class group relativities and type of policy relativities then makes use of these relativities. A two-way relativity procedure is

used because it will account for the different percentages of monoline and multiline experience in each class group and the different percentage of class group experience in each type of policy in the calculation of the classification and type of policy relativities. This procedure also accounts for the interaction of TOP and class group experience.

This iterative procedure uses the following formulae to solve for a set of type of policy relativities and for a set of class group relativities (5):

$$TOPi = \frac{\sum_j Wij\ Rij}{\sum_j Wij\ CGj} \quad \text{where} \quad 1 \leq i \leq m$$

$$CGj = \frac{\sum_i Wij\ Rij}{\sum_i Wij\ TOPi} \quad \text{where} \quad 1 \leq j \leq n$$

where:

TOPi = the relativity for the ith type of policy,

CGj = the relativity for the jth class group,

Wij = the adjusted earned premium for the ith TOP and the jth class group,

Rij = the loss ratio relativity for the ith TOP and jth class group,

m = the number of types of policy in the analysis,

n = the number of class groups in the analysis.

This procedure first determines m type of policy relativities and then uses them to determine n class group relativities. Those class group

relativities are then used to determine a new set of type of policy relativities and the process continues until the difference in results from one iteration to the next is negligible.

An interesting result of the minimum bias procedure is that the relativities for the types of policy and class groups will maintain the raw marginal relativities. Assume, for example, the following M&C information before the minimum bias procedure for the Multiline Office Type of Policy were presented for State X:

TOP: 33 Offices Class Group	Latest Year's Premium	Five-Year Loss Ratio
09 M&C Contractors	272,227	0.023
11 LDSCP/Decor/Salvage	138,023	1.164
12 Miscellaneous	870	25.879
Total TOP Office	411,120	0.461
Total All TOPS	25,807,507	0.353

The relativity for the Office TOP would simply be .461/.353 or 1.306. This relativity can also be found by using the relativity for the Office TOP and the relativities for each class group, which resulted from the minimum bias procedure. The relativities are shown below:

Class GP	Relativity TOP	Relativity Class Group
09	1.342	0.995
11	1.342	0.925
12	1.342	1.025

Therefore the relativity 1.306 for the TOP can be found by multiplying the minimum bias relativities for the TOP and class group by the premium, and dividing the sum by the total premium for the Office package policies.

	272,227	x	1.342	x	0.995	=	363,502
+	138,023	x	1.342	x	0.925	=	171,335
+	870	x	1.342	x	1.025	=	1,197
Totals	411,120						536,034

The relativity is therefore equal to 536,034/411,120 or 1.304 which is within rounding of the raw relativity of 1.306.

Now, credibilities are assigned to each TOP and each class group relativity based upon the formula $Z = \sqrt{P/C}$ where P is the 5-year claim total for the class group or TOP and C is the credibility constant: C = 2,500 for OL&T BI; C = 3,000 for M&C BI; and C = 7,500 for M&C PD.

Credibility weighted relativities are then calculated using:

$$W = R^{Z}$$

where:

Z is the credibility for the class group or TOP,

R is the relativity for the class group or TOP, calculated using the minimum bias procedure,

W is the credibility weighted relativity.

This is equivalent to a linear weighting of the log of the class group or TOP relativity with the relativity S, for all TOP's and all class groups combined:

$$\text{Log } W = Z \log R + (1-Z) \log S$$

Since the all TOP-all class group relativity by definition is always 1.00, this becomes:

$$\text{Log } W = Z \log R + (1-Z) \text{ Log } (1.00)$$

$$\text{Log } W = Z \log R + 0$$

$$W = R^{Z}$$

These credibility-weighted relativities are balanced to guarantee that the premium weighted average relativity remains at one. Therefore, the sum of all balanced relativities for each TOP weighted on the latest year's PPMR for each TOP will be approximately equal to the PPMR for the state. This

will also hold true for the class group balanced relativities and PPMR.

For instance, assume the following:

TOP	Minimum Bias Formula Relativities	Cred. %	%-Wtd. Rel.	Balanced Relativities	Latest Year PPMR	PPMR X Relativity
10	0.999	1.00	0.999	0.995	15,501,467	15,423,960
33	1.342	0.10	1.030	1.026	411,120	421,809
34	0.771	0.20	0.949	0.945	1,235,083	1,167,153
35	0.922	0.10	0.992	0.988	64,878	64,099
36	1.197	0.40	1.075	1.071	1,920,574	2,056,935
37	0.896	0.30	0.968	0.964	1,672,709	1,612,491
38*	-	-	1.017	1.013	5,001,676	5,066,698
Total					25,807,507	25,813,145

As you can see, the total premium after applying relativities is within .02% of the original premium. Slight differences do exist due to rounding in the relativities. The average relativity of 1.00 is also maintained when a weighted average is taken over all TOP-class group cells. Note that the TOP 38, in this case, has been capped at 1.022. The minimum bias procedure calculated a relativity for this TOP that would have brought the current IPMF over this cap. Therefore, the relativity was capped so that:

$$\text{Current IPMF} * \frac{\text{TOP 38 Relativity}}{\text{TOP 10 Relativity}} = 1.022$$

Once the balanced relativities are determined, they are used to generate indicated overall monoline classification rate changes and multiline indications which apply to the current implicit package modification factors. The indicated IPMF's are calculated by the following:

$$\text{TOP y } \underline{\text{indicated}} \text{ IPMF} = \frac{\text{TOP y current IPMF x TOP y relativity}}{\text{monoline relativity}}$$

The indicated IPMF's are then capped at a minimum and maximum level. Once they are capped, the relativity review described above is reperformed to account for these caps. Note that one year's current IPMF's are based on the previous year's indicated IPMF's.

Monoline indicated changes are determined for each class group by multiplying the monoline TOP relativity by the relativity for each class group and the overall indicated rate level change for the state. Once a class group indication is determined, it is multiplied by the monoline premium for that class group, these are then summed over all class groups and divided by the total monoline premium for the state. This will produce the overall indicated monoline rate level change factor. This calculation is necessary because the monoline exposure distribution by class group is different from that for all TOP's combined, making it

inappropriate to just multiply the overall change by the monoline relativity.

The formula for this indicated monoline rate level change factor is:

$$\frac{\sum(\text{Monoline Rel}) \times (\text{Class Gp. Rel.}) \times (\text{Overall Ind.}) \times (\text{Monoline Class Gp. Prem.})}{\text{Monoline Premium for all Class Groups}}$$

where the summation is over all class groups.

The next three pages show a complete minimum bias exhibit.

Territory Relativities

Territory relativities reflect the differences in experience between the various territories in a state. The characteristics of the different territories will vary. For example, a territory such as a large city will have different characteristics from a small town and should be rated separately. Territory relativities are calculated using three-year or five-year loss ratios, depending upon the size of the state, and dividing the loss ratio for the territory by the statewide formula loss ratio. If the loss ratio for a territory is not fully credible, it would be

STATE X

M & C BI BASIC LIMITS RELATIVITY ANALYSIS

SUMMARY OF EXPERIENCE USED IN SIMULTANEOUS REVIEW

TYPE OF POLICY	CLASS GROUP	(1) 1986 PREM. @ PRES RATES	(2) 1982 - 1986 PREM @ PRES RATES	(3) FIVE-YEAR LOSS RATIO	(4) RELATIVITY	(5) NUMBER OF CLAIMS
10 MONOLINE	01 FOOD PRODUCTS	120,760	414,952	0.894	2.533	52
	02 QUARRY OPERATIONS	123,501	595,531	0.552	1.564	20
	03 INDUSTRIAL MANUF.	110,596	427,807	0.534	1.513	12
	04 LIGHT & MISC. MANUF.	1,078,833	4,443,079	0.315	0.892	121
	05 MASONRY CONTRACTING	1,631,329	10,581,718	0.261	0.739	273
	06 CNTR EQUIP RNT W/OP	1,678,649	11,600,043	0.353	1.000	245
	07 ERECTION & WRECKING	856,409	4,103,048	0.224	0.635	100
	08 BUILDING TRADES	3,532,047	19,604,254	0.393	1.113	692
	09 MISC. CONTRACTORS	3,181,003	17,635,836	0.353	1.000	507
	10 UTILITIES & DEALERS	370,875	1,405,876	0.386	1.093	52
	11 LDSCP/DECOR/SALVAGE	2,026,906	10,217,019	0.269	0.762	311
	12 MISCELLANEOUS	790,559	3,800,265	0.282	0.799	130
	TOTAL*	15,501,467	84,829,428	0.336	0.952	2,515
33 MULTILINE OFFICE	09 MISC. CONTRACTORS	272,227	1,016,966	0.023	0.065	6
	11 LDSCP/DECOR/SALVAGE	138,023	589,623	1.164	3.297	45
	12 MISCELLANEOUS	870	1,774	25.759	72.972	1
	TOTAL*	411,120	1,608,363	0.461	1.306	52
34 MULTILINE MERCANTILE	01 FOOD PRODUCTS	1,271	40,255	0.201	0.569	4
	03 INDUSTRIAL MANUF.	18,022	125,763	0.015	0.042	2
	06 CNTR EQUIP RNT W/OP	7,909	31,405	0.000	0.000	0
	09 MISC. CONTRACTORS	345,519	1,814,019	0.194	0.550	13
	10 UTILITIES & DEALERS	64,662	290,209	0.384	1.088	11
	11 LDSCP/DECOR/SALVAGE	168,864	715,374	0.331	0.938	33
	12 MISCELLANEOUS	628,836	2,357,528	0.312	0.884	102
	TOTAL*	1,235,083	5,374,553	0.279	0.790	165
35 MULTILINE INSTITUTIONAL	06 CNTR EQUIP RNT W/OP	41	8,472	2.429	6.881	1
	10 UTILITIES & DEALERS	64,784	663,669	0.452	1.280	35
	11 LDSCP/DECOR/SALVAGE	53	64,057	0.094	0.266	1
	TOTAL*	64,878	736,198	0.453	1.283	37
36 MULTILINE SERVICES	03 INDUSTRIAL MANUF.	18,836	105,495	0.066	0.187	2
	04 LIGHT & MISC. MANUF.	242,942	1,242,932	0.550	1.558	71
	06 CNTR EQUIP RNT W/OP	5,679	29,967	0.000	0.000	0
	07 ERECTION & WRECKING	478,144	2,805,042	0.324	0.918	87
	08 BUILDING TRADES	126,212	800,004	0.263	0.745	39
	09 MISC. CONTRACTORS	27,552	207,651	0.030	0.085	2
	10 UTILITIES & DEALERS	175,863	883,055	0.811	2.297	74
	11 LDSCP/DECOR/SALVAGE	570,029	2,702,525	0.281	0.796	81
	12 MISCELLANEOUS	277,317	1,528,496	0.576	1.632	133
	TOTAL*	1,920,574	10,305,167	0.409	1.159	489

STATE X

M & C BI BASIC LIMITS RELATIVITY ANALYSIS

SUMMARY OF EXPERIENCE USED IN SIMULTANEOUS REVIEW

TYPE OF POLICY	CLASS GROUP	(1) 1986 PREM. @ PRES RATES	(2) 1982 - 1986 PREM @ PRES RATES	(3) FIVE-YEAR LOSS RATIO	(4) RELATIVITY	(5) NUMBER OF CLAIMS
37 MULTILINE INDUST/PROC.	01 FOOD PRODUCTS	148,217	717,830	0.355	1.006	82
	02 QUARRY OPERATIONS	93,602	494,709	0.514	1.456	18
	03 INDUSTRIAL MANUF.	64,284	408,953	0.461	1.306	8
	04 LIGHT & MISC. MANUF.	1,248,991	7,069,571	0.340	0.963	174
	06 CNTR EQUIP RNT W/OP	4,368	9,552	0.000	0.000	0
	07 ERECTION & WRECKING	50,162	325,948	0.507	1.436	8
	11 LDSCP/DECOR/SALVAGE	37,302	204,322	0.200	0.567	9
	12 MISCELLANEOUS	25,783	115,178	0.193	0.547	0
	TOTAL#	1,672,709	9,346,063	0.354	1.003	299
38 MULTILINE CONTRACTORS	05 MASONRY CONTRACTING	519,410	3,082,994	0.497	1.408	95
	06 CNTR EQUIP RNT W/OP	1,030,349	6,113,966	0.231	0.654	132
	07 ERECTION & WRECKING	69,780	486,536	0.458	1.297	12
	08 BUILDING TRADES	1,349,458	8,978,280	0.403	1.142	324
	09 MISC. CONTRACTORS	1,207,024	7,902,421	0.470	1.331	316
	11 LDSCP/DECOR/SALVAGE	748,094	4,289,277	0.412	1.167	166
	12 MISCELLANEOUS	77,561	357,265	0.146	0.414	10
	TOTAL#	5,001,676	31,210,739	0.392	1.110	1,055
TOTAL ALL TOPS#	01 FOOD PRODUCTS	270,248	1,173,037	0.595	1.686	138
	02 QUARRY OPERATIONS	217,103	1,090,240	0.536	1.518	38
	03 INDUSTRIAL MANUF.	211,738	1,068,018	0.426	1.207	24
	04 LIGHT & MISC. MANUF.	2,570,766	12,755,582	0.349	0.989	366
	05 MASONRY CONTRACTING	2,150,739	13,664,712	0.318	0.901	368
	06 CNTR EQUIP RNT W/OP	2,726,995	17,793,405	0.305	0.864	378
	07 ERECTION & WRECKING	1,454,495	7,720,574	0.278	0.788	207
	08 BUILDING TRADES	5,007,717	29,382,538	0.392	1.110	1,055
	09 MISC. CONTRACTORS	5,033,325	28,576,893	0.351	0.994	844
	10 UTILITIES & DEALERS	674,184	3,242,809	0.502	1.422	172
	11 LDSCP/DECOR/SALVAGE	3,689,271	18,782,197	0.335	0.949	646
	12 MISCELLANEOUS	1,800,926	8,160,506	0.343	0.972	376
	TOTAL#	25,807,507	143,410,511	0.353	1.000	4,612

TOTALS IN COLUMNS (3) & (4) ARE AVERAGES USING COLUMN (1) AS WEIGHTS.

STATE X

M & C BI BASIC LIMITS RELATIVITY ANALYSIS

TOP	(1) BAILEY FORMULA RELATIVITY	(2) CREDIBILITY Z	(3) Z-WTD. RELATIVITY	(4) BALANCED RELATIVITY	STATEWIDE COVERAGE RATE CHANGE OF 1.145 OR + 14.5%
10	0.999	1.000	0.999	0.995	
33	1.342	0.100	1.030	1.026	
34	0.771	0.200	0.949	0.945	
35	0.922	0.100	0.992	0.988	
36	1.197	0.400	1.075	1.071	
37	0.896	0.300	0.968	0.964	
38 *	-	-	1.017	1.013	

CLASS GROUP					(5) INDICATED MONOLINE RATE LEVEL CHANGE
01	1.791	0.200	1.124	1.125	+ 28.2%
02	1.590	0.100	1.047	1.048	+ 19.4
03	1.250	0.0	1.000	1.001	+ 14.0
04	1.023	0.300	1.007	1.008	+ 14.8
05	0.888	0.300	0.965	0.966	+ 10.1
06	0.871	0.300	0.959	0.960	+ 9.4
07	0.753	0.200	0.945	0.946	+ 7.8
08	1.103	0.500	1.050	1.051	+ 19.7
09	0.995	0.500	0.997	0.998	+ 13.7
10	1.393	0.200	1.069	1.070	+ 21.9
11	0.925	0.400	0.969	0.970	+ 10.5
12	1.025	0.300	1.007	1.008	+ 14.8
			OVERALL MONOLINE RATE LEVEL CHANGE		+ 14.0%

*TOP 38 IMPLICIT PMF CAPPED AT 1.022

credibility weighted with the statewide loss ratio to determine the territory formula loss ratio.

At this point, two things should be noted regarding territory relativities. Currently, only monoline data is used because of certain system limitations. When the variance studies were performed to determine new credibility standards for each of the sublines, they were based upon monoline and multiline data combined. Additional studies would have been necessary to determine whether the new standards would have been appropriate for monoline data only. Since, in 1990, multiline data will be used in the territory relativity calculations, as described below, it was deemed unnecessary to perform the analysis and make such a change in credibility standards for the interim period. For this reason, the old credibility standard of 683 claims is still in place. Also, the losses and premiums that are used are not adjusted for trend or development.

We can now calculate the formula loss ratio for each territory

$$FLRi = (Z)\,(TLRi) + (1-Z)\,(SLR)$$

where:

FLRi = formula loss ratio for territory i,
TLRi = territory loss ratio,
SLR = state loss ratio,
Z = credibility for the territory $= \sqrt{(\text{total claims in territory})/683}$.

The exhibit which follows shows these calculations.

State X
Manufacturers and Contractors Liability Insurance
Bodily Injury
Development of Territory Rate Level Relativities

-1-	-2-	-3-	-4-	-5-	-6-
Territory	$25,000 Basic Limits Premium At Present Rates#	$25,000 Loss & Loss Adj Ratio*+	Credibility	Formula Loss & Loss Adj Ratio+	Indices Col 5/ Total Col 5
1	6,709,426	.339	1.00	.339	1.046
2	8,792,052	.312	.90	.313	.966
Total	15,501,478	.324		.324	

Policy Year Ending December 31, 1987
* Policy Years Ending December 31, 1983 through December 31, 1987
+ Total ratios are premium weighted averages.

During 1989, the propriety of incorporating the territory relativity calculation into the minimum bias procedure was examined. The minimum bias procedure will be substituted for the current loss ratio procedure during 1990. Territory relativities will be based upon monoline and multiline data and will be determined using a three-way minimum bias procedure, the three dimensions being class group, type of policy, and territory.

Not only will the type of policy and class group relativities be calculated, but also territory relativities will be calculated through this procedure. This procedure will be basically the same as the two-way procedure described above except that the iterative formulas will need to include territory relativities. Assuming the number of territories in the state is p, the formulas for calculating these relativities will therefore be:

$$TOPi = \frac{\sum_j \sum_k Wijk\ Rijk}{\sum_j \sum_k Wijk\ CGj\ TERk} \qquad \text{where } 1 \leq i \leq m$$

$$CGJ = \frac{\sum_i \sum_k Wijk\ Rijk}{\sum_i \sum_k Wijk\ TOPi\ TERk} \qquad \text{where } 1 \leq j \leq n$$

$$TERk = \frac{\sum_i \sum_j Wijk\ Rijk}{\sum_i \sum_j Wijk\ TOPi\ CGj} \qquad \text{where } 1 \leq k \leq p$$

where:

Wijk = the adjusted earned premium for the ith TOP, jth class group and kth territory,

Rijk = the loss ratio relativity for the ith TOP, jth class group, and kth territory,

TERk = the relativity for the kth territory.

The remaining definitions for TOPi and CGj are analogous to the two-way procedure.

When this procedure is implemented, the new credibility standards will apply for territories as well, because the multiline data will be included.

Once the indicated monoline rate level change factor for the state is determined, along with class group and territory relativities, the actuary is ready to calculate revised basic limits rates reflecting this change.

Calculating Revised Class Rates

The initial step in calculating a revised general liability basic limit rate is to compute the proposed base rate (PBR) for a particular class group in a particular territory. Individual classifications are mapped into ratemaking class groups for credibility reasons. Currently, OL&T has thirteen such groups and M&C has twelve. Each class group contains classes that are similar in nature and risk. The class groups for OL&T and M&C are:

	OL&T Class Group		M&C Class Group
1.	Apartments & Tenements	1.	Food Products
2.	Miscellaneous	2.	Quarry Operations
3.	Retail Stores - Misc.	3.	Industrial Manuf.
4.	Dept., Drug, Groc., Var. Stores	4.	Light & Misc. Manuf.
5.	Groceries - Receipts over $500,000	5.	Masonry Contracting
6.	Restaurants	6.	Cntr. Equip. Rnt - w/op
7.	Clubs & Athl. Estab.	7.	Erection & Wrecking
8.	Shopping Ctrs., etc.	8.	Building Trades
9.	Medical & Nursing	9.	Misc. Contractors
10.	Churches & Schools	10.	Utilities & Dealers
11.	Theaters	11.	Landsc./Decor./Salvage
12.	Storekeepers	12.	Miscellaneous
13.	Hotels & Motels		

Classes will be grouped differently under CGL.

The proposed base rate represents the average rate that should be charged for the base class in the class group. The base class in a class group is generally the class with the most stability in experience from year to year. The rates for all other classes in a class group are calculated relative to the base class rate.

The formula for the PBR is as follows:

$$PBR_{jk} = \frac{PPMR_{jk}}{\text{Adjusted Exposures}_{jk}} \times \text{Class Group Off-Bal.}_{k} \times \text{Class Gp. Relativity}_{j} \times \text{Territory Relativity}_{k} \times \text{Monoline Rate Level Change Factor}$$

It should be noted that the PBR is calculated using monoline data only.

Some of the terms in the above formula need to be explained:

For states that have territories, the above formula would be used to calculate a PBR for territory k and class group j. Currently, there are five states with territories in M&C and thirty states with territories in OL&T. The remainder of the states without territories would use the above formula with slight modifications. The territory relativity and the class group off-balance would not be needed in these cases.

Premium at present manual (PPMRjk) represents the latest year's monoline PPMR for territory k and class group j.

Adjusted exposures jk represent the exposures for each class in group j and territory k for each class multiplied by the class differential and summed. The class differential is the relationship between the class and the class group base class. A review is performed every few years which compares class experience for each class in the class group to the experience for the base class. Relativities are then determined by comparing the loss ratio for the individual class to the loss ratio for the base class. Class differentials are then based upon these indicated relativities.

The reason that the formula divides PPMR for the class group by these adjusted exposures is to calculate a present base rate for the group. Therefore, (PPMRjk)/(Adj. Expjk) can be called the present base rate for territory k and group j. This is not simply equal to the present rate for the base class because of changes in the exposure distribution by class over time.

The purpose of the class group off-balance is to compensate for distortions that may arise in the territory premium levels by strictly

applying the class group relativities for each group to a given territory. The exposure distribution of the class group by state is not necessarily the same as the distribution by territory. The class group off-balance adjusts the class group relativities by territory so that they balance back to unity for the territory. Therefore, the formula for the off-balance is equal to:

$$\frac{\text{(total premium in the territory)}}{\sum \text{(premium for the class group in the territory) X (class group rel)}}$$

where the denominator is summed over all class groups.

Class group relativity j represents the monoline class group relativity for class group j which was determined by the minimum bias procedure, ie. monoline indicated change for the class group divided by the monoline indicated change for the state. It is not appropriate to simply multiply by the class group relativity because of distortions due to different exposure distributions by type of policy.

The monoline rate level change factor is the indicated monoline change which was also calculated using the minimum bias procedure.

The information needed to calculate a proposed base rate for several class groups in territory 1 of State X is shown below. We are using the statewide monoline change factor of 1.140 and the territory 1 relativity of 1.046.

Class Group	PPMR	Adjusted Exposures	Class Group Relativity	Class Group Off-Bal.	Proposed Base Rate
01	75,449	229,604	1.125	.991	.437
02	61,541	63,695	1.048	.991	1.197
03	40,431	86,234	1.001	.991	.555
04	465,693	1,124,016	1.008	.991	.494

There are a number of differences in the current procedure for calculating the PBR from that procedure as outlined by Lange. Lange mentioned the use of industry group relativities for M&C. The three industry groups for which relativities were calculated were: manufacturing classes, contracting classes, and all other classes. These industry groups were used in order to provide more credible relativities than would have resulted from using only class group relativities, and also to account for these diverse risk types in M&C. This procedure need not be used today for two reasons. First, the inclusion of multiline data increases the credibility of the individual class group relativities. Second, the minimum bias procedure, which is used to calculate class group relativities, accounts for any of these industry group differences.

Once the PBR for a class group is calculated, it is quite simple to determine the revised general liability rate for an individual class in that group. The rate is equal to the PBR multiplied by the class differential. As mentioned earlier, this differential represents the relativity of the class experience to the base class experience.

This rate is then rounded according to the following general liability rounding rules:

Rates	Round to the Nearest
0 - .049	$ .001
.05 - .99	.01
1.00 - 9.99	.10
10.00 -99.99	.50
100.00 -Over	1.00

The rounding rules are slightly different under CGL.

FUTURE DIRECTIONS

As you have seen, many further changes to the ratemaking procedure are already planned. Some of these changes, like the three-way minimum bias procedure, will be implemented by 1990. Other changes, such as combined bodily injury and property damage reviews, will be implemented within the next three or four years.

There are still several unresolved questions regarding CGL ratemaking, many of which revolve around the so-called "fringe" coverages. These are coverages, such as broad form property damage, which were previously purchased separately and are now part of the basic coverage. Some of the unresolved issues have to do with trending and developing this data. The resolution of these issues will surely result in some changes.

Other changes in the ratemaking procedure will certainly result from ISO's decision to publish only prospective loss costs rather than rates. For example, the expected loss ratio will no longer be part of the ratemaking process, and all premiums will be replaced by expected losses.

No other major changes to ISO's ratemaking procedure directly due to loss costs are being implemented at this time. Companies, of course, will

have to determine their own expense provisions and use them to convert ISO's loss costs into rates.

There are areas in the methodology that might be examined simply because it would be interesting to look into other methods. Among these are examination of differences in trend by state or region, as well as refining the procedures used to determine class differentials. The search for a good econometric model of frequency trend will also continue.

As we stated at the outset, this paper is truly only a snapshot of premises and operations at one short period in time. Ratemaking is constantly changing. This is one of the things that makes it so exciting.

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