INDIVIDUAL RISK RATING
(TEXTBOOK CHAPTER DRAFT)
I. INTRODUCTION

Manual ratemaking determines what rates should be charged groups of entities for specified coverage and entity characteristics. Individual risk ratemaking works within the rating groups to modify the group rates in whole or in part to reflect an individual entity's experience.

If all entities in all rating groups were truly homogeneous, fluctuations in experience would be fortuitous. While this is the goal of manual ratemaking, it is not usually possible to achieve. In addition, some entities are so large that their experience is, to some extent, "credible." The combination of non-homogeneous rating groups and entities with credible experience indicates that individual risk ratemaking is appropriate.

A. Goals of Individual Risk Ratemaking

For an insurer, the primary goal of individual risk ratemaking is to more accurately price the coverage provided than if rates were based only on manual rates. Non-traditional risk financing mechanisms may also call for individual risk ratemaking. For groups of entities, such as pools or risk retention groups, the primary goals of individual risk ratemaking (sometimes referred to as cost allocation) are to more accurately allocate costs to participants and to motivate participation in risk control programs. These are also the goals of individual risk ratemaking for individual entities retaining ("self-insuring") all or part of their risks and allocating the associated costs to departments or other units. Individual entities purchasing insurance may similarly wish to allocate the insurance costs to their departments or other units. For individual entities in either situation, the units to which the costs are being allocated take the role of participants or "insureds." Some entities may participate in individual risk ratemaking systems as both allocator and allocatee.
Motivation of participation in risk control programs is a secondary goal of insurers using individual risk ratemaking. Other goals of insurers and other entities using individual risk ratemaking are to appropriately balance risk sharing and risk bearing and to provide information to design or modify risk control programs. For individual entities, the allocation of costs to units allows for more accurate pricing of products and services.

B. Attributes of Good Individual Risk Ratemaking Systems

Good individual risk ratemaking systems have the following attributes:

- serve the needs of the organization using them,
- appropriately balance risk sharing and risk bearing,
- are not subject to internal or external manipulation,
- are simple to administer,
- are easy to understand, and
- do not subject the entities subject to them to large fluctuations in costs from one year to the next due to fortuitous experience.

Some of the attributes listed above are sufficient but not necessary to insure that other attributes listed above are met. As practical considerations may override one or more of these attributes, all are listed.
Prior to designing any individual risk ratemaking system, the organization using it should determine its needs for the system. These needs may simply be the goals listed above. Or the entity may have different needs. For example, a public entity wishing to allocate the costs of its general liability insurance back to its various departments may wish to allocate half the cost to its public utility which can recover costs in its rates.

An individual risk ratemaking system should appropriately balance risk sharing and risk bearing. The costs for small entities whose experience is not at all credible should be determined solely based on risk sharing. Large entities whose experience is completely credible should have their costs solely based on risk bearing. Entities between these extremes should have their costs based on a weighting of risk sharing and risk bearing.

Individual risk ratemaking systems should not be subject to internal or external manipulation. Manipulation is internal if the entity to which costs are being allocated can influence the cost allocation. An example is when the entity to which costs are being allocated sets the case reserves used in the individual risk ratemaking calculation. Manipulation is external if some agency other than the entity to which costs are being allocated can influence the cost allocation. An example is when a marketing manager can override the pricing results of the individual risk ratemaking calculation.

As a practical consideration, individual risk ratemaking systems should be simple to administer. If one is very complicated to administer, it may not be used. A system which is simple to administer is also more likely to be easy to understand. Understanding is important particularly in those situations in which participation in risk control programs is one of the goals: the easier a system is to understand, the better will be the motivation, assuming the system is appropriately designed.
A good individual risk ratemaking system does not subject the entities subject to it to large fluctuations in costs from one year to the next due to fortuitous experience. An individual risk ratemaking system should reflect an entity's experience only to the extent that it is credible. Fortuitous experience is not credible because it is the result of chance alone. An individual risk ratemaking system that reasonably balances risk sharing and risk bearing usually has this attribute of moderating the impact of fortuitous cost fluctuations. However, a system could have this attribute without reasonably balancing risk sharing and risk bearing.

C. Overview of Individual Risk Ratemaking

There are two basic types of individual risk ratemaking systems: prospective and retrospective. Prospective systems use past experience to determine costs for the future. Retrospective systems use experience to determine the final costs for the experience (past) period.

Retrospective systems are more responsive to experience changes than prospective changes. This is an advantage when a primary goal is to motivate participation in risk control programs. This responsiveness also means that retrospective systems result in less stable costs from one time period to the next than do prospective systems.

While different systems use different formulae, all individual risk ratemaking systems weight experience and exposure. The weight assigned to the experience portion is a reflection of the credibility (degree of belief) that the entity's experience is valid.

There are practical considerations that impact individual risk ratemaking systems. These include such items as using alternative exposure measures and data to those desired if those desired are not readily available. If one of the goals is to motivate participation in risk
control programs and the results of the experience rating calculation do not make a material difference to the entity to which costs are being allocated, there will probably be no such motivation.

For individual entities allocating risk financing costs to units, different tax rates and systems, the ability of units to purchase their own insurance, and whether and how unit managers get the benefits or penalties of the costs allocated to their units all impact how effectively an individual risk ratemaking system will meet its goals.

D. Terminology

The insurance industry is notorious for using words in different ways, even within the same company. It is important to understand in every situation how terms are used as different usage could produce different results. Below are discussed some basic terminology used in this chapter.

1. Claims and Occurrences

A claim is a demand by an individual or other entity to recover for loss. An occurrence is a series of incidents happening over a period of time that collectively results in personal injury or property damage. Note that one occurrence may have multiple claims associated with it. An example is an automobile accident in which several people, each of whom files a claim, are injured.

"Claim" is often used when "occurrence" is meant. Additionally, some entities count the different components of a claim as separate claims. For example, a general liability claim with both bodily injury and property damage may be counted as two claims.
"Claim" is often used also to refer to "losses." "Claim" and "occurrence" are zero/one words: they indicate either presence or absence and not amount.

Many individual risk ratemaking systems limit the losses used in the experience portion of the calculation. These limits are usually applied to each occurrence. Some formulae for the credibility used in the individual risk ratemaking calculation rely on number of occurrences.

2. Losses, ALAE, and ULAE

"Losses" refers to the amount associated with a claim. This is the amount a claim is worth, not the request for payment. For liability, losses includes bodily injury, property damage, and personal damage. For workers' compensation, losses includes medical and indemnity.

Allocated loss adjustment expenses (ALAE) are attorneys' fees, investigative fees, etc., associated with settling a particular claim. Unallocated loss adjustment expenses (ULAE) are expenses associated with settling claims which can not be allocated to settlement of a particular claim.

For an insurer, ALAE are usually the cost of outside legal counsel and investigators and ULAE are usually the costs of the claim department, including office space, salaries and benefits, supplies, etc. However, some insurers use no outside resources to settle claims (and have no ALAE) while other insurers keep time and expense records for the claim department and charge the costs to claims as ALAE (and have no ULAE). Similar situations can occur with non-traditional risk financing mechanisms.

"Losses" sometimes refers to losses only and sometimes to losses and ALAE. Different individual risk ratemaking systems treat losses, ALAE, and ULAE differently. And the same
system used by different entities may produce different results if ALAE and ULAE are defined differently.

3. Time Periods

An accident period is the period during which an occurrence occurs, regardless of when any policies covering it are written or when the occurrence is reported or paid. A policy period is the period during which an occurrence occurs for policies written during a specified time, regardless of when the claim is reported or paid.

Exhibit 1 illustrates the accident period and policy period concepts for policies written to cover accidents occurring during the policy period (referred to as an occurrence basis policy). The accident years are represented by vertical lines; the policy years by 45 degree lines. Note that accident year 1981 contains accidents (occurrences) associated with policies written in 1980 and 1981, and policy year 1981 contains some accidents that occur in 1981 and some that occur in 1982. A policy written December 31, 1981 will have almost all accidents associated with it occurring in 1982. For any one entity with an occurrence basis policy, the policy period is the same as the accident period.

Not all policies are written to cover accidents occurring during the policy period. Two other options are "claims-made" and "claims-paid." Claims-made policies cover claims (or occurrences) reported during the policy period, regardless of when claim occur or are paid if they occur after the retroactive date. Claims-paid policies cover the claims (or occurrences) paid during the policy period, regardless of when claims occur or are reported if they occur and are reported after the appropriate retroactive dates. Retroactive dates are used to prevent duplicate coverage in converting from occurrence basis policies to claims-made or...
claims-paid. If an entity changes from occurrence basis to claims-made to claims-paid, two retroactive dates, one for occurrences and one for reporting, would be necessary.

There are many coverage questions that arise with claims-made and claims-paid policies because of poor coverage wording. The two main questions are:

- Is the coverage for claims or occurrences?
- How is the report (or payment) date defined?

Non-traditional risk financing mechanisms also have these time period concepts. For example, individual entities retaining risk may decide to fund during each fiscal year only for those occurrences reported during the fiscal year.

The time period concepts are important in individual risk ratemaking because the first step in designing or understanding such a system is to know what costs are involved. This depends on the coverage provided or the funding basis, which is a function of the time period under consideration.

4. Loss Components

Paid losses are losses that have been paid. Outstanding losses, or case reserves, are estimates by the claim examiner of the remaining amount required to settle particular claims based on the knowledge about those claims at a particular date. Case reserving is an art, not a science, so different examiners may set reserves on the same claim at different amounts.
Case reserves, when added to the payments on open claims, do not and are not supposed to reflect the ultimate settlement amount. Case reserves are based on knowledge at a particular point in time. In general, additional information about a claim tends to be worse, rather than better. This means that there is usually an upward development of the payments on open claims plus case reserves on a given group of claims. It is possible to have downward development, but this is very unusual. The difference between the current total of payments on open claims plus case reserves and the ultimate settlement value for a given group of claims is called "case reserve development." Note that occurrence basis and claims-made coverage will need a reserve to reflect case reserve development.

Occurrence basis coverage will also need a reserve to reflect unreported occurrences. Claims-made coverage will need a reserve to reflect unreported claims if coverage is provided for occurrences reported during a particular period since not all claims associated with an occurrence are reported at the same time. The unreported occurrences/claims reserve is the true "IBNR" (incurred but not reported) reserve.

"Reported losses" refers to the sum of payments plus case reserves. "Unreported losses" refers to the case reserve development plus unreported occurrences/claims reserve. "Incurred losses" refers to the sum of reported and unreported losses. Note that unreported losses and incurred losses contain different items for occurrence and claims-made coverage and may contain different items for different types of claims-made coverage.

"Case reserves" are sometimes used when "reported losses" are meant. Many entities refer to "reported losses" as "incurred losses" and to "unreported losses" and "IBNR." The result is confusion, with incurred losses plus incurred but not reported losses equaling incurred losses.
Exhibit 2 illustrates the loss component terminology used in this chapter. These terms also apply to ALAE. Sometimes losses and ALAE are treated together, sometimes separately, and sometimes as a mixture. An example of the last is treating paid losses and paid ALAE separately, but setting case reserves for losses and ALAE combined or for losses only.

To properly design, understand, or use an individual risk ratemaking system, loss component terminology for the system and the data available to be used by the system must be clarified.

5. Frequency and Severity

Two other terms that have different usage in different situations that arise in conjunction with individual risk ratemaking systems are "frequency" and "severity." Frequency is the number of claims (or occurrences) per exposure unit. "Frequency" is sometimes incorrectly used to refer to the number of claims or occurrences. Frequency is a relative, not an absolute, measure.

Severity is the average loss per claim (or per occurrence). Note that loss may include or exclude ALAE.

E. What is to be Allocated

The first task in designing or understanding an individual risk ratemaking system is to determine what is to be allocated. For traditional insurance, the answer often is all costs. These include losses, ALAE, ULAE, reinsurance premium, risk control costs, overhead, taxes, miscellaneous expenses, and profit associated with insurance policies of the type being written (e.g., occurrence).
Non-traditional risk financing mechanisms and individual entities allocating risk financing costs back to units also may want to allocate all costs associated with insurance policies of the type being written. Those costs may include different items, such as excess insurance premium and a risk margin (money for adverse loss and ALAE experience), and exclude others, such as taxes and profit. Non-traditional risk financing mechanisms and individual entities allocating costs back to units and even some insurers may want to allocate only some subset of costs, such as losses, ALAE, and ULAE, with other costs treated in a different manner.

Note that part of the determination of what is to be allocated involves determining the basis on which policies are written or funding occurs. This is necessary so that the various components subject to the allocation are appropriately tabulated and adjusted.
II. PROSPECTIVE SYSTEMS

There are three basic types of prospective individual risk ratemaking systems: schedule rating, experience rating, and some types of composite rating. Schedule rating takes into consideration characteristics that should impact loss and ALAE experience but that are not reflected in that experience. Experience rating uses an entity's actual experience to modify manual rates (determined by the entity's rating group). Composite rating simplifies the premium calculation for large, complex entities and, in some instances, allows the entities' experience to impact the manual rates or determine the rates regardless of rating group.

A. Schedule Rating

Schedule rating is the only individual risk ratemaking system that does not directly reflect an entity's experience: it recognizes characteristics that should impact an entity's experience but that are not actually reflected in that experience. These characteristics could result from recent changes in exposure or risk control programs.

Schedule rating systems usually take the form of percentage credits and debits. These credits and debits are sometimes applied before and sometimes after experience rating. There may be a limit to the total debit or credit that an entity can receive.

Note that schedule credits and debits apply only to those characteristics which should impact an entity's loss and ALAE experience. If a characteristic is listed which should not impact a particular entity's loss and ALAE experience, there should be no adjustment to the manual rates for that characteristic for that entity.
Also note that the application of schedule credits and debits may take considerable underwriting judgment. A schedule rating system that is based on objective criteria will result in more consistent treatment of entities subject to it than a system that relies on subjective evaluation. This is illustrated by the two examples of schedule rating that follow.

1. **Insurance Services Office General Liability Schedule Rating Plan**

For eligible entities, the manual rates may be modified according to the table below in addition to any experience rating modification. The maximum schedule rating modification is 25% up or down.

**ISO General Liability Schedule Rating Table**

<table>
<thead>
<tr>
<th>A. Location</th>
<th>B. Premises - Condition, Care</th>
<th>C. Equipment - Type, Condition, Care</th>
<th>D. Classification Peculiarities</th>
<th>E. Employees - Selection, Training Supervision, Experience</th>
<th>F. Cooperation</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Exposure Inside Premises</td>
<td>-5% to +5%</td>
<td>-10% to +10%</td>
<td>-10% to +10%</td>
<td>-10% to +10%</td>
<td>-2% to +2%</td>
</tr>
<tr>
<td>(ii) Exposure Outside Premises</td>
<td>-5% to +5%</td>
<td>-10% to +10%</td>
<td>-10% to +10%</td>
<td>-10% to +10%</td>
<td>-2% to +2%</td>
</tr>
</tbody>
</table>

This plan relies heavily on subjective evaluation. For example:

- What is it about the condition and care of the premises that results in a credit of 10%, 9%, etc?
Will different underwriters give identical schedule credits and debits in identical situations?

Will the same underwriter give identical schedule credits and debits in identical situations?

2. **Roller Skating Rink Risk Retention Group Schedule Rating Plan**

This schedule rating plan is similar to one developed for a roller skating rink risk retention group offering general liability coverage. All participating entities are eligible. There is no maximum schedule credit other than the one inherent in the plan (40%). Note that only credits are given. The manual rates assume none of the characteristics in the schedule rating plan exist.

The general credit list is as follows:

<table>
<thead>
<tr>
<th>A. Floor supervision</th>
<th>+10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>B. Premises</td>
<td>+5%</td>
</tr>
<tr>
<td>C. Rental Skates</td>
<td>+5%</td>
</tr>
<tr>
<td>D. Management</td>
<td>+3%</td>
</tr>
<tr>
<td>E. Incident Report</td>
<td>+10%</td>
</tr>
<tr>
<td>F. First Aid</td>
<td>+5%</td>
</tr>
<tr>
<td></td>
<td>Total</td>
</tr>
</tbody>
</table>

Details of the floor supervision credit follow:

Rink must meet or exceed industry safety standard of one floor supervisor per 200 skaters at all times.

Rink has a written policy or procedure which includes:

- a distinctive uniform or vest for floor supervisors,
- floor supervisors must be paid employees, owners, or family members of owners,
- floor supervisors must be at least 18 years of age, and
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a written training program for floor supervisors.

The floor supervisor training program must include the following items at a minimum:

- Floor guards should inspect the floor for foreign objects at all times.
- During special numbers or events, floor guards should keep unqualified skaters off the floor.
- Floor guards should have written policy regarding unruly skaters.
- Floor guards should have explicit, written instructions in case of an accident including:
  - not moving the injured skater,
  - diverting skaters from the injured skater,
  - notifying management of an incident, and
  - procedure for contacting emergency medical/police/fire assistance.

Floor supervisor training must include a minimum of one safety meeting per calendar quarter.

Floor supervisor training must be recorded and verified by the employee.

ALL OF THE ABOVE MUST BE PRESENT TO EARN THE 10% CREDIT. NO PARTIAL CREDIT WILL BE GIVEN.

The other credits similarly rely on objective criteria that can be verified by audit and/or surprise inspections. All credits encourage activities which should favorably impact loss and ALAE experience. Note that credit is given for activities which a rink has just begun, regardless of its actions in the past.

B. Experience Rating

All individual risk ratemaking systems are a form of experience rating. However, the term "experience rating" has come to mean a particular type of prospective system, which is discussed in this section.
Experience rating assumes that the past, with appropriate adjustments, is predictive of the future. Actual losses, and sometimes ALAE, for a prior period are compared to expected losses (and ALAE). To have an "apples to apples" comparison, several different experience and exposure base combinations can be used, including the following:

- actual paid losses (and ALAE) at a particular date and the expected paid losses (and ALAE) at that date both for the experience period,

- reported losses (and ALAE) at a particular date and the expected reported losses (and ALAE) at that date both for the experience period,

- projected ultimate losses (and ALAE) and expected losses both for the experience period, and

- projected ultimate losses (and ALAE) for the experience period adjusted to the current exposure and dollar levels and expected losses at the current dollar and exposure levels.

Projected ultimate losses are the expected ultimate settlement value of all subject claims/occurrences. Projected ultimate ALAE are the expected ultimate ALAE costs of all subject claims/occurrences. The expected losses (and ALAE) are based on past or current exposure, as appropriate. A weighting of the actual and expected components results in the cost to the entity which is the subject of the system for the current period.

The three components of experience, exposure, and credibility (the weighting factor) and some additional considerations are discussed below.
1. **Experience**

The experience base should be related to the exposure base, as detailed above, and the basis on which policies are written or funding occurs. If the policy to be rated is written on an occurrence basis, any of the four options listed above for accidents occurring in the experience period could be used. If the policy to be rated is written on a claims-paid basis, the paid losses option or the projected ultimate losses option adjusted to current exposure and dollar levels, both for payments made during the experience period, are the options of choice. If the costs to be allocated include ALAE, ALAE should be included with losses in the calculation.

The length of the experience rating period usually ranges from two to five years. The shorter the period, the more responsive the plan will be to changes that truly impact loss (and ALAE) experience, such as changes in the risk control program, and the more subject to fortuitous fluctuations in loss (and ALAE) experience. Conversely, a longer period will result in less responsiveness to changes and to fortuitous occurrences.

To reduce the impact of fortuitous occurrences, many experience rating plans place per occurrence limits on the losses (and ALAE) used in the experience rating calculation. These limits sometimes apply to losses only, with ALAE unlimited or treated in a different manner, and sometimes to losses and ALAE combined. Note that if actual losses (and ALAE) are limited, the expected losses (and ALAE) must be also to maintain an "apples to apples" comparison. If losses (and ALAE) are limited, the cost of expected losses (and ALAE) above the per occurrence limit must be collected through a different part of the experience rating formula than the weighting of experience and exposure. Annual or other period aggregate limits may also be used.
If projected ultimate losses are to be used in the experience rating calculation, they can be developed in a number of ways similar to those used to develop projected ultimate losses used to determine manual rates. Projected ultimate losses are often based on paid or reported losses at a particular date.

For the last experience option listed above, projected ultimate losses are adjusted to current exposure and dollar levels. Dollar level adjustments should include both economic and social inflation. The latter category includes such items as changes in the legal atmosphere and law changes.

Exposure adjustments include both converting the experience period to the current period (e.g., dividing by three to go from a three-year experience period to a one-year current period) and adjusting for changes in the magnitude of the exposure. Both can be accomplished at once by dividing the projected ultimate losses for the experience period, adjusted to current dollar level, by the exposure for the experience period, adjusted to current dollar level if appropriate, and applying this "rate" to the exposure for the current period.

2. Exposure

The expected losses are a function of the past or current exposure base, as appropriate. The exposure base should be related to the experience base, as detailed above. For the first three options listed above, the past exposure base is used; for the last option, the current exposure base is used.

Expected losses are usually a product of an expected loss rate and the exposure. The expected loss rate can be based on the manual rates for the prior or current period, adjusted
to the appropriate dollar level. For example, to develop expected loss rates for a prior period, the current expected loss rate could be adjusted to the prior period's dollar level, or the prior period's expected loss rates could be used directly. The former approach is usually better if there have been no underlying changes in the nature of the exposure because the current expected loss rate is based on more recent information than the prior period's loss rates.

The exposure measure used should reflect the underlying risk of loss and ALAE. It is not always possible to use the theoretically optimal exposure measure. In practice, insurers and non-traditional risk financing mechanisms often use whatever exposure measure insurers use in their premium calculations.

For general liability, exposure measures often used are sales, payroll, total operating expenditures, and square footage. For workers' compensation the exposure measure is usually payroll adjusted for differences in payroll type (e.g., a coal miner is expected to have more losses and ALAE per payroll dollar than a secretary, even though both are employed by the same entity). For property, exposure measures often used include actual cash value, stated amount, or replacement cost.

Non-traditional risk financing mechanisms may use different exposure measures for different costs. For example, for a public entity workers' compensation pool the exposure base for all administrative costs may be full-time-equivalent employees while the exposure base for losses and ALAE is payroll, with both full-time-equivalent employees and payroll adjusted for differences in payroll type. The use of two exposure measures may be the result of different payroll scales being used by different participants.
Individual entities allocating risk financing costs to units may also use different exposure measures for different costs. And some costs, such as the cost of a policy that applies only to one unit, may be allocated without using the experience rating plan.

3. Credibility

The actual (experience) and expected (exposure) components as of the experience rating calculation are weighted to produce the costs the entity under consideration will pay. The weight assigned to the experience component is called “credibility.” The weight assigned to the exposure component is one (1.000) minus the credibility.

Credibility reflects the degree of belief that the entity’s experience is valid. Credibility has three criteria that must be met:

1. Credibility should not be less than zero or greater than one.

2. Credibility should increase as the size of risk increases.

3. The percentage charge for any loss of a given size should decrease as the size of risk increases.

These criteria can also be shown as mathematical relationships:

\[ Z - \text{credibility} \]
\[ E - \text{size of risk} \]

1. \[ 0 \leq Z \leq 1. \]
2. \( \frac{dZ}{dE} > 0 \).

3. \( \frac{d}{dE} \left[ \frac{Z}{E} \right] < 0 \).

These three criteria are met if credibility follows the curve shown in Exhibit 3. Note that size of risk is represented in the diagram by exposure. Size of risk can also be based on expected losses or expected number of claims. Chapter 6 contains a detailed discussion of credibility.

4. **Other Considerations**

Experience rating plans may be designed so that there is a minimum or maximum premium charge. These are often based on the prior year's premium adjusted for changes in exposure. For example, the maximum premium change from one year to the next may be the change indicated by any exposure changes plus or minus 25%. This means that if there is an increase of 15% because of an increase in exposure, the total increase possible after application of the experience rating plan is 40%.

The premium collected under experience rating plans may not equal the expected premium in total. This means that the plan is "off-balance." If this can be anticipated, the experience rating plan can include as a last step, multiplication by a factor to correct for this off-balance. Alternatively, the manual rates can include an off-balance correction.
5. **Insurance Services Office General Liability Experience Rating Plan**

The Insurance Services Office general liability experience rating plan is illustrated in Exhibits 4 and 5. This example is used throughout the following discussion of the plan.

This plan may be used for occurrence and claims-made general liability coverages, with a few exceptions, for those entities meeting the eligibility criteria specified in the plan. The coverage in the example is premises/operations and products/completed operations for policy period 1/1-12/31/88 written on a third-year claims-made basis.

The experience basis is projected ultimate losses and ALAE for the experience period. The exposure basis is expected losses and ALAE for the experience period. Both the projected ultimate losses and ALAE and expected losses and ALAE are limited to basic limits, which applies to losses only, and by a maximum single limit per occurrence (MSL), which applies to the basic limits losses and unlimited ALAE.

The experience period is the three policy periods completed at least six months prior to the policy effective date for the calculation being performed. If three policy periods are not available, one or two may be used. Occurrences associated with tail coverage on claims-made policies are excluded. In the example, the three policy periods are 1/1-12/31/84, 1/1-12/31/85, and 1/1-12/31/86. The older two were written on an occurrence basis; the most recent on a first-year claims-made basis. The evaluation date is 9/30/87.

The projected ultimate losses and ALAE limited by basic limits and MSL for the experience period are the sum of the reported losses and ALAE at 9/30/87 and the expected unreported losses and ALAE at 9/30/87, both limited by basic limits and the MSL. The experience component is the actual loss and ALAE ratio, the projected ultimate losses and ALAE limited
by basic limits and MSL divided by the subject premium (the total basic limits premium subject to experience rating).

The exposure measure is premium. The exposure component is the adjusted expected loss ratio. The actual and expected loss ratios are compared using a credibility factor to arrive at the experience credit (percentage reduction in premium) or debit (percentage increase in premium). This plan has no minimums, maximums, or explicit off-balance correction.

Exhibit 4 shows the basic calculation. Exhibit 5 shows the calculation of the expected unreported losses and ALAE at 9/30/87 and subject premium. The expected unreported losses and ALAE at 9/30/87 are the product of the subject premium, adjusted expected loss and ALAE ratio, and expected percentage losses and ALAE unreported at 9/30/87. These three quantities reflect the impact of basic limits losses and the MSL.

Note that there is no adjustment for unreported losses and ALAE for the claims-made policies, even though there may be case reserve development. This results in an probable underestimation of the actual loss and ALAE ratio and a resulting probable overstatement of any credits or understatement of any debits.

The subject premium is the product of the current basic limits premium, two policy adjustment factors, and policy period adjustment factors. The Type 1 policy adjustment factors adjust premium to an occurrence level. The Type 2 policy adjustment factors adjust for the experience period being claims-made. In 1/1-12/31/86 in the example, the third-year claims-made premium is adjusted up to an occurrence basis by the Type 1 factor and down to a first-year claims-made basis by the Type 2 factor because the experience for the 1/1-12/31/86 period is first-year claims-made. The policy period adjustment factors adjust current premium to policy period dollar levels. It is not clear if these factors also adjust for
changes in coverage, such as changes in exclusions.

The calculation performed to determine the experience credit/(debit) is as follows:

\[
\text{CD} = \frac{\text{AELR} - \text{ALR}}{\text{AELR}} \times Z.
\]

This can be rearranged to a more familiar form:

\[
\frac{(A \times Z) + (E \times (1 - Z))}{E} = M
\]

where

\[
E = \text{Subject Premium} \times \text{AELR}
\]

and

\[
A = \text{Projected Ultimate Losses and ALAE Limited by Basic Limits and MSL.}
\]

Note that

\[
M = 1 - \text{CD}.
\]

For the example:

\[
\begin{align*}
\text{CD} &= 4.6\% \text{ from Exhibit 4}, \\
E &= 60,641, \\
A &= 55,828, \\
Z &= 0.580, \text{ and} \\
M &= 0.954 = 1 - 0.046.
\end{align*}
\]
This plan has special rules for treating non-standard expense allowances, deductibles, and experience periods with no claims.

6. **Workers' Compensation Pool Experience Rating Plan**

The experience rating plan of a workers' compensation pool for fire districts in one state is illustrated in Exhibits 6 through 8. This example is used throughout the following discussion of the plan.

This plan is used for occurrence workers' compensation coverage written on a guaranteed cost basis for all entities participating in the pool. Pool participation has been constant since the pool's inception and is not expected to change for 7/1/88-89, the policy period in question. All policies renew 7/1.

The costs to be allocated using a weighting of experience and exposure are the expected losses and ALAE for 7/1/88-89, discounted for anticipated investment income. The estimated discounted expected expenses other than ALAE for 7/1/88-89 are distributed to participant based on the expected full-time-equivalent (FTE) personnel for 7/1/88-89.

The experience basis is reported losses and ALAE at 6/30/87 for the experience period, adjusted for changes in FTE personnel. The exposure basis is expected full-time-equivalent employees for the 7/1/88-89 period. The reported losses and ALAE at 6/30/87 are limited to $25,000 per occurrence. The experience period is the latest three complete policy periods, i.e., 7/1/84-85, 7/1/85-86, and 7/1/86-87. Credibility is based on FTE employees for the experience period.
FTE personnel are used rather than payroll as an exposure measure, the credibility base, and
to allocate estimated discounted expenses for 7/1/88-89 due to the presence in some of the
districts of volunteer firefighters and pay scale discrepancies between districts. Volunteer
firefighters are covered by workers' compensation law. The generally fortuitous nature of
workers' compensation claims for firefighters and the pay scale discrepancies indicate that
some costs and credibility are more closely related to FTE personnel than payroll.

The plan has a built-in minimum: the estimated discounted administrative expenses for
7/1/88-89, as allocated based on expected FTE personnel for 7/1/88-89. The plan also has a
maximum for each participant: 25% above the prior year's contribution (for 7/1/87-88 in this
example), adjusted for any increase in total recommended contribution but not for any
decrease (a 30% increase in this example, from $853,000 to $1,109,000). The total increase
allowable in this example is 62.5% \((1.300 \times 1.250) - 1.000\).

Because pool participation has been and is expected to remain constant, it is possible to
calculate the exact off-balance and adjust accordingly so that the total dollars collected are
the total recommended contribution for the group. The off-balance may need to be
recalculated after application of minimums and maximums, depending on their impact.

Exhibit 6 shows the premium determination. Exhibit 7 shows the determination of A, the
discounted expected losses and ALAE for 7/1/88-89 allocated based on experience. Exhibit 8
shows the determination of E (the discounted expected losses and ALAE for 7/1/88-89
allocated based on exposure), Z (credibility), minimum premium, and maximum premium.

The premium before adjustment for off-balance, minimums, and maximums is determined as
follows:
Unadjusted Premium = Minimum Premium + ((A x Z) + ((E x (1.000 - Z))).

The unadjusted premium for the example is shown in column (7) of Exhibit 6. Column (8) of Exhibit 6 shows the premium adjusted for the off-balance. Column (9) of Exhibit 6 shows the premium adjusted for maximum premiums combined with an additional off-balance calculation. Note that in the example, no participant's premium was lower than the applicable minimum. Any amounts under minimum premiums would have to be reallocated similarly to the reallocation of the amounts over maximum premiums.

A is the discounted expected losses and ALAE for 7/1/88-89 allocated based on experience (calculated in Exhibit 7). The reported losses and ALAE at 6/30/87 for accident period 7/1/84-87 are limited to $25,000 per occurrence. The ratio of these to FTE personnel for 7/1/84-87 results in the raw annual loss and ALAE rate. The raw annual loss and ALAE rate is applied to the expected FTE personnel for 7/1/88-89 to obtain unadjusted A's. The unadjusted A's are adjusted so that the desired total of $832,000 of discounted expected losses and ALAE for 7/1/88-89 would be collected if all participants had credibilities of 1.00.

E is the discounted expected losses and ALAE for 7/1/88-89 allocated based on exposure. The E's are calculated in Exhibit 8 by distributed the $832,000 in proportion to the expected FTE personnel for 7/1/88-89. This is what would be collected if all participants had credibility of 0.00. The credibilities (Z) are based on FTE personnel for 7/1/84-87 and the formula in Exhibit 8. The minimum and maximum premiums are also calculated in Exhibit 8.

C. Composite Rating

Composite rating is an administrative tool to facilitate the rating of large, complex risks upon audit. Instead of rating different coverages using different exposure measures, all
applicable coverages are rated using one, composite exposure measure.

The composite rate applied to the composite exposure measure is determined at the beginning of the policy period under consideration based on estimated exposures. It is used to determine the deposit premium based on the estimated composite exposure and the final premium based on the audited composite exposure. The composite rate may be based on manual rates to which the appropriate experience modification factors have been applied or on the entity’s experience. The remainder of this section discusses the latter case, using the loss rating portion of the Insurance Services Office Composite Rating Plan for Automobile Physical Damage, Automobile Liability, General Liability, Glass and Theft Insurance as an example.

Exhibit 9 shows the basic formulae for the ISO Composite Rating Plan loss rated risks example. Eligibility for loss rating is based on the reported losses and ALAE at the latest evaluation date, limited to various per occurrence limits, for the same period of time as the experience period to be used in the calculation. Different eligibility requirements apply for different combinations of coverage and limits. The premium charged is based solely on the entity’s experience, adjusted for differences in coverage type (occurrence or claims-made year), trends in losses and ALAE and exposure, and other factors which may impact the appropriateness of the composite rate.

The composite rate is the adjusted premium for the experience period divided by the adjusted composite exposure for the experience period. The adjusted premium for the experience period is sum of the adjusted projected ultimate losses and ALAE, converted from occurrence to claims-made basis if appropriate, divided by the expected loss and ALAE ratio, for each type of loss. The adjusted composite exposure for the experience period is the composite exposure for the experience period, adjusted by exposure trend factors, converted from
occurrence to claims-made if appropriate. The projected ultimate losses and ALAE are the reported losses and ALAE at latest evaluation date developed to ultimate, converted from claims-made to occurrence if appropriate, trended to the year for which the composite rate is being calculated, and adjusted for other changes if appropriate.

The reported losses and ALAE used in the calculation are subject to various per occurrence limits. The plan has special rules for treating non-standard expense allowances, deductibles, and limits larger than those used in the composite rating calculation. The deposit premium is not subject to experience rating since it is based solely on the entity's experience up to the limits used in the calculation. The final premium may be subject to retrospective rating. Both deposit and final premiums may be subject to schedule rating.
While experience rating and some forms of composite rating assume that the past, with appropriate adjustments, is predictive of the future, retrospective rating uses the experience during the period to determine the costs for the period. This makes costs based on retrospective rating plans more responsive to changes in experience and more subject to fortuitous fluctuations in experience than experience rating or composite rating plans. However, retrospective rating is very similar to prospective experience rating in that many of the elements are the same.

As with experience rating, actual losses, and sometimes ALAE, are compared to expected losses (and ALAE), although in this case they are both for the current period. To have an "apples to apples" comparison, several different experience and exposure base combinations can be used, including the following:

- actual paid losses (and ALAE) at a particular date and the expected paid losses (and ALAE) at that date both for the experience period,

- reported losses (and ALAE) at a particular date and the expected reported losses (and ALAE) at that date both for the experience period, and

- projected ultimate losses (and ALAE) and expected losses both for the experience period.

These are the same as the first three options listed for experience rating.
As with experience rating, the experience base should be related to the exposure base and the basis on which policies are written or funding occurs. If the costs to be allocated include ALAE, ALAE should be included with losses in the calculation.

The length of the retrospective rating period is usually one or three years. As with experience rating, the shorter the period, the more responsive the plan will be to changes that truly impact loss and ALAE experience, such as changes in the risk control program, and the more subject to fortuitous fluctuations in loss and ALAE experience. Conversely, a longer period will result in less responsiveness to changes and to fortuitous occurrences.

Retrospective rating plans may also limit losses (and ALAE) per occurrence and in aggregate to reduce the impact of fortuitous occurrences, as may experience rating plans.

If projected ultimate losses are to be used in the retrospective rating calculation, they can be developed in a number of ways similar to those used to develop projected ultimate losses used to determine manual rates. Projected ultimate losses are often based on paid or reported losses at a particular date.

The expected losses are a function of the current exposure base. The exposure base should be related to the experience base, as detailed above. As for experience rating, expected losses are usually a product of an expected loss rate and the exposure.

Also as for experience rating, the exposure measure used should reflect the underlying risk of loss and ALAE. It is not always possible to use the theoretically optimal exposure measure. In practice, insurers and non-traditional risk financing mechanisms often use whatever exposure measure insurers use in their premium calculations.
Credibility has the same function and is used in the same way for retrospective rating as for experience rating. Retrospective rating plans also may have minimum or maximum premium charges and need to be corrected for off-balance, as with experience rating plans.

The deposit premium for retrospective rating plans may be based on an experience rating plan. Retrospective adjustments are made periodically after the end of the experience period for a pre-determined number of adjustments or until the insurer and insured agree to end the adjustments.

Two examples of retrospective rating plans are discussed below.

A. National Council on Compensation Insurance Retrospective Rating Plan

The National Council on Compensation Insurance Retrospective Rating Plan applies to workers' compensation and employer's liability for eligible insureds. An insured must elect to participate in the plan and the insurer must agree.

The basic formulae are shown in Exhibit 10. Losses, minor ALAE for workers' compensation, and all ALAE for employer's liability are the subject of the allocation. Some aircraft-related claims are excluded and the costs of some accidents involving more than one person are limited. All other costs are collected as a function of the losses, exposure (as represented by the standard premium), or, for taxes only, the retrospective premium before taxes. All policies are written on an occurrence basis.

The deposit premium collected at the beginning of the period is the experience rated premium. Retrospective adjustments are made using claim data at 18, 30, 42, ... months after the beginning of the policy period, if it is a one-year retrospective period, until insurer and
insured agree there will be no more. For a three-year retrospective period, the claim data are evaluated at 42, 54, 66, ... months after the beginning of the policy period.

For losses under any applicable limits, the experience is given credibility of 1.000. Losses over any applicable limits are given zero credibility, and money for them is collected based on exposure, as represented by standard premium.

The plan has minimum and maximum retrospective premiums. Costs above the maximum less those below the minimum are collected from/credited to the insured based on exposure, as represented by standard premium. Various minimum and maximum retrospective premium combinations are possible (including no minimum or maximum). The choice of minimum and maximum premiums impacts the basic premium. The plan has no explicit off-balance correction.

The general retrospective rating formula calculates retrospective premium as the sum of basic premium and converted losses, both multiplied by the tax multiplier. The basic premium, which is a function of the standard premium (exposure), provides for the following costs:

- insurer expenses such as acquiring and servicing the insured's account;
- risk control services, premium audit, and general administration of the insurance;
- an adjustment for limiting the retrospective premium between the minimum and maximum retrospective premiums; and
- an allowance for the insurer's possible profit or contingencies.
The converted losses are the reported limited losses at the evaluation date multiplied by the loss conversion factor. The loss conversion factor covers the ALAE not included with the losses and ULAE. The tax multiplier covers licenses, fees, assessments, and taxes which the insurer must pay on the premium it collects.

There are two additional elements the insured may elect, if the insurer agrees: a loss limitation resulting in an excess loss premium and a retrospective development premium. Both these premiums are subject to the tax multiplier. The retrospective rating formula with these elective premium elements is also shown in Exhibit 10.

If the loss limitation is accepted, the reported limited losses at any evaluation are further limited to an agreed-upon amount per accident. The cost of losses above this amount and related ALAE and ULAE are collected through the excess loss premium. It is a function of standard premium (exposure).

Because reported limited losses tend to develop over time upwards to the ultimate limited losses, the first retrospective adjustment is likely to result in the insurer returning premium to the insured. Successive retrospective adjustments will probably result in most of, if not all of or more than, this amount being returned by the insured to the insurer. To smooth out these back-and-forth payments, some insureds opt to use the retrospective development premium, which attempts to offset this process. The retrospective development premium is a function of standard premium (exposure). It is used only for the first three retrospective adjustments and decreases over time.

Note that there does not seem to be any part of the formula that recovers for the cost of the excluded aircraft-related claims and amounts above limits on accidents involving more than one person. There is also an overlap of the excess loss premium and basic premium.
The excess loss premium collects for losses and related expenses above the per accident limit; the basic premium collected for losses and related expenses above the maximum limit, some of which are the result of losses above the per accident limit.

B. Automobile Physical Damage Insurance Retrospective Allocation to Units by Single Entity

Exhibit 11 illustrates the retrospective allocation of automobile physical damage insurance premium to units by a single entity. The coverage is actual cash value, written on an occurrence basis for one year.

The deposit premium collected from the units at the beginning of the period is based on the expected cost of insurance, allocated to unit based on exposure as represented by the expected number of vehicles. There is no distinction for different types of vehicles. This is reasonable if each unit has the same vehicle expected cost per vehicle.

There is one retrospective adjustment, made using data at 18 months after the beginning of the policy year. Only one adjustment is made because automobile physical damage claims are reported and settled very quickly and the actual exposure is known shortly after the year ends. The actual cost of the insurance is allocated based on audited exposure (actual number of vehicles) and based on reported losses and ALAE. These two allocations are weighted using credibility. Losses and ALAE are unlimited because the cost of any one occurrence is limited by the actual cash value of the vehicle in the accident plus any ALAE, which should be small. All experience is given a credibility of 0.25 regardless of the exposure size to make the plan easier for the unit managers to understand.

The plan has no minimum and maximum retrospective premiums. The plan has no off-balance correction as none is needed because the credibility factors are the same for all units.
Accident Year/Policy Year Illustration for Occurrence Policies


Loss Terminology Illustration

- Paid Losses
- Outstanding Losses
- Reserve for Case Reserve Development
- Unreported Claims Reserve

- Reported Losses
- Incurred Losses
- Unreported Losses
General Credibility Illustration

Credibility

1.0

Credibility

Exposure

Exhibit 3
Basic Calculation

Coverage: Premises/Operations and Products/Completed Operations

Policy Being Rated: 1/1-12/31/88 Third-Year Claims-Made

Experience Period: 1/1-12/31/84 Occurrence 1/1-12/31/85 Occurrence 1/1-12/31/86 First-Year Claims-Made

I. Experience Component:

A. Reported Losses and ALAE at 9/30/87 Limited by Basic Limits and MSL 44,300

B. Expected Unreported Losses and ALAE at 9/30/87 Limited by Basic Limits and MSL (See Exhibit 5) 11,520

C. Projected Ultimate Losses and ALAE Limited by Basic Limits and MSL ((A) + (B)) 55,828

D. Total Basic Limits Premium Subject to Experience Rating (See Exhibit 5) 138,272

E. Actual Loss and ALAE Ratio ((C) / (D)) 0.410

II. Exposure Component: Expected Loss and ALAE Ratio 0.445

III. Credibility: 0.580

IV. Experience Credit/Debit: 4.67

(((II) - (I-E)) / (II) x (III))

Notes: MSL is the maximum single limit per occurrence, applied to basic limits losses and unlimited ALAE. It is based on the total basic limits premium subject to experience rating (subject premium).

The adjusted expected loss ratio and credibility are supplied by ISO. Credibility is based on the total basic limits premium subject to experience rating.
Chapter 2 - Individual Risk Ratemaking
Margaret Wilkinson Tiller

September 5, 1988

ISO Experience Rating Sample Calculation

Expected Unreported Losses and ALAE at 9/30/87
and Subject Premium

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
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<tr>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td>1.06</td>
<td>1.00</td>
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<td>0.856</td>
<td>6,772</td>
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</table>

Total: 136,272              11.52%

Notes:
(3) is for the 1/1-12/31/88 third-year claims-made policy.
(4) adjusts premium up to an occurrence level.
(5) adjusts for experience period being claims-made, reflecting claims-made year.
(6) adjusts current premium to policy period dollar levels.
(7) = (3) x (4) x (5) x (6).
(8) and (10) also reflect MSL.
(10) = (7) x (8) x (9).
(4), (5), (6), (8), and (9) are supplied by ISO.

MSL is the maximum single limit per occurrence, applied to basic limits losses and unlimited ALAE. It is based on the total basic limits premium subject to experience rating (subject premium).

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### Workers’ Compensation Pool Experience Rating Sample Calculation

**Premium Determination**

<table>
<thead>
<tr>
<th>Premium</th>
<th><strong>( \text{(1)} ) Fire Minimum</strong></th>
<th><strong>( \text{(2)} ) Fire Maximum</strong></th>
<th><strong>( \text{(3)} ) A</strong></th>
<th><strong>( \text{(4)} ) E</strong></th>
<th><strong>( \text{(5)} ) E</strong></th>
<th><strong>( \text{(6)} ) Unadjusted</strong></th>
<th><strong>( \text{(7)} ) Adjusted #1</strong></th>
<th><strong>( \text{(8)} ) Adjusted #2</strong></th>
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<tbody>
<tr>
<td>A</td>
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<td>372,825</td>
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<td>8,634</td>
<td>821</td>
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<td>3,927</td>
<td>3,990</td>
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<tr>
<td>C</td>
<td>18,810</td>
<td>93,623</td>
<td>13,286</td>
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<td>70,319</td>
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<td>53,402</td>
<td>5,183</td>
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<td>171,593</td>
<td>172,188</td>
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<td>50,045</td>
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<td>K</td>
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<td>M</td>
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<td>0.00</td>
<td>20,156</td>
<td>19,977</td>
<td>20,082</td>
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</table>

**Total** | **277,000** | **1,386,250** | **832,000** | **832,000** | **1,118,941** | **1,109,000** | **1,109,000** |

**Notes:**

1. \( \text{(2)} \) is (6) of Exhibit 8.
2. \( \text{(3)} \) is (8) of Exhibit 8.
3. \( \text{(4)} \) is (7) of Exhibit 7.
4. \( \text{(5)} \) is (3) of Exhibit 8.
5. \( \text{(6)} \) is (5) of Exhibit 8.
6. \( \text{(7)} \) is \( \text{((4)} \times (6)) + ((5) \times (1.00-(6))) \).
7. \( \text{(8)} \) is \( \text{(7)} / \text{Total (7)} \times 1,109,000 \).
8. \( \text{(9)} \) is \( \text{(8)} \), adjusted for maximum premiums with amount over maximum premiums reallocated based on \( \text{(8)} \).
## Chapter 2 - Individual Risk Ratemaking

Margaret Wilkinson Tiller

Workers' Compensation Pool Experience Rating Sample Calculation

September 5, 1988

Exhibit 7

### Determination of A

<table>
<thead>
<tr>
<th>Fire District</th>
<th>Reported Limited Losses</th>
<th>FTE</th>
<th>Rate</th>
<th>Raw Annual Loss &amp; ALE</th>
<th>FTE</th>
<th>Unadjusted A</th>
<th>Adjusted A</th>
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<tr>
<td>A</td>
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<td>133.33</td>
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<tr>
<td>J</td>
<td>130,682</td>
<td>234.6</td>
<td>557.04</td>
<td>95.5</td>
<td>53,365</td>
<td>121,658</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>47,985</td>
<td>25.0</td>
<td>1854.91</td>
<td>8.8</td>
<td>16,234</td>
<td>37,010</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>193</td>
<td>9.0</td>
<td>20.20</td>
<td>3.1</td>
<td>9.1</td>
<td>143</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>4,768</td>
<td>14.3</td>
<td>233.43</td>
<td>5.4</td>
<td>1,801</td>
<td>4,105</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>63</td>
<td>20.0</td>
<td>3.15</td>
<td>9.1</td>
<td>29</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td><strong>Total/Avg.</strong></td>
<td><strong>370,463</strong></td>
<td><strong>1322.5</strong></td>
<td><strong>723.81</strong></td>
<td><strong>500.7</strong></td>
<td><strong>264,981</strong></td>
<td><strong>552,000</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** 
\[ (7) = 832,000 \times \left( \frac{(6)}{\text{Total (6)}} \right) \] 
832,000 is the discounted expected losses and ALE for 7/1/88-89.
### Chapter 2 - Individual Risk Ratemaking

Margaret Wilkinson Tiller

Workers' Compensation Pool Experience Rating Sample Calculation

---

**Exhibit 8**

**Determined of E, Z, Minimum Premium, and Maximum Premium**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
<td>(7)</td>
</tr>
<tr>
<td>A</td>
<td>168.8</td>
<td>280,491</td>
<td>463.3</td>
<td>0.50</td>
<td>93,384</td>
<td>229,410</td>
</tr>
<tr>
<td>B</td>
<td>2.7</td>
<td>4,487</td>
<td>7.5</td>
<td>0.00</td>
<td>1,494</td>
<td>5,313</td>
</tr>
<tr>
<td>C</td>
<td>34.0</td>
<td>58,497</td>
<td>76.7</td>
<td>0.12</td>
<td>18,810</td>
<td>57,609</td>
</tr>
<tr>
<td>D</td>
<td>15.2</td>
<td>25,257</td>
<td>50.0</td>
<td>0.00</td>
<td>8,409</td>
<td>32,860</td>
</tr>
<tr>
<td>E</td>
<td>51.6</td>
<td>85,742</td>
<td>132.0</td>
<td>0.25</td>
<td>28,546</td>
<td>105,586</td>
</tr>
<tr>
<td>F</td>
<td>69.8</td>
<td>115,985</td>
<td>182.8</td>
<td>0.33</td>
<td>38,615</td>
<td>138,658</td>
</tr>
<tr>
<td>G</td>
<td>0.3</td>
<td>499</td>
<td>1.6</td>
<td>0.00</td>
<td>168</td>
<td>948</td>
</tr>
<tr>
<td>H</td>
<td>12.3</td>
<td>20,439</td>
<td>36.1</td>
<td>0.00</td>
<td>6,805</td>
<td>25,383</td>
</tr>
<tr>
<td>I</td>
<td>23.8</td>
<td>38,548</td>
<td>68.6</td>
<td>0.09</td>
<td>13,167</td>
<td>44,688</td>
</tr>
<tr>
<td>J</td>
<td>93.0</td>
<td>159,188</td>
<td>234.6</td>
<td>0.39</td>
<td>32,992</td>
<td>106,287</td>
</tr>
<tr>
<td>K</td>
<td>8.8</td>
<td>14,623</td>
<td>26.0</td>
<td>0.00</td>
<td>4,868</td>
<td>17,318</td>
</tr>
<tr>
<td>L</td>
<td>3.1</td>
<td>5,151</td>
<td>9.0</td>
<td>0.00</td>
<td>1,715</td>
<td>5,903</td>
</tr>
<tr>
<td>M</td>
<td>5.4</td>
<td>8,973</td>
<td>14.3</td>
<td>0.00</td>
<td>2,987</td>
<td>9,642</td>
</tr>
<tr>
<td>N</td>
<td>9.1</td>
<td>15,121</td>
<td>20.0</td>
<td>0.00</td>
<td>5,034</td>
<td>15,151</td>
</tr>
</tbody>
</table>

**Total**

500.7 832,000 1,322.5 277,000 853,000 1,386,250

**Notes:**

1. (3) is distributed based on (2). 832,000 is the discounted expected losses and ALAE for 7/1/88-89.

2. (5) is determined based on (4) as follows:

<table>
<thead>
<tr>
<th>FTE Personnel Years</th>
<th>Credibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 or less</td>
<td>0.00</td>
</tr>
<tr>
<td>60 - 1,199</td>
<td>(FTE personnel years - 60) / 1,199</td>
</tr>
<tr>
<td>1,200 or more</td>
<td>1.00</td>
</tr>
</tbody>
</table>

(6) is distributed based on (2). This is the minimum premium.

(8) = (7) x (1,109,000 / 353,000) x 1.25. 1,109,000 is the total recommended contribution for 7/1/89-89.
Types of Losses Covered: General Liability, Automobile Liability, Automobile Physical Damage, Glass, and Theft

Experience Period: Five years beginning between six and five and one-half years prior to the date the composite rate is to be effective. As few as three years, beginning between four and three and one-half years prior to the date the composite rate is to be effective, may be used if that is all that are available.

Experience: For each type of loss, calculate by accident year and total the adjusted projected ultimate losses and ALAE as follows:

<table>
<thead>
<tr>
<th>Losses</th>
<th>Conversion</th>
<th>Loss &amp; ALAE</th>
</tr>
</thead>
</table>
| $ALAE$ $X$ | $ALAE$ $X$ | $From$ $X$ Factors $X$ Reflect at Least Development Claims-Made to Current Other Evaluation Factor to Occur. Year Changes Date

Adjusted Composite Exposure for Experience Period: For the experience period, calculate the adjusted composite exposure as follows:

<table>
<thead>
<tr>
<th>Composite Exposure Factor X Trend X From for Exper. Factors Occur to Period</th>
<th>Conversion</th>
</tr>
</thead>
</table>

Adjusted Premium for Experience Period: For each type of loss, calculate the loss premium as following:

<table>
<thead>
<tr>
<th>Adjusted Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projected Factor X Expected</td>
</tr>
<tr>
<td>Ultimate $X$ From Loss &amp; ALAE</td>
</tr>
<tr>
<td>Losses Occur to Ratio</td>
</tr>
</tbody>
</table>

Total these to get the adjusted premium for the experience period.

Composite Rate: The composite rate is calculated as follows:

<table>
<thead>
<tr>
<th>Adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjusted Composite Premium Exposure for Exper. for Exper. Period Period</td>
</tr>
</tbody>
</table>
Chapter 2 - Individual Risk Ratemaking
Margaret Wilkinson Tiller

Final Premium: The final premium is calculated as follows:

<table>
<thead>
<tr>
<th>Audited</th>
<th>Exposure X Composite</th>
</tr>
</thead>
<tbody>
<tr>
<td>for Policy Rate</td>
<td></td>
</tr>
<tr>
<td>Period</td>
<td></td>
</tr>
</tbody>
</table>

Notes: Various per occurrence limits apply to reported losses and ALAE.

For automobile physical damage, exclude ALAE.

The following are provided by ISO:

- Loss and ALAE development factors,
- Conversion factors from occurrence to claims-made,
- Loss & ALAE trend factors,
- Exposure trend factors, and
- Conversion factors from claims-made to occurrence,
- Expected loss and ALAE ratios.
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NCCI Retrospective Rating Plan Example

Experience Period: One or Three Years
Deposit Premium: Experience Rated Premium
Retrospective Adjustments: Uses claim data at 18, 30, 42, ... months from the beginning of a one-year policy period and claim data at 42, 54, 66, ... months from the beginning of a three-year policy period.

Retrospective Rating Formula:

\[
\text{Retro.} = \left[ \frac{\text{Basic} + \text{Converted}}{\text{Losses}} \right] \times \text{Multiplier}
\]

Basic = Standard \times \text{Premium Factor}

Premium = \text{Premium} \times \text{Premium Factor}

Standard Premium = Manual Premium modified for experience rating, loss constants, and minimum premium excluding premium discount and expense constants.

Reported Limited Loss
Converted = Losses \times Conversion
Losses at Eval. Factor

Reported limited losses include interest on judgments, expenses incurred in obtaining third party recoveries, and ALAE for employer's liability claims, exclude some aircraft-related claims, and have limits on some accidents involving more than one person.

Retrospective Rating Formula

With Selective Premium Elements:

\[
\text{Excess} = \left[ \frac{\text{Basic} + \text{Converted} + \text{Loss} + \text{Devel.}}{\text{Losses} + \text{Premium} + \text{Premium}} \right] \times \text{Multiplier}
\]

Excess = \text{Loss} \times \text{Conversion Factor}

Loss = \text{Standard} \times \text{Loss} \times \text{Conversion Factor}

Retro. Devel. = \text{Standard} \times \text{Devel.} \times \text{Conversion Factor}

Converted losses are calculated as above, but reported limited losses now also have a per accident limit.

Minimum and Maximum Retrospective Premiums:

\[
\text{Retro.} = \text{Standard} \times \text{Retro.}
\]

Premium = \text{Premium} \times \text{Premium Factor}

September 5, 1988

Exhibit 10
Page 1 of 2
### Chapter 2 - Individual Risk Ratemaking

Margaret Wilkinson Tiller

<table>
<thead>
<tr>
<th>Maximum Retro. Premium</th>
<th>Maximum Retro. Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor</td>
<td>Factor</td>
</tr>
</tbody>
</table>

Note: The following are provided by NCCI:

- Basic Premium Factor,
- Excess Loss Premium Factor,
- Loss Conversion Factor,
- Maximum Retrospective Premium Factor,
- Minimum Retrospective Premium Factor,
- Retrospective Development Factor, and
- Tax Multiplier.
## Chapter 2 - Individual Risk Ratemaking

### Margret Wilkinson Tiller

**Automobile Physical Damage Insurance Retrospective Allocation to Units by Single Entity Example**

---

**Deposit Premium**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Expected Cost of Insurance</th>
<th>Expected Number of Allocated Vehicle Based on Years Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>A</td>
<td>500</td>
<td>50,000</td>
</tr>
<tr>
<td>B</td>
<td>1,000</td>
<td>100,000</td>
</tr>
<tr>
<td>C</td>
<td>750</td>
<td>75,000</td>
</tr>
<tr>
<td>D</td>
<td>500</td>
<td>50,000</td>
</tr>
<tr>
<td>E</td>
<td>2,500</td>
<td>250,000</td>
</tr>
<tr>
<td>Total</td>
<td>5,250</td>
<td>525,000</td>
</tr>
</tbody>
</table>

*Note: (3) is allocated based on (2). (3) is the deposit premium.*

**Retrospective Premium**

| Unit | Actual Insurance Number of Allocated Vehicle Based on Exposure Months Experience Credibility Premium |
|------|------------------------------------------------|-----------------------------------------------------------------------------------------------|
|      | Actual Cost of Insurance                          | Reported Losses & ALAE                      | Actual Cost of Insurance Allocated Based on Years Experience | Retro. Premium |
| (1)  | (2)                                                | (3)                                           | (4)                                                          | (5)           | (7)                             |
| A    | 525                                                | 48,659                                        | 35,000                                                      | 52,778        | 0.25                            | 49,688          |
| B    | 1,000                                              | 97,317                                        | 60,000                                                      | 90,476        | 0.25                            | 95,607          |
| C    | 600                                                | 55,610                                        | 60,000                                                      | 90,476        | 0.25                            | 64,326          |
| D    | 500                                                | 46,341                                        | 30,000                                                      | 45,238        | 0.25                            | 46,066          |
| E    | 2,450                                              | 227,973                                       | 130,000                                                     | 196,032       | 0.25                            | 219,313         |
| Total| 5,125                                              | 475,000                                       | 315,000                                                     | 475,000       | 475,000                         |

*Notes.*

(3) is allocated based on (2).

(5) is allocated based on (4).

(7) = ((3) x (1.00 - (9))) + ((5) x (6)).