AN APPROACH TO RATEMAKING FOR SELF-INSURED WORKERS' COMPENSATION FOR BOTH INDIVIDUALS AND GROUPS

Ann M. Conway

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Traditional actuarial techniques may not always produce appropriate pricing and reserving analyses for the self-insured market. In particular, potential self-insurers often have very limited historical data. The paper presents an overview of the various self-insurance mechanisms and discussions common limitations inherent in self-insurers' data. An approach is then described, which is designed to be practical rather than theoretical, to develop pricing or reserving indications for a potential or ongoing self-insurer. This approach combines industry data with the employer's experience to provide a stable base for projecting future costs. Various data sources are described and their advantages and disadvantages are discussed. In addition to the development of loss estimates, the impact of discounting, risk margins, and program expenses is considered. The paper concludes with a description of how the model can be used to evaluate self-insurance program feasibility and estimate reserves.

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Self-insurance, which represents about 30% of the 1992 workers compensation market (1), will likely continue to grow through the 1990's. Traditional actuarial techniques may not always produce appropriate pricing and reserving analyses for this market due to various limitations in self-insurers' data. In this paper, we first define self-insurance and discuss some of these data limitations. We then describe an approach that can be used to develop pricing or reserve indications for a workers compensation self-insurer. The approach, which is designed to be practical, not theoretical, recognizes that the analyst may have access to data that is much sparser than that available for insurance company pricing and reserving analyses. Throughout the paper alternative data sources are described and potential limitations in these items are discussed.

An Overview

Workers compensation self-insurance encompasses both individual self-insurance and self-insured groups; these risk financing methods are among those called alternative markets. Under a typical individual self-insurance program, an employer pays its own workers compensation claims, subject to the per occurrence and aggregate limits provided by its excess carrier. Claims handling is often contracted to a third-party administrator (TPA). This form of self-insurance represents the largest share of the self-insurance market.

During the 1980's group self-insurance emerged as an alternative risk financing market. In this funding mechanism, a group of employers forms what is essentially a mini-insurance company to fund their workers compensation liabilities. Members' premiums are used to pay losses and expenses. Favorable results are shared through dividend programs, while adverse results may subject the membership to assessments or surcharges.

A major factor in the growth of workers compensation alternative markets is the expansion of the residual market (or assigned risk pool). In some states, the residual market, which was intended to provide coverage to risks with unusually adverse experience, represents over half the total market. Insurers are assessed for residual market losses. Frequently, they pass on these assessments to their individual insureds through a residual market loading (RML) or an assigned risk overburden (ARO). The impact of RMLs is not insignificant; in some states an insured's RML can be more than 50% of its premium. Individual and group self-insurers are exempt from RML charges in most states.

States have implemented numerous programs, such as the All Risk Adjustment Program (ARAP), premium surcharges, and the elimination of premium discount, to make the residual market self-supporting. The net result of these efforts is to increase pool risks' workers compensation costs. Not surprisingly, this can make self-insurance a more attractive option.

The growth in self-insurance and its impact on the residual market is not without criticism. Two areas of concern include:

- **Rate Adequacy** - Hager (2) notes that self-insurance does not solve rate adequacy problems; instead it shifts the costs of the residual market to other employers.

- **Residual Market Size** - Hager also points out that group self-insurance alone will not solve the problem of residual market growth, given that the rate differential for a self-supporting residual market is likely to be 40% to 50%.

It is unlikely that risks with favorable experience would join a self-insurance group (SIG) with employers who have adverse results. Also, a SIG comprising risks with worse than average experience may not be viable unless the members were surcharged.

However, given employers' frustrations with the costs of the workers compensation system, many will choose to seek out potential cost savings that could be achieved through self-insurance. Besides avoiding RMLs and other residual market costs, self-insurers enjoy a cash flow advantage. Rather than an initial premium expense, payments reflect the actual timing of losses and expenses. More important, self-insurance often gives employers additional incentive to control claims, which ultimately results in lower costs.

Both individual and group self-insurance are licensed on an individual state basis. All but two states permit individual self-insurance, while group self-insurance is currently allowed in about 30 states. Some additional states permit group self-insurance for groups of public employers. The nature of state licensing can make self-insurance burdensome for a multi-state employer. For example, an employer with locations in twenty states would need to obtain an individual self-insurer's license in each of these states, to join twenty SIGs, or to use some combination of individual self-insurance and SIG membership.

As part of the licensing process, potential self-insurers are required to submit financial data and claims histories; actuarial analyses are required in some states. States typically impose certain size criteria (e.g., number of employees, level of payroll, relationship of net worth to standard premium) for prospective self-insurers. Some states preclude employers with experience modification factors above a certain level (e.g., 1.25) from self-insuring. States also impose reinsurance requirements with respect to the levels of specific retentions and aggregate attachments; these requirements are often a function of the level of expected losses or standard premium.

There is a wide range of rigor in the approval process for self-insurers. Public authorities are often allowed to self-insure without any formal approval. Some states perform a qualitative analysis of private self-insurers' compliance with the regulatory criteria. Other states, such as Illinois, use a quantitative rating system to qualify a private self-insurer.

Approved self-insurers are typically required to post a security bond with the state to guarantee their reserves. The amount of the bond may be decided statutorily or may be based on actuarial projections.

Generally self-insurers are required to report payroll and/or imputed premium and the level of incurred and/or paid losses during a year, since losses and/or premiums are often the basis for assessments. It is important to note that many states do not review ultimate loss levels for individual self-insurers. There tends to be a greater degree of oversight, however, with respect to self-insurance groups. In several states, SIGs are required to include actuarially determined reserve estimates in their published financial statements, and these statements are reviewed by the regulatory authorities.

Some key differences between individual and group self-insurance are as follows.

- **Liability** - An individual self-insurer is responsible for its own liabilities, in addition to any assessments for insolvent self-insurers. Some states have self-insurance guaranty funds, which assume the liabilities of an insolvent self-insurer in excess of bond or deposit amounts. These funds are generally financed by assessments on solvent self-insurers. A SIG member is typically liable, on a joint and several basis, for its own liabilities and those of any members of the group who cannot meet their obligations. The joint and several nature of group self-insurance may reduce its attractiveness to larger employers who could be perceived as "deep pockets" in the event that the group's experience was unfavorable. Although group programs are designed to be self-rated, (e.g., members with "good" experience receive dividends, while members with "poor" experience are ineligible for dividends or may receive surcharges) if a member cannot pay assessments (e.g., due to a bankruptcy) its liabilities would be spread among other group members.

- **Size** - Typically individual self-insurers tend to be larger corporations, because of the financial requirements and size limitations imposed on self-insurers. Also, given the level of frictional costs (reinsurance, claims administration) self-insurance may not make economic sense for a smaller employer. The potential year-to-year variability in loss experience has income statement implications, which can make self-insurance less attractive for a smaller employer.

- **Homogeneity** - Individual self-insurers tend to be homogeneous, as do most groups. However, some states (e.g., Maine) allow heterogeneous self-insurance groups. It is important to note that it is possible to put together a relatively diverse group (for example, a manufacturing group) even in a state that only allows homogeneous groups.

- **Taxation** - For federal income tax (FIT) purposes, individual self-insurers are generally allowed to deduct only paid losses and expenses. A member of a self-insurance group can deduct premiums paid but would be taxed on any dividend income received from the group. Since SIGs are generally structured to return all profits to members, the groups would generally not incur FIT. There may, however, be timing issues based on the group's policy year and its tax period. For example, a group incepting on October with a twelve-month policy would incur FIT on its unearned premium reserve (UPR) as of December 31, if it were taxed on a calendar year basis. The FIT on the UPR would become a prepaid asset. This asset could be realized as the policy year's premiums were earned, as this would reduce the UPR and its associated tax liability to zero (i.e., as of the subsequent October 1).

- **Balance Sheet** - There is no uniformity in the reflection of workers compensation liabilities in individual self-insurers' balance sheets. Some individual self-insurers include both case and incurred but not reported (IBNR) reserves on their financial statements, while others account for workers

compensation on a pay-as-you-go basis. The treatment of these liabilities should become more consistent in financial statements published on or after December 15, 1993, when accounting standard FAS 112 applies. This standard requires employers to reflect all post-employment liabilities, including workers compensation, on an accrual basis. Depending on the degree of regulatory oversight, the rigor imposed by a group program may increase the relative accuracy of its members' accounting for workers compensation liabilities.

Data Limitations

The data available for self-insurers' pricing and reserving analyses are typically limited, although the data limitations between prospective self-insurers and ongoing self-insurers can vary. Prospective self-insurers will presently have some form of an insured program and will be subject to a carrier's payroll audit program and loss reporting procedures. This would suggest that loss and exposure data could be easily obtained, but in practice this is often not true. The viability of an ongoing self-insurer's data is dependent on the employer's attention to workers compensation, the level of service provided by its vendors, and the state's regulatory oversight.

Among the factors that limit the reliability of self-insurers' (ongoing and/or prospective) data are:

- **Reporting** - Ongoing self-insurers' experience is typically not included in bureau data, since self-insurers are generally not required to report to either the National Council on Compensation Insurance (NCCI) or state rating bureaus. Thus, their data are not subject to the usual audit checks that an insurer's data would receive. To the extent that a self-insurer uses one of the larger TPAs, its loss data would generally be available in a format similar to an insurer's loss runs. However, attorneys are allowed to act as TPAs in several states and their

data reporting procedures may be very different from insurance company practices.

- **Availability** - Many employers do not save loss runs. It is often not possible to get historical loss runs re-created, particularly for employers in the residual market, since the normal customer relationship does not apply. Pool risks' loss runs can also be very limited in detail; some carriers include only incurred loss information in these compilations. In developing projections for prospective self-insurers, the actuary is often forced to rely on data from the employer's experience modification worksheets, which include only incurred loss data. Some states provide a modest discount to risks that are not eligible for experience rating due to their size, if they have no lost time claims. In these states, information from premium calculations can be used to verify the "loss-free" status of these risks.

- **Deductible Distortions** - Deductible programs have grown more common in the workers compensation market in response to residual market growth. These programs affect both voluntary and pool risks. For voluntary insureds, a deductible program can reduce premium taxes, RMLs, and other premium-based assessments. In some states employers in the assigned risk pool are required to adopt a deductible plan; the rationale for this approach is to increase an employer's incentive to control losses. Claims handlers use many approaches in compiling loss data for insureds with deductible programs. Some carriers' loss runs are on a gross basis, while others are net, with associated deductibles tracked through a separate reporting mechanism. It is important for the actuary to verify that the loss data provided for an analysis is on a first-dollar basis. If only net data is available, the analysis needs to be modified to adjust for this data limitation.

- **Variation in Claims Handlers** - The practices of individual claim administrators (both insurers and TPAs) vary widely with respect to claims settlement and reserving. Often an individual self-insurer will have multiple administrators for its historical experience period. This problem is exacerbated in evaluating the experience of members of a proposed SIG, particularly in a market with severe availability problems (e.g., with a large residual market), because individual members are likely to have used several claims handlers.

- **Data Quality** - In evaluating SIG feasibility, the actuary is often forced to rely on data from the members' experience modification worksheets. The accuracy of modification factors is dependent on carriers submitting accurate data to the rating bureau. Problems can arise because an experience rating factor for a multi-state, multi-carrier, or multi-company risk requires a substantial amount of data. Also, as Gillam (2) notes, carriers' incentives to monitor the accuracy of submitted loss data for non-renewal or involuntary business are reduced.

Industry Model Approach

In a typical industry rate filing, aggregate accident and/or policy year losses are estimated using the latest evaluation of loss data and historical development patterns (e.g., the loss development approach). The development factors may be adjusted to reflect law changes, market shifts, or other identifiable variables. A key assumption underlying this analysis is that the aggregate industry data provides a credible basis for estimating ultimate losses. As discussed above, self-insurers' data is generally much less credible than aggregate industry data. Also, historical loss information may be limited or incomplete, and development histories may be unavailable. Rather than estimating ultimate losses for a self-insurer or a SIG through

reported or paid loss projections, an alternative technique, the industry model approach, is used in this paper. There are five major steps in the analysis, including:

- Develop a model of expected workers compensation costs, using insurance industry data and the self-insurer's exposure profile.

- Select reporting and payment patterns, which estimate the rate at which the employer's claims emerge and settle.

- Compare the self-insurer's actual loss experience with the results implied by the industry model to select an experience relativity, which considers the credibility of the self-insurer's experience.

- Use the selected experience relativity with projected industry pure premiums and the self-insurer's actual or estimated payroll to estimate losses for the upcoming period or to calculate indicated reserves.

- Adjust the loss or reserve estimates to reflect reinsurance, expenses, discounting, and risk margins.

This approach, which contains a number of similarities with the hospital funding model described by Bickerstaff (4), provides a stable model of expected costs for a self-insurer, while reflecting the employer's unique characteristics. The use of additional data sources provides a much larger data base than the self-insurer's experience alone represents and is intended to provide a stable base for projecting future costs.

There are four key elements to the model

- exposures,
- industry pure premiums,

- loss limitation factors, and
- reporting and payment patterns.

Each of these elements is described in more detail in the following sections.

It should be noted that the model approach described here relies heavily on state-specific parameters. This can be advantageous for evaluating the experience of prospective or ongoing SIGs or the by-state experience of an individual self-insurer, particularly when the self-insurer's data has limited credibility. For a large employer with countrywide exposures, the analyst may prefer to use traditional projection methods, given the amount of work required to develop multiple sets of state-specific parameters.

Exposures

Exhibit 1 presents a summary of historical exposure data for a sample self-insurer. In this example the exposure base used is unlimited payroll by classification code. For a prospective self-insurer, this data can be derived from experience modification worksheets or premium audits. Ongoing self-insurers will generally need this information to obtain premium quotes from their excess insurers. The payroll by class is then used to calculate payroll distributions, using one of two approaches:

- Calculate an overall payroll distribution for the experience period and apply relativity factors to adjust for shifts in exposure distributions.

- Calculate separate payroll distributions for each policy year.

The first approach is simpler to develop and the Exhibit 1 distribution is derived on this basis.

Typically, unlimited payroll is the exposure base used for this analysis. Other exposure bases could include

- hours worked,
- hourly wage,
- limited payroll,
- head count, or
- premium.

The Milliman & Robertson (M&R) review of NCCI ratemaking procedures (5) notes that unlimited payroll represents a reasonable compromise between practical and theoretical considerations. Unlimited payroll offers several advantages, including:

- **Data Availability** - Since unlimited payroll is the rating basis used in all states (except Washington) and is necessary for tax purposes, it can generally be readily obtained. An exposure base such as hours worked would only be readily obtainable for non-salaried employees, if at all. Also, the use of an alternate exposure base would generally require that industry rating data be converted to be consistent with the selected exposure base.

- **Data Verification** - Typically payroll, at least on an aggregate basis, is subject to audit procedures, while other potential exposure bases (e.g., hours worked) may not be audited. Although competitive pressures may depress the level of reported payroll for initial account pricing, insurance carrier audit procedures will generally tend to adjust for this discrepancy.

- **Reflects Exposure** - There is some quantifiable relationship between payroll and projected losses. It has been suggested that using average wages as an exposure base would more appropriately reflect the impact of statutory benefit maximums, unlimited medical benefits, and potentially higher accident rates for

inexperienced and/or lower paid workers. Feldblum (6) notes, however, that higher paid workers may be more likely to seek out more expensive medical services and be represented by attorneys.

Many potential drawbacks to using unlimited payroll as an exposure base arise out of the workers compensation classification system, including:

- **Classification Rules** - All payroll is generally assigned to the same class code except the standard exception classes (e.g., 8810 (clerical/office workers)) though employees may have very different functions in the employer's business (7). The classification code used in rating is the code that carries the largest amount of payroll. Feldblum (8) points out that classifications are based on products and services, which are proxies for occupation. He then notes that occupational accidents and diseases actually relate to industrial processes and operations. Knowledgeable employers can also "play" the class rating system by assigning payroll to lower-rated classes. Although this can be corrected through payroll audits or partially adjusted for in the calculation of an experience modification factor, it does depress the initial premium level. This strategy can backfire when an employer decides to self-insure, because the resulting modification factor may be over the acceptable limits.

- **Location** - Presently rates are developed on a statewide basis. Since frequency and severity may vary significantly by geographic location within a state, using an employer's statewide payroll without finer geographical distinctions may not accurately reflect overall exposure to claims.

- **Secondary Rating Characteristics** - The rating system does not directly reflect secondary rating characteristics except through judgmentally applied (and competitively driven) schedule rating programs. Feldblum (9) discusses other classification dimensions, such as workforce characteristics (e.g., age and sex),

the availability of group health coverage, and the financial health of the employer, which can be powerful predictors of workers compensation costs.

The imperfections in the exposure base need to be considered as part of an employer's decision to self-insure. Some employers will find that the impact of secondary rating characteristics make traditional insurance programs the least costly financing alternative. For a SIG, some potential inequities in the rating system may be balanced out by a dividend program. However, if only larger members are eligible for dividends, smaller employers could still be subject to the potential inequities inherent in the classification system.

Sometimes, only premium data may be readily available (e.g., when evaluating SIG feasibility for a large group of small insureds). One should be cautious about using premium as an exposure basis. Premium is distorted by a variety of factors, including rate level changes, rate adequacy, experience modification factors, ARAP surcharges, deductible credits and premium discount. When possible, premium audits should be reviewed to convert the premium data to a payroll basis.

Industry Pure Premiums

Exhibit 2 shows pure premiums (losses per $100 of payroll) for each class representing a non-incidental measure of the self-insurer's exposures. A practical cut off for inclusion is 1% of payroll, although the relative loss level of the excluded classes should be considered. For example, even if ironworkers (Class 5040, a class that typically has very high rates) represented 0.5% of payroll, one would generally include this class in the pure premium analysis, given the level of expected losses.

Columns (2) - (18) of Exhibit 1 show the employer's payroll distribution. Item (20), which shows the percentage distribution by class, is calculated by dividing the total payroll for each class by the total payroll for the employer (for example, the Class 7380 percent, 0.1%, equals $110,000/$85,824,000). An adjusted total is calculated in Column (21), by summing

payroll for classes representing at least 1% of payroll. The adjusted distribution (Item (22)) is calculated by dividing the class payroll (for the greater than 1% classes) by the adjusted total payroll (for example, the 8010 adjusted distribution, 26.9%, equals $22,270,000/$82,866,000).

There are three steps used in the procedure to derive the pure premiums shown in Columns (2) through (8) of Exhibit 2.

- Schedule Z data, which is compiled from the Unit Statistical Plan (USP) data submitted by insurers, is used to construct individual development histories for each class with credible experience. This analysis is performed separately for indemnity and medical losses. The results could also be calculated on a combined basis or by injury type. Aggregate industry development data, which is used to calculate the tail factors in this analysis, could be used in the projection instead of class-specific development. In selecting between aggregate industry and class-specific development data it is important to consider both the credibility of the classification experience and the degree to which the class results vary from average emergence patterns.

- For each class, the selected development patterns are applied to the latest evaluation of loss data to project losses to an ultimate basis.

- Estimated ultimate losses for each classification are divided by payrolls, which can be obtained from the classification analyses in the rate filings, to derive pure premiums.

After pure premiums for each class by year are calculated, weighted average pure premiums by year for the self-insurer are developed in Column (10) of Exhibit 2 using the employer's adjusted payroll distribution in Item (9).

Several other data sources could be used to derive pure premiums, including:

- **Other Employers Data** - To the extent that the experience of other employers in similar industries and states is available, it could be used to derive benchmark pure premiums. To do so, one would need both loss and exposure data. If other employers have similar characteristics with respect to territory and employer size as the potential self-insurer, their data may produce pure premiums that are more appropriate than those derived from industry data. For some classes, other employers' data may be the most credible data source, if most of the industry is self-insured.

- **Industry Rates** - Using industry rates is probably the simplest method to derive pure premiums, since it involves multiplying the published rates by loss ratios, which can be derived from rate filings. Potential problems with this approach include:

  - **Inadequate Pricing** - To the extent that there is significant rate inadequacy in a particular market, this approach will generally produce inadequate pure premiums.

  - **Class Differentials** - Even when rates are adequate, the implied pure premiums for all classes may not be appropriate, due to the various capping limits inherent in the bureau ratemaking approaches. The NCCI and other rating bureaus develop rate indications on an overall basis; the subsequent rate level change is then distributed to the individual classes, subject to capping procedures. To the extent that a class is chronically underpriced, pure premium indications derived from industry rates will be understated.

As states move to published loss costs (or pure premiums) rather than published rates, pure premiums can be obtained directly from filings. However, both of the limitations described above are equally applicable to published loss costs.

- **Industry Classification Analysis** - Pure premiums by class are included in the classification analysis incorporated in bureau rate filings. Before using this data one may want to consider unwinding some of the adjustment factors reflected in these pure premiums (e.g., loss adjustment expense (LAE) loading, underwriting year/accident year offset, adjustments for law reforms). In some states, the adjustment process is relatively straightforward, while in others the calculations are quite complex, and can only be approximated from data in the filing. A significant advantage to using Schedule Z data directly is that one can apply adjustment factors directly to unadjusted data, instead of backing out adjustment factors on an approximate basis.

A potential drawback that should be considered in using pure premiums derived directly from Schedule Z is that this approach does not reflect the ratemaking stabilizers (e.g., loss limitations) noted by Gillam (10). One way to temper the pure premiums would be to use the Oregon ratemaking approach described by Lamb (11). This approach assigns partial loss development (e.g., serious, non-serious) to each class in proportion to partial expected losses, instead of assigning all the partial development to classes with reported partial losses. The expected losses used to allocate development could be based on adjusted countrywide data or prior evaluations of state-specific data.

Thus far the analysis has produced pure premiums for historical periods, since typically published data will lag two to four years. Projections for recent years and the prospective period can either be developed by class and weighted by exposures, or in total, using the weighted average result. In practice the latter approach tends to produce more stable results, with the benefit of less work, due to the variability of individual classification experience.

In Exhibit 3, this approach is demonstrated. The weighted average historical pure premiums from Exhibit 2 are adjusted to a common date (1992) to reflect both benefit level changes and cost changes (residual trend) by the application of benefit level and trend factors. The benefit level and trend factors are computed on an aggregate basis using industry rate filings. To further refine the analysis, these factors could be computed separately by injury type or class and combined using exposure-based weights (e.g., payroll by class or expected losses based on industry data) to calculate an overall trend factor.

Since each Column (4) entry is at a common cost and benefit level, the selected 1992 pure premium shown in Item (5) of Exhibit 3 is based on the average of the Column (4) results. After selecting a current level pure premium, one of two approaches can be used to derive historical pure premiums for each policy year:

- Adjust the current level pure premium for the impact of trend and historical benefit level changes for each year.

- Use the above approach for the years where industry pure premiums are not available but use the actual pure premiums for the older years (assuming the self-insurer's policy period coincides with the industry policy/accident year).

The Exhibit 3 results are based on the second method. The choice of an approach should reflect the variability of the year-to-year pure premiums and the likelihood that industry results are consistent with the self-insurer's experience. For example, if the 1985 industry results were unusual due to factors that affected similar employers consistently, a reasonable initial assumption is that the self-insurer's experience would show similar results. If it is likely that the employer's results for this year were very different than the industry's, it may be more appropriate to estimate a 1985 pure premium by adjusting the 1992 selection for benefit level changes and trend, instead of using the actual industry pure premium.

In deriving the yearly pure premiums in Item (7) of Exhibit 3, there is also an adjustment for shifts in the exposure mix by year. This adjustment is performed because, although the overall distribution by class has been relatively stable, there are some significant variations in the individual year-to-year results (as shown in the bottom half of Exhibit 1). The exposure distribution adjustment factors (Column (6b) in Exhibit 3) are derived in Exhibit 4. Estimated relativities for each pure premium class are calculated in Section A of Exhibit 4 by dividing the industry class pure premiums by a base class industry pure premium. In this exhibit, Class 8810 (clerical/office workers) is used as the base class. This selection is made for two reasons:

- Class 8810 is a standard exception class and most self-insurers have a significant volume of Class 8810 payroll.

- Its pure premium is low compared to most other classes, so by using it as a base class, the calculated relativities more readily highlight significant exposure shifts.

Average relativities are calculated for each policy year in Column (9) of Exhibit 4, using the class relativities (Section A) and the yearly payroll distribution (Section B). A relativity is also calculated using the payroll distribution for the overall experience period, which is used to develop the weighted average pure premiums in Exhibit 2. The exposure distribution adjustment factors in Column (6b) of Exhibit 3 are derived by comparing the individual policy year's weighted average relativity with the average relativity for the overall period. For example, the 1985 exposure distribution factor, .996, (Exhibit 3, Column (6b)) is equal to the 1985 weighted average relativity, 8.005, divided by the overall weighted average relativity, 8.033 (both from Column (9) of Exhibit 4).

The trend and benefit factors used in Exhibit 3 are derived directly from industry rate filings. This highlights a key assumption underlying the modeling approach: inflationary impacts on a self-insurer's loss costs are consistent with model trend assumptions. If the adjusted pure

premiums in Column (4) of Exhibit 3 show a consistent upward or downward trend, it may be appropriate to review the trend assumptions underlying the analysis. This observed trend could result from using overall benefit level factors (often significant benefit changes have varying impacts by class due to differences in class injury distributions) or to changes in the exposure distribution. The following paragraphs present additional approaches that could be used to adjust trend or benefit level factors.

- **Trend** - Other methods to develop trend factors could include deriving trends directly from the weighted pure premiums, using alternative data sources, or adjusting the trends derived from rate filings.

    - **Direct Calculation** - The weighted average pure premiums developed in Exhibit 2 would be adjusted to reflect benefit level changes. These results would be fitted through standard regression techniques to produce an implied trend that should be compared to industry data for reasonableness. It can often be difficult to get a credible trend factor using this approach, because the number of data points available tends to be limited.

    - **Alternative Data Sources** - There are a variety of published data sources that can be used to supplement the trend information derived from rate filings (e.g., medical inflation indices, CPI data). One should be cautious in using CPI wage inflation as a proxy for workers compensation indemnity trend (Feldblum (12) suggests that this is likely to understate trend). Another source of trend data could be the experience of similarly-situated employers. If sufficient data are available, one could use the techniques described by Kaufman & Schwartzmann (13) to estimate trends by type of disability.

- **Adjusting Published Trends** - The NCCI approach relies heavily on regression techniques. State-specific results implied by the regressions are credibility-weighted with countrywide trend factors. To adjust the bureau trends, one could vary the quantities to which the NCCI assigns the balance of credibility. If one believes that the trends implied by the regressions in the filing are not credible, the mixed estimation techniques described by Brehm and Guenter (14) could be used to derive alternate trend assumptions. Also, the trends that are used in Exhibit 3 reflect statewide indemnity and medical weightings. Indemnity and medical weightings that reflect the individual self-insurer's loss profile could be used instead of the statewide weighting.

- **Benefit Level** - Potential distortions in benefit level factors can be due to the varying impact of law changes by class or to shortcomings in the NCCI/bureau evaluation techniques.

  - **Class Variation** - The effect of major benefit revisions can vary significantly by class, depending on its injury distribution (in particular, for serious injuries). If there have been significant law changes, it may be appropriate to use benefit level adjustment factors based on a mix of injury type losses consistent with the self-insurer's exposure distribution, rather than an overall benefit level change.

  - **Bureau Methodology** - The NCCI's data collection techniques and the breakout by injury type (e.g., permanent partial) may not be meaningful in the context of state law revisions. The M&R review of NCCI ratemaking procedures (15) notes that many law revisions cannot be analyzed with the existing databases. Often, these changes, which are referred to as non-formula revisions are both substantial and

subject to much dispute (e.g., the 1987 Maine reforms).

Feldblum (16) also cites some additional problems in estimating the impact of law revisions, including

- duration effects are "censored from above" (in that the disability has not yet ended),
- indirect effects vary by claimant characteristics, and
- it is difficult to quantify and analyze the dynamics and interactions of the system.

It may not be possible to directly adjust for some of these shortcomings. However, an understanding of the potential problems in estimating law amendment factors may help the analyst interpret anomalies in the self-insurer's year to year pure premiums.

Loss Limitation Factors

One would not expect that most self-insurer's experience is fully credible on a total limits basis. By imposing a loss limitation in the analysis, which can be independent of the applicable loss limit for the program, one

- increases the credibility of the results, and
- minimizes the distortions caused by the occurrence of unusual losses.

The modeling approach assumes that a self-insurer's experience is only meaningful as a measure of expected limited cost (e.g., losses capped at a per occurrence limit). The indications derived are used as a relative cost measure.

The selection of a limit reflects several criteria, including:

- **Size of Risk** - Typically, larger insureds will have a greater volume of large claims, so that a credible analysis could be performed at higher limits.

- **Large Loss Frequency** - In the selection of a loss limit, one should consider the volume of losses in excess of the proposed limit. If only a few claims exceed this limit, one should consider using a lower limit.

- **Data Availability** - Sometimes the limit may be dictated by the data supplied for the analysis; for example, aggregate loss data could be provided, along with detailed information on claims in excess of a particular limit. With this type of data, one could only perform the analysis at limits that are at least equal to that of the detailed data.

It can also be helpful to perform the analysis at several limits, since this allows the analyst to measure how the self-insurer's size of loss distribution compares with industry aggregate data.

In deriving an adjustment for the loss limitation, one should consider:

- **Implied Limitations** - Pure premiums derived from different sources will reflect varied implied loss limitations. The Exhibit 2 pure premiums, which are based on Schedule Z data, could be considered unlimited (although large loss incidence will vary significantly by year and class). Pure premiums derived from industry rates or classification analyses, as well as those based on the experience of other similarly situated employers, generally reflect a degree of limitation.

- **Sources of Adjustment Data** - Typically a self-insurer will not have sufficient large loss history to build a set of adjustment factors. The most common source of adjustment data is excess loss factors (ELF's) published by the rating

bureaus or the NCCI. Historically, NCCI and rating bureaus published ELF's, which were adjusted to reflect the overlap in the Table M insurance charge using excess loss adjustment amounts (ELAA). Both the ELFs and the ELAAs were premium based. When states move to loss cost rating, the NCCI/bureau published factors do not include an expense loading. (These are sometimes referred to as excess loss pure premium factors.) Throughout this paper, the term ELF is used to refer to the published excess loss factors. To the extent these factors are premium-based, the analyst will need to back out expense loadings to estimate a true excess loss factor (see page 24).

It should be noted that there is some degree of concern that the published excess factors are inadequate, particularly at higher loss limits. Factors contributing to this inadequacy include

- benefit expansions,
- data collection limitations, and
- the expansion of the claim emergence period.

In some applications, these limitations could overstate a self-insurer's funding indications (for example, when the excess factors are used to carve out a layer of the estimated ultimate losses (see page 32). However, in calculating the experience relativity, these limitations could distort the self-insurers' results (the expected losses would be overstated, which would reduce the experience relativity). Where possible, the individual self-insurer's data should be used to test the appropriateness of the adjustment factors selected (most employers' data would only be sufficient to perform a reasonability check).

- **Law Changes** - Significant law revisions can have a substantial impact on large claim experience, to the extent that the changes expand or reduce benefits for more seriously injured workers. It may be appropriate to use more than one

set of adjustment factors in the analysis, to reflect the impact of law changes.

After reviewing the self-insurer's data, a loss limit of $100,000 is selected. To calculate loss limitation factors in Exhibit 5, excess loss factors for each class (Columns (6) - (11)) are weighted by the expected loss distribution by class to calculate an overall excess loss factor. (The state in which the self-insurer operates has published rates, rather than loss costs). The expected loss distribution is computed using the payroll distribution from Exhibit 1 and the calculated pure premiums for each class from Exhibit 2 (In the example the latest year's (1988) pure premium is used. A weighted average could be substituted.) The overall ELF is then divided by the industry expected loss ratio (to remove the expense loading) to derive an excess loss factor which can be applied to losses.

The Exhibit 5 factors are calculated for two periods, pre-1986 and post-1986. This approach is used to reflect the impact of a significant benefit expansion implemented in 1986. A more precise result could be derived by calculating individual excess loss factors for each year. The increase in the associated effort may not materially improve the analysis for several reasons, including:

- Unless there is a substantial change in benefits, the published factors generally do not vary significantly by year.

- There is some degree of mismatch in the data, because the excess factors are published on a per occurrence basis, while the analyst will typically review data on a per claim basis. The NCCI also reviews per claim data to derive excess factors. They adjust for the mismatch by applying a 10% adjustment factor to the results implied by the per claim analyses to produce the published factors.

It should be noted that the published ELFs also include risk margins. Given the size of this factor (typically .005), adjusting the ELFs for risk margins would not have a material affect on the analysis.

Reporting and Payment Patterns

The pure premiums developed in Exhibit 2 are on an ultimate basis, while the available loss data are generally relatively immature. Reporting patterns based on the results of the industry pure premium analysis are used to adjust the industry pure premiums to a maturity consistent with the actual loss data. These patterns, which are derived from Schedule Z data, are weighted in Exhibit 6 using expected losses by class as weights. Indemnity and medical patterns are combined using weights appropriate for the employer's or the state's indemnity/medical split (e.g., 60/40, 70/30).

It should be noted that the oldest maturity shown in Exhibit 6 is 42 months. For this self-insurer, loss data was obtained from experience modification worksheets, which generally include only three policy years of data.

A key assumption underlying the model is that in Exhibit 6 the self-insurer's reporting patterns are similar to industry data. The pattern derived does reflect the self-insurer's exposure profile but is not carrier specific. There are several alternative data sources that can be used to derive development factors, including:

- **Other Employers Data** - Compilations of experience for similarly-situated employers can be used to estimate development patterns. The criteria discussed in the pure premium section (see page 15) also apply to these compilations.

- **A.M. Best Data** - Schedule P in "Aggregates & Averages" can be used to develop both reporting and payment patterns. This may be a less than optimal choice, because this data is countrywide and includes all carriers, while reporting and payment patterns vary significantly, both by state and company. Alternatively, "Insurance Company Reports" (or an Annual Statement) can be used to analyze development. However, unless the company reviewed is a

single state carrier, the implied development patterns may be inappropriate for the self-insurer's experience.

- **Rate Filings** - NCCI and bureau filings can be used to derive development factors. These offer the advantage of being state specific, but entail two potential disadvantages:

    - In some states, industry development is compiled only on a policy year basis. Typically self-insurers' experience is collected on an accident year basis, so it is necessary to adjust the industry factors to reflect the respective maturities of the data. Even in states where accident year data is available, it may be necessary to interpolate data from rate filings, since it is generally available at 12n + 6 month (e.g., 18 months, 30 months) valuations.

    - The information is generally state-specific, not company-specific. Some rating bureaus include carrier development in their filings, so it may be possible to derive development factors that reflect the individual claims handler's approach. To the extent that the self-insurer has used multiple carriers, the compilation of development patterns in this manner may be time consuming. Also, data derived from rate filings is based on aggregate experience and may not be reflective of the emergence patterns for the exposures analyzed.

A limitation in the bureau filings, which is also true of the patterns derived from Schedule Z data, relates to estimating the tail factor. Historically, NCCI filings used data through the eighth valuation. Tail factors were derived under the assumption that there were no significant year-to-year volume changes. Although the data is adjusted for inflation, the M&R review of NCCI ratemaking procedures (17) notes that it may understate trends in development. This disadvantage should disappear over time. Recent filings use data valued

to the twelfth year and the NCCI is collecting data so that future development will be based on data through fifteen years.

All of the sources described above would provide development factors that reflect various limitations. However, self-insurers' data are often analyzed at relatively low limits ($25,000 to $100,000 per claim). There are several ways to adjust the development data to reflect that development on limited losses is truncated, relative to total limits development, including:

- Use fitting techniques, such as those described by Pinto & Gogol (18) or Sherman (19), to adjust development patterns to reflect the limitations.

- Compare limited and unlimited data for similarly-situated companies.

In practice the latter approach may be more reasonable, given the various limitations in the data to be analyzed, and that is the approach used in Exhibit 6. The weighted average development patterns based on Schedule Z data (Column (10)) are multiplied by an adjustment factor (Column (11)) to calculate an estimated limited loss reporting pattern in Column (12). The Column (11) adjustment factors are selected judgmentally after reviewing development data for several other employers.

It should be noted that the Exhibit 6 patterns are based on historical reporting data. Development patterns can be affected by many factors, including

- law revisions,
- changes in claims settlement practices,
- changes in case reserve adequacy,
- exposure growth,
- data reporting problems of individual insurers,
- market shifts, and
- economic or industry shifts.

One can use the techniques described by Berquist & Sherman (20), Fleming & Mayer (21) or McLenahan (22) to modify historical patterns for some of these changes, to the extent claim count data is available. Industry filings generally include only incurred counts, so it may be necessary to judgmentally adjust the patterns to reflect the impact of the previously cited factors.

Comparison of Actual and Expected Results

Expected reported losses are developed by combining the various model parameters in Exhibits 7 and 8. The analysis can also be performed on a paid basis but the results are likely to be more volatile. Also, data limitations may restrict the analysis to an incurred basis (for example, if the only data source is experience modification worksheets).

Expected limited losses are estimated in Exhibit 7 as follows:

- Estimated ultimate losses are calculated in Column (4) of Exhibit 7 by multiplying each year's payroll (Column (2)) by the weighted pure industry premiums (Column (3)).

- The ultimate expected losses are adjusted to a limited basis in Column (6) of this exhibit using loss limitation factors (Column (5)), which are the complements of the excess loss factors derived in Exhibit 5. The complements of these factors are used since limited experience is evaluated (e.g., less than or equal to the loss limit of $100,000).

The limited expected losses from Exhibit 7 are then adjusted in Exhibit 8 to reflect the maturity of the actual loss data, using the loss reporting patterns in Column (3), which are derived in Exhibit 6. As noted previously, the loss data used in this analysis are derived from

experience modification worksheets, so the latest valuation reflects maturities of 42 months or less.

Column (5) of Exhibit 8 shows the self-insurer's loss data, limited to $100,000 per claim. There are several issues to consider in evaluating the self-insurer's loss data, including:

- **Consistency in treatment of expenses -** Some carriers include allocated loss adjustment expense (ALAE) in loss runs while others include only loss data. Carriers' practices vary significantly with respect to reserving for ALAE. If the industry pure premiums used in the analysis are exclusive of ALAE, the loss data used should also exclude ALAE.

- **Affect of deductible programs -** As discussed on page 7, it is preferable that the self-insurer data be on a first dollar basis, since the industry pure premiums are derived in this manner. Otherwise, the excess loss factors derived in Exhibit 5 can be used to adjust the industry pure premiums to reflect the appropriate deductible level.

- **Affect of loss limitations -** Actual loss data needs to be adjusted for the selected loss limitation. The loss limit also needs to be considered in evaluating individual carriers' loss runs, although these are generally on an unlimited basis. If one is using experience modification worksheets, care should be exercised in using totals, since they reflect loss limitations which vary by state and by year.

- **Data maturity -** Often in evaluating the experience for potential members of a SIG, the data provided will reflect varying levels of maturity for each policy period. It may be more effective to calculate approximate average maturities, rather than to analyze each member's data separately.

The next step in using the model approach is to compare the actual and expected results to calculate experience relativities (see Column (6) of Exhibit 8). This is done by year and in total; typically various averages of the relativities are calculated. A credibility factor is used to weight the self-insurer's indicated experience relativity and the expected relativity of 1.0 (the initial expectation is that the self-insurer's experience will be equal to that projected by the model). The credibility standard used in Exhibit 8 is based on the state's classification credibility standard, which is derived from rate filings.

An experience relativity is then selected which considers

- the credibility of the self-insurer's results,
- year-to-year volatility, and
- trends in the emerged experience.

In Exhibit 8, we select an experience relativity of .90, implying that this self-insurer's results are 10% better than industry data would suggest. It should be noted that this experience relativity only provides a measure of how the self-insurer's experience compares to the modeled projection of industry experience. This factor is developed on a different basis and applied differently than the experience modification factors promulgated by the NCCI and other rating bureaus.

In the selection of an experience relativity, it is important to review the results of the analysis. Typically one would expect that the overall relativity should be at a reasonable level (for example, since the initial expectation is 1.00, a reasonable range could be from .50 to 1.50 or from .75 to 1.25). If the Item (7) results are outside of the "reasonable" range, the model inputs should be reviewed, particularly for a self-insurer with low credibility. Otherwise, one runs the risk of significantly mis-stating a self-insurer's results, since the application of credibility could produce a credibility-weighted experience relativity that is close to unity. For example, a self-insurer with 10% credibility and a historical relativity of 2.50 would have a credibility weighted relativity of 1.15 (1.15=(.10x2.50)+(.90x1.00)), implying that its results

are 15% worse than industry data would suggest. Funding estimates based on this assumption could prove to be severely inadequate, if actual results were consistent with the self-insurer's own relativity (150% worse than industry data).

A key consideration in evaluating the self-insurer's experience is the estimation of credibility. Credibility is a function of the volume of data, its reliability, and the loss limit analyzed. Credibility standards can be expressed as a function of claim counts or expected losses. Using an expected loss criteria, which is essentially exposure based, has the advantage of giving a self-insurer with unusually few claims credibility based on its expected, rather than its actual, results.

The NCCI uses a classical credibility approach, which is also the basis for Item (8) in Exhibit 8. For each injury type, (serious, non-serious, and medical) a specific number of claims are required for full credibility. This claim count standard is converted into an expected loss one by the assumption of severities for each injury type (e.g., if the full credibility standard for serious injuries were 50 claims, and the average serious severity were $100,000, then the serious injury experience of a class with $5.0 million (50 x $100,000) in serious injury losses would be 100% credible). The use of severities, which change with wage levels and other cost drivers, makes this approach somewhat inflation sensitive.

The full credibility standard used in Exhibit 8 is calculated by summing the state-specific serious, non-serious, and medical credibility standards for a single classification. A self-insurer with expected losses equal to or greater than those required for full credibility is assigned a credibility of 1.00. Partial credibilities are calculated using the 3/2 exponent rule.

It should be noted that this approach can often produce a credibility factor of unity, particularly for states in which the bureau credibility standards are relatively low. Research produced by Meyers (23) and others has implied that there is a limiting value of credibility for larger risks that is less than 1.00. A simple approach to increase the full credibility

standard used would be to multiply the classification standard by the number of classes considered in the analysis.

The selection of a classical or Bayesian credibility standard is up to the individual analyst. The model approach described here, which is designed to develop reasonable estimates based on limited data, relies on the classical standard for its relative simplicity. Mahler (24) notes that the credibility process forgives small errors in the credibility weights (e.g., classical vs. Bayesian) so it may be more important to focus on the computation of the model estimates, rather than the credibility weights.

Projection of Losses for the Upcoming Year

Expected losses for the upcoming year are derived multiplicatively in Exhibit 9 using:

- projected payroll,
- an industry pure premium,
- an adjustment for excess insurance,
- the selected experience relativity, and
- an adjustment for significant law revisions and/or operational changes.

Projected payroll is typically provided by the self-insured. The industry pure premium, the excess adjustment factor, and the selected experience relativity are derived from Exhibits 2, 5, and 8, respectively. It should be noted that the adjustment factor for excess insurance reflects a $250,000 limitation, rather than the $100,000 limitation imposed in deriving an experience relativity in Exhibit 8. The selected limit used to estimate 1993 losses in Exhibit 9 should reflect the per occurrence limits that the self-insurer will purchase. These are often mandated statutorily, and for some classes, the statutory per occurrence limits effectively preclude self-insurance.

One may also adjust the loss estimates to reflect any aggregate protection purchased (e.g., stop loss). This can be accomplished by adjusting the excess loss factor or in the development

of confidence levels (see page 35). In this analysis, there is no adjustment made for any aggregate limits, because it is unlikely that the stop loss will be pierced (the statutory requirements for aggregate cover in this state are not particularly restrictive).

The law amendment factor shown in Exhibit 8, which is used to reflect a major statutory benefit reduction, was based on an insurance industry analysis.

Estimating Rates

The calculation of expected losses is the first step in estimating rates for a self-insured program. Additionally one should derive estimates of the following quantities:

- affect of discounting,
- risk margins, and
- estimated expenses.

Each of these items is discussed in the following paragraphs.

- **Affect of Discounting** - Exhibit 10 details the calculation of discount factors. The factors shown in Column (5) of this exhibit are developed using industry payment patterns and an assumed investment yield of 5.0%. Payment patterns can also be derived from other data sources (see pages 25-27) and can be adjusted using techniques previously mentioned (see page 27-28). It is frequently necessary to rely on industry data for this purpose, since loss payment information is generally less available than incurred loss data. Even for self-insurers with reasonable payment histories, industry data may be needed to derive tail factors.

  The interest rate assumption used in the analysis should be consistent with the anticipated long term rate of return to be earned on invested assets, as noted by

D'Arcy (25). It should also reflect the degree of riskiness in the outstanding reserve. Butsic (26) describes a procedure that can be used to estimate a risk adjustment factor for discounting. Typically the factor he derives is roughly equivalent to a three-point adjustment from the market rate for U.S. Government securities of similar duration to the expected loss payments. Also, some states proscribe an interest rate to be used in the analysis, and self-insurers are required to use this assumption, unless they can prove that they can achieve a different (e.g., greater) return.

- **Risk Margins** - One key difference between a self-insurer and a commercial insurer is that the self-insurer is not required to maintain a capital/surplus type account. The need for this type of account is created by several contingencies that operate on these types of programs, including:

  - Historical data may prove to be poor predictors of actual future experience.
  - Significant changes may occur in the social, legal or economic environment.
  - An unforseen series of losses or one or more large losses could affect the self-insurer's solvency.
  - Year-to-year results, even for a large exposure base, will likely be volatile.

The addition of a margin for adverse deviation can serve a similar purpose as a capital/surplus account.

As discussed in "Risk Margins for Discounted Reserves" (27), there are several approaches that can be used to derive risk margins, including

- an empirical study of variation in development patterns or historical reserve deficiencies,

- confidence interval techniques using size of loss distributions,

- ruin-theory application to reduce the probability of insolvency to a specified level,

- utility theory, and

- the difference between discounting at a risk-related rate and a risk-free rate.

The risk margins shown in Exhibit 11 are derived using computer simulation techniques. Key steps in the process include:

- Claims are assumed to be Poisson-distributed and the lognormal distribution is used for severities.

- Frequencies, severities, and coefficients of variation (COV's) are estimated using industry classification data, adjusted for the impact of trend and benefit level changes. Separate distributions are developed for serious, non-serious, and medical claims. For this example, parameters are derived using industry data for the three classes that represent the largest share of the self-insurer's losses (Classes 8010, 8111, and 8232). The class specific parameters are weighted by payroll to produce a single distribution for each group of claims.

- A number of claims is selected from the serious frequency distribution.

- For each serious claim, a claim amount is selected from the serious severity distribution and adjusted for the loss limit (per occurrence).

- The sample loss for serious injury is the sum of the claim amounts generated.

- Claim numbers and claim amounts are then selected for both non-serious and medical losses; in each case, the claim amounts are also adjusted to reflect the

applicable loss limits.

By repeating this process multiple times, risk margins to be applied to the estimated losses can be derived. Total results should also be adjusted in the simulation process to reflect the impact of any aggregate protection, if applicable.

Both the Poisson and the lognormal distributions are often used in simulation routines. It is not clear that the Poisson is the most appropriate frequency distribution for workers compensation. However, as Meyers (28) notes, selecting another distribution (e.g., negative binomial) is not likely to have a substantial effect on the results. Other distributions such as the Pareto or the Weibull can be used in place of the lognormal distribution.

The simulation approach is used in this example because it is relatively simple to apply. Bickerstaff (29) suggests that direct approximation may be superior to Monte Carlo methods, if the mean and variance of the underlying distributions can be calculated directly and precisely. He also notes that the multiple interactions between variables make it difficult to perform a direct approximation. As Heckman notes (30), a viable theoretical approach to risk loading depends on the convergence of many ideas; there is not one correct approach. Given the various limitations in self-insurers' data, a more refined method for producing risk margins may not produce better estimates. It may be more effective to concentrate on the reasonableness of the results produced.

One way to review the simulation results is by using excess loss factors to test the impact of the loss limit. For example, if the simulation results implied that 3% of losses were eliminated at a $250,000 retention, the simulation parameters should be reviewed since the loss limitation factors (which may be understated) suggest that nearly 7% of losses are greater than $250,000 (as indicated in Column (11) of Exhibit 5).

The width of the implied risk margins should also be compared to the variability of the historical experience. For example, the self-insurer's indicated experience relativity in the six-year experience period ranged from .009 to 1.032, within a selected relativity of .900 (See Column (6) of Exhibit 8). This suggests that the 75% to 80% confidence level risk margin be at least equal to 1.15 (1.032/.900). Because many potential self-insurers' large loss experience tends to be favorable, this comparison often produces a minimum risk loading. Also, the Exhibit 8 results reflect losses limited to $100,000, while the self-insurer's retention is $250,000. In deriving risk margins, the impact of large claim emergence, which is often the key factor affecting program viability, should be considered.

- **Estimated Expenses** - Expense factors to be considered, along with some typical ranges include:

Item	Typical Cost
Claims Handling	6% to 10% of Claims
Loss Control	2% to 5% of Premium
Administration	2% to 4% of Premium
Actuarial, CPA, and Legal Fees	2% to 3% of Premium
Assessments	2% of Premium *
Excess Insurance	5% to 20% of Premium **

* With wide variation by state. Also, in some states assessments are proportional to losses or to a combination of premium and losses.

** Depending on retention, classification, state.

The first three items can be estimated based on information provided by the self-insured and/or its vendors. To check the reasonableness of the assumptions, one can review filings for other SIGs, which are generally public documents. SIG expense data

can also be used as a benchmark for individual self-insurer expenses, with adjustments for factors such as loss volume, and the number of locations.

The impact of assessments can be calculated using state assessment schedules. These are generally available from brokers or insurance departments. It is important to consider all potential assessments since premium-based assessments may comprise a relatively small percentage of the total amount (e.g., New York's current assessment rate is 24% of indemnity benefits paid).

Information on the cost of excess protection can be provided by the self-insurer's broker or the program administrator.

Item (5g) of Exhibit 11 summarizes the expense assumptions for the prospective self-insurer.

Exhibit 12 combines the loss and expense analyses to derive indicated rates at various confidence levels. The expense amounts used in this calculation are on a nominal basis, except the claims handling costs, which are assumed to be paid at the rate at which losses are paid. This assumption was based on information on the TPA agreement provided by the self-insurer. Other costs could also be discounted to reflect timing differences, but the discount impact would generally be lesser (one would not expect that most program expenses would be paid as losses are paid).

Estimated rates at the various confidence levels are then computed by dividing the total program costs by estimated payroll (in 100's of dollars). It should be noted that this approach develops an overall, rather than a class specific, rate. We focus on an overall rate for two reasons:

- Self-insurers typically will not have sufficient data to establish rates by class. Class-specific rates could be established using classification relativities (derived

from a pure premium analysis or an industry rate filing) and a premium distribution by class (so that the rates by class balance to the overall rate).

- SIGs are often required to use industry rates for their initial program years. Even after they are allowed to develop their own rates, they typically use an overall pricing approach (e.g., a 10% deviation from industry rates) rather than using credits and debits that vary by class.

Additional Uses for Analysis

The modelling approach described above can be used to perform a quantitative analysis of self-insurance program feasibility or to estimate reserves.

- **Program Feasibility**

  Exhibits 13 and 14 detail the key steps in the feasibility analysis. Projected manual premium is calculated in Exhibit 13 by multiplying the self-insurer's projected payroll by class by the published rates. The manual premium then needs to be adjusted for

  - known rate level changes,
  - experience modification factors,
  - ARAP surcharges,
  - expense constants, and
  - premium discount.

  In the example, the rates used have an effective date of January 1, 1993, which coincides with the self-insurer's inception date. Prospective rate level changes (in particular, rate decreases) should be reflected in the projection, even if they can only be estimated on an aggregate basis. The impact of experience modification factors and ARAP surcharges is often an estimate (based on the prior year's results) since the

applicable factors may not be available as of the evaluation date. The amounts associated with expense constants and the premium discount can be estimated from the manual rate pages.

In most states, the net premium thus calculated represents the available income (before dividends and/or surcharges) to a self-insured group, at least in the initial years of operation. For an individual self-insurer this amount represents a benchmark to evaluate the feasibility of self-insurance.

Exhibit 14 summarizes the components of the feasibility analysis. Discounted losses at various confidence levels plus expenses are compared to net premiums. This analysis is performed at various confidence levels to provide an indication of program costs if experience is worse than expected.

For example, at a 75% confidence level, discounted costs are estimated to be $1.406 million (a 75% confidence level means that there is a 75% probability that actual future costs (adjusted for interest earnings) will be less than or equal to $1.406 million). The estimated net premium (under a guaranteed cost plan; for a retro plan, the premium should be adjusted to reflect the cash flow provisions of the plan) is $1.560 million, suggesting that self-insurance could provide savings of $154,000, if losses emerge at a 75% level. However, if results emerge at the 90% confidence level, a self-insurance program could cost $152,000 more than an insured program. Although states often specify a particular confidence level to be used in funding (e.g., a 75% level) it is important to review the impact of adverse results with a potential self-insurer. Ultimately the decision to self-insure or to join a SIG is based on a variety of other considerations (e.g., balance sheet strength, administrative issues, reinsurance availability) beyond the financial implications.

- **Estimated Reserves**

Exhibit 15 details how the industry analysis could be used to estimate reserves for an ongoing self-insurer. (Since this is meant to be illustrative, only three years' results are shown in the calculation. An actual reserve calculation would need to include estimates for all program years.) Estimated expected losses (Column (2)), which are calculated in Exhibit 7, are adjusted to reflect the selected experience relativity (Column (3)) and the estimated percentages of unreported losses as of December 1992 (Column (4)) to calculate indicated incurred but not reported losses (IBNR) in Column (5). The estimated percentages of unreported losses are based on the development patterns derived in Exhibit 6. Case reserves (provided by the self-insurer) are added to the estimated IBNR to calculate total reserves as of December 1992 (Column (7)). The estimated reserves can then be adjusted for loss expense, discounting and risk margins. An individual self-insurer often has more flexibility in reflecting the impact of discounting and risk margins on their balance sheet than a self-insurance group. The self-insurer's requirements are determined by its auditors, while the SIG requirements are often established by regulatory authorities.

REFERENCES

1) Johnson & Higgins, "Self-Insurance Trends and Perspectives", 1992

2) William D. Hager, "The Workers Compensation Crisis: Addressing the Real Problem" Casualty Actuarial Society Forum (Spring 1992 Edition), pp. 189-191.

3) William R. Gillam, "What Every Actuary Should Know About Workers Compensation Experience Rating (and Then Some)", December 6, 1990, p.32

4) Dave Bickerstaff, "Hospital Self-Insurance Funding: A Monte Carlo Approach" Casualty Actuarial Society Forum (Winter 1989 Edition), pp. 89-138.

5) Milliman & Robertson, "1991: NCCI Examination Volume VIII, Section IIB, Part 6", p. 19.

6) Sholom Feldblum, "Workers Compensation Ratemaking", 1993, p. 14.

7) Peter Lencsis, "Employee Leasing and Interstate Trucking: Related Problems in Workers Compensation Insurance", NCCI Digest, Volume IV, Issue III (1989), pp. 3-4.

8) Feldblum, op. cit, p. 93.

9) Feldblum, op. cit, p. 95.

10) William R. Gillam, "Calculation of Experience Rating Values and Plan Parameters", Casualty Actuarial Society Forum (Spring 1990), p. 35.

11) R. Michael Lamb, "Partial Loss Development Based on Expected Losses for Workers Compensation Class Ratemaking", Casualty Actuarial Society - 1993 Ratemaking Call Papers, pp. 313-340.

12) Feldblum, op. cit., p.44.

13) Allan M. Kaufman and Joy A. Schwartzman, "Evaluating Workers Compensation Trends Using Data by Type of Disability", Casualty Actuarial Society 1990 Discussion Paper Program, Volume I, pp. 425-461.

14) Paul Brehm and Denis Guenthner, "The Econometric Method of Mixed Estimation: An Application to the Credibility of Trend", Casualty Actuarial Society 1990 Discussion Paper Program, Volume I, pp. 171-215.

15) Milliman & Robertson, "1991: NCCI Examination Volume VII, Section IIB, Part 5, p. 1-53.

16) Feldblum, op. cit., pp. 62-67.

17) Milliman & Robertson, 1991: NCCI Examination Volume III, Section IIB, Part 1, p. 26.

18) Emanuel Pinto and Daniel F. Gogol, "An Analysis of Excess Loss Development", PCAS XXIV, Part 2, (1987) pp. 227-255.

19) Richard Sherman, "Extrapolating, Smoothing, and Interpolating Development Factors, PCAS LXXI, (1984) p. 122-155.

20) James R. Berquist and Richard E. Sherman, "Loss Reserve Adequacy Testing: A Comprehensive Approach", PCAS, Volume LXIV (1977), pp. 123-185.

21) Kirk G. Fleming and Jeffrey H. Mayer, "Adjusting Incurred Losses for Simultaneous Shifts in Payment Patterns and Case Reserve Adequacy Levels, Casualty Actuarial Society 1988 Discussion Paper Program, pp. 189-214.

22) Charles McLenahan, "Adjusting Loss Development Patterns for Growth", Casualty Actuarial Society Forum (Fall 1987 Edition) pp. 155-172.

23) Glen G. Meyers, "An Analysis of Experience Rating", PCAS LXXII, (1985), p. 278.

24) Howard C. Mahler, "Credibility: Practical Applications, Casualty Actuarial Society Forum (Fall 1989 Edition), p. 190.

25) Stephen P. D'Arcy, "Revisions in Loss Reserving Techniques Necessary to Discount Property-Liability Loss Reserves", Casualty Actuarial Society Forum p. 201.

26) Robert P. Bustic, "Determining the Proper Interest Rate for Loss Reserve Discounting: An Economic Approach", Casualty Actuarial Society 1988 Discussion Paper Program pp. 163-170.

27) Committee on Reserves of the Casualty Actuarial Society, "Risk Margins for Discounted Loss Reserves", Casualty Actuarial Society Forum (Winter 1989 Edition), pp. 147-148.

28) Glen Meyers, "An Analysis of Retrospective Rating", PCAS LXVII (1980), p. 110.

29) Bickerstaff, op. cit, p. 107.

30) Philip E. Heckman, Casualty Actuarial Society Forum (Spring 1992 Edition), p. 39.

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SAMPLE SELF-INSURER
Workers Compensation

Exhibit 1

Estimated Payroll Distribution

Year (1)	7380 (2)	8001 (3)	8010 (4)	8017 (5)	8039 (6)	8044 (7)	8046 (8)	8058 (9)	8107 (10)	8111 (11)	8232 (12)	8350 (13)	8380 (14)	8742 (15)	8748 (16)	8810 (17)	9015 (18)	Total (19)	Adjusted Total (21)
1985	0	221,000	2,393,000	0	0	139,000	0	0	0	504,000	445,000	0	0	455,000	0	2,766,000	40,000	6,962,000	6,562,000
1986	0	203,000	2,555,000	0	0	186,000	0	229,000	173,000	1,303,000	903,000	0	0	923,000	0	4,433,000	0	10,908,000	10,519,000
1987	27,000	67,000	4,766,000	0	0	0	0	245,000	987,000	1,655,000	973,000	0	0	1,273,000	0	13,556,000	0	23,549,000	23,455,000
1988	27,000	71,000	5,738,000	0	0	0	0	384,000	1,344,000	2,042,000	1,299,000	0	0	1,640,000	0	7,293,000	0	19,836,000	19,739,000
1989	28,000	128,000	5,766,000	37,000	193,000	209,000	84,000	646,000	758,000	2,045,000	1,048,000	0	389,000	1,341,000	135,000	7,349,000	11,000	20,169,000	18,954,000
1990	28,000	86,000	1,052,000	0	0	0	120,000	532,000	0	0	626,000	320,000	0	179,000	209,000	1,248,000	0	4,400,000	3,637,000
Total	110,000	776,000	22,270,000	37,000	193,000	534,000	204,000	2,036,000	3,262,000	7,549,000	5,294,000	320,000	389,000	5,811,000	344,000	36,645,000	51,000	85,824,000	82,866,000
(20) Distribution	0.1%	0.9%	25.9%	0.0%	0.2%	0.6%	0.2%	2.4%	3.8%	8.8%	6.2%	0.4%	0.5%	6.8%	0.4%	42.7%	0.1%		
(22) Adj'd Distrib'n	--	--	26.9%	--	--	--	--	2.5%	3.9%	9.1%	6.4%	--	--	7.0%	--	44.2%	--		
(23) Adj'd Distrib'n by year																			
1985	--	--	36.5%	--	--	--	--	0.0%	0.0%	7.7%	6.8%	--	--	6.9%	--	42.2%	--		
1986	--	--	24.3%	--	--	--	--	2.2%	1.6%	12.4%	8.6%	--	--	8.8%	--	42.1%	--		
1987	--	--	20.3%	--	--	--	--	1.0%	4.2%	7.1%	4.1%	--	--	5.4%	--	57.8%	--		
1988	--	--	29.1%	--	--	--	--	1.9%	6.8%	10.3%	6.6%	--	--	8.3%	--	36.9%	--		
1989	--	--	30.4%	--	--	--	--	3.4%	4.0%	10.8%	5.5%	--	--	7.1%	--	38.8%	--		
1990	--	--	28.9%	--	--	--	--	14.6%	0.0%	0.0%	17.2%	--	--	4.9%	--	34.3%	--		
Total	--	--	26.9%	--	--	--	--	2.5%	3.9%	9.1%	6.4%	--	--	7.0%	--	44.2%	--		

Notes:

(2) – (18) Provided by Sample Self-Insurer.
(19) Sum of (2) through (18)
(20) Classification Totals divided by Column (19) Total.
(21) Sum of (2) through (18), excluding classes representing less than 1% of the total.
(22) Classification Totals divided by Column (21) Total.
(23) Yearly classification payroll divided by Column (21). Excludes classes representing less than 1% of the total

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SAMPLE SELF-INSURER
Workers Compensation

Exhibit 2

Weighted Average Historical Pure Premiums

Year	Industry Pure Premium for Class Code							Weighted Average Industry Pure Premium
	8010	8058	8107	8111	8232	8742	8810	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(10)
1985	$3.080	$3.080	$4.134	$3.948	$6.924	$0.440	$0.241	$2.006
1986	3.278	3.278	3.832	4.113	7.063	0.610	0.269	2.100
1987	3.153	3.153	6.183	6.390	7.195	0.579	0.286	2.377
1988	3.865	3.865	5.640	6.761	10.056	0.657	0.362	2.820
(9) % of Payroll	26.9%	2.5%	3.9%	9.1%	6.4%	7.0%	44.2%	

Notes :

(2) – (8) Based on analysis of insurance industry data.
(9) % of Payroll based on data supplied by the Sample Self-Insurer. See Exhibit 1, (22).
(10) (2) through (8) weighted using weights in (9).

SAMPLE SELF-INSURER
Workers Compensation

Derivation of Industry Pure Premium

Year	Weighted Average Industry Pure Premium	Adjustment Factor to 1992 Benefit and Cost Level	Weighted Average Industry Pure Premium at 1992 Level
(1)	(2)	(3)	(4)
1985	$2.006	1.918	$3.846
1986	2.100	1.698	3.565
1987	2.377	1.519	3.610
1988	2.820	1.390	3.921
(5) Selected 1992 Pure Premium		$3.650	
(6) Adjustment Factors for		Benefit and Cost Level (a)	Exposure Dist'n (b)
1985		–	0.996
1986		–	1.060
1987		–	0.782
1988		–	1.114
1989		0.786	1.069
1990		0.853	1.259
1993		1.088	0.998
(7) Selected Industry Pure Premium for			
1985		$1.998	
1986		2.227	
1987		1.859	
1988		3.142	
1989		3.067	
1990		3.922	
1993		3.964	

Notes:

(2) From Exhibit 2, (10).
(3) Based on data derived from industry rate filings.
(4) (2) x (3).
(5) Selected judgmentally based on results of 1985 – 1988.
(6a) Factor appropriate to adjust to benefit and cost level for each year.
(6b) Derived from Exhibit 4, (9).
(7) 1985–88: (2) x (6b). 1989–93: (5) x (6a) x (6b).

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SAMPLE SELF-INSURER
Workers Compensation

Exhibit 4

Derivation of Industry Pure Premium
Adjustment for Exposure Distribution

	A. Estimated Class Relativity						
Year	8010	8058	8107	8111	8232	8742	8810
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1985	12.780	12.780	17.154	16.382	28.730	1.826	1.000
1986	12.186	12.186	14.245	15.290	26.257	2.268	1.000
1987	11.024	11.024	21.619	22.343	25.157	2.024	1.000
1988	10.677	10.677	15.580	18.677	27.779	1.815	1.000
Weighted Average	11.551	11.551	17.089	18.318	26.976	1.974	1.000

	B. Distribution of Payroll by Class							C. Weighted Average Relativity
Year	8010	8058	8107	8111	8232	8742	8810	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1985	36.5%	0.0%	0.0%	7.7%	6.8%	6.9%	42.2%	8.005
1986	24.3%	2.2%	1.6%	12.4%	8.6%	8.8%	42.1%	8.518
1987	20.3%	1.0%	4.2%	7.1%	4.2%	5.4%	57.8%	6.284
1988	29.1%	1.9%	6.8%	10.3%	6.6%	8.3%	36.9%	8.949
1989	30.4%	3.4%	4.0%	10.8%	5.5%	7.1%	38.8%	8.587
1990	28.9%	14.6%	0.0%	0.0%	17.2%	4.9%	34.3%	10.116
Weighted Average	26.9%	2.5%	3.9%	9.1%	6.4%	7.0%	44.2%	8.033
1993	16.3%	5.8%	0.3%	4.0%	15.1%	2.4%	56.1%	8.018

Notes :

A. (2) through (8) calculated as ratio of individual class pure premium to class 8810 pure premium.
See Exhibit 2, (2) through (8). Weighted average calculated using annual payroll and pure premiums by class.
B. Provided by the Sample Self-Insurer.
C. Average class relativities from A, weighted by payroll distribution in B.

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SAMPLE SELF-INSURER
Workers Compensation

Exhibit 5

Calculation of Loss Limitation Factors

Class Code	Hazard Group	Percentage of Payroll	Pure Premium	Percentage of Losses	pre 1986 ELF 100K Limit	post 1986 ELF 50K	100K	150K	200K	250K
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
8010	II	26.9%	3.865	36.8%	0.017	0.354	0.201	0.116	0.069	0.047
8058	II	2.5%	3.865	3.4%	0.017	0.354	0.201	0.116	0.069	0.047
8107	II	3.9%	5.640	7.9%	0.017	0.354	0.201	0.116	0.069	0.047
8111	II	9.1%	6.761	21.8%	0.017	0.354	0.201	0.116	0.069	0.047
8232	II	6.4%	10.056	22.8%	0.017	0.354	0.201	0.116	0.069	0.047
8742	III	7.0%	0.657	1.6%	0.028	0.423	0.264	0.166	0.109	0.079
8810	II	44.2%	0.362	5.7%	0.017	0.354	0.201	0.116	0.069	0.047
Total		100.0%			0.017	0.355	0.202	0.117	0.070	0.048
	(12) ELPF's as a percentage of losses				0.026	0.546	0.311	0.180	0.107	0.073

Notes :

(2), (6), (7)-(11) Derived from industry information.
ELF: Excess Loss Factor.
(3),(4) From Exhibit 2, (2) through (9).
(5) [(3) x (4)] / Sum of [(3) x (4)].
(12) Total weighted (by (5)) average Excess Loss Factors / 0.65.

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SAMPLE SELF-INSURER
Workers Compensation

Exhibit 6

Calculation of Loss Development Factors

Age	8010	8058	8107	8111	8232	8742	8810	Weighted Average Percentage Reported	% of 100K Reported to Total Limits	Estimated % Reported at 100K Limits
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(10)	(11)	(12)
				Indemnity Losses – % Reported						
42	76.16%	76.16%	80.58%	76.92%	78.37%	79.18%	73.10%			
30	63.49%	63.49%	62.00%	68.68%	65.32%	68.87%	60.94%			
18	50.79%	50.79%	41.32%	52.83%	48.38%	51.02%	46.88%			
				Medical Losses – % Reported						
42	90.74%	90.74%	90.79%	92.51%	95.69%	97.18%	93.90%			
30	84.03%	84.03%	94.25%	89.77%	89.45%	92.51%	86.88%			
18	74.68%	74.68%	79.87%	76.10%	81.37%	78.43%	66.84%			
				Total Losses – % Reported						
42	81.99%	81.99%	84.66%	83.16%	85.30%	86.38%	81.42%	83.25%	97.00%	85.82%
30	71.71%	71.71%	74.90%	77.12%	74.97%	78.33%	71.32%	73.97%	90.00%	82.19%
18	60.35%	60.35%	56.74%	62.14%	61.58%	61.98%	54.86%	60.45%	85.00%	71.12%
(9) % of Losses	36.8%	3.4%	7.9%	21.8%	22.8%	1.6%	5.7%			

Notes :

(2) – (8) Based on analysis of insurance industry data. Percentage reported for total losses is a weighted average of 60% indemnity and 40% medical, based on statewide indemnity / medical split.
(9) From Exhibit 5, (5).
(10) (2) through (8) weighted using weights in (9).
(11) Selected judgmentally.
(12) (10) / (11).

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SAMPLE SELF-INSURER
Workers Compensation

Exhibit 7

Derivation of Expected Losses Limited to $100,000

Year	Estimated Payroll (00's)	Industry Pure Premium	Estimated Expected Losses	Adjustment Factor for Loss Limitation	Estimated Expected Limited Losses
(1)	(2)	(3)	(4)	(5)	(6)
1985	$69,620	$1.998	$139,133	0.974	$135,456
1986	109,080	2.227	242,871	0.974	236,451
1987	235,490	1.859	437,848	0.689	301,759
1988	198,360	3.142	623,166	0.689	429,477
1989	201,690	3.067	618,550	0.689	426,296
1990	44,000	3.922	172,580	0.689	118,939
Total	$858,240		$2,234,147		$1,648,379

Notes :

(2) Provided by the Sample Self-Insurer. See Exhibit 1, (19).
(3) Based on analysis of insurance industry data. See Exhibit 3, (7).
(4) (2) x (3).
(5) Derived from insurance industry data based on assumed limit of $100,000. See Exhibit 5, 1.0 - (12).
(6) (4) x (5).

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SAMPLE SELF-INSURER
Workers Compensation

Exhibit 8

Calculation of Experience Relativity

Year	Estimated Expected Losses Limited to $100,000	Estimated Percentage Reported	Estimated Reported Losses Limited to $100,000	Actual Reported Losses Limited to $100,000	Indicated Experience Relativity
(1)	(2)	(3)	(4)	(5)	(6)
1985	$135,456	85.82%	$116,253	$1,065	0.009
1986	236,451	85.82%	202,931	115,580	0.570
1987	301,759	85.82%	258,980	267,353	1.032
1988	429,477	85.82%	368,593	275,740	0.748
1989	426,296	82.19%	350,363	205,763	0.587
1990	118,939	71.12%	84,586	64,011	0.757
Total	$1,648,379		$1,381,707	$929,512	0.673
	(7) Average Experience Relativity				
	(a) Latest 2				0.672
	(b) Latest 3				0.697
	(c) Volume Weighted				0.673
	(d) Middle 3 of 5				0.697
	(8) Credibility				22.8%
	(9) Credibility Weighted Experience Relativity				0.925
	(10) Selected Experience Relativity				0.900

Notes:

(2) From Exhibit 7, (6).
(3) Derived from industry rate filings. See Exhibit 6, (12).
(4) (2) x (3).
(5) Provided by the Sample Self-Insurer.
(6) (5) / (4).
(7) Averages of (6).
(8) Based on industry classification credibility standard.
(9) [(7c) x (8)] + [1 - (8)].
(10) Selected judgmentally.

SAMPLE SELF-INSURER
Workers Compensation

Calculation of 1993 Estimated Losses

(1) Estimated 1993 Payroll (00's)	$384,450
(2) Estimated 1993 Pure Premium	$3.96
(3) Adjustment for Loss Limitation	0.927
(4) Selected Experience Relativity	0.900
(5) Adjustment for 1991 Law Revision	0.820
(6) Adjusted 1993 Pure Premium	$2.71
(7) Estimated 1993 Losses	$1,042,359

Notes :

(1) Provided by the Sample Self-Insurer.
(2) Based on analysis of insurance industry data. See Exhibit 2, (7).
(3) From Exhibit 5, 1.0 - (12). Assumes $250,000 per occurrence retention.
(4) From Exhibit 8, (10).
(5) Based on industry information.
(6) (2) x (3) x (4) x (5).
(7) (1) x (6).

SAMPLE SELF-INSURER Exhibit 10
Workers Compensation

Calculation of Discount Factors

Months (t) (1)	Incremental Percent Paid (2)	Present Value Calculations Interest Rate = 5.0% Annual Funding – Beginning of Year: Percent Unpaid At End Of Month (t) (3)	Present Value Of Payments At Month (t) (4)	Average Discount Factor For Remaining Payments At End Of Month (t) (5)
0		100.00		0.8383
12	16.29	83.71	15.8974	0.8521
24	26.06	57.65	24.2209	0.8359
36	16.94	40.71	14.9948	0.8165
48	11.86	28.85	9.9982	0.7886
60	7.11	21.74	5.7084	0.7636
72	4.70	17.04	3.5938	0.7404
84	3.32	13.72	2.4177	0.7175
96	2.15	11.57	1.4911	0.7030
108	1.51	10.06	0.9974	0.6951
120	1.35	8.71	0.8492	0.6842
132	0.45	8.26	0.2696	0.7017
144	0.50	7.76	0.2853	0.7182
156	0.52	7.24	0.2826	0.7347
168	0.55	6.69	0.2846	0.7506
180	0.56	6.13	0.2760	0.7666
192	0.58	5.55	0.2723	0.7819
204	0.58	4.97	0.2593	0.7972
216	0.57	4.40	0.2427	0.8128
228	0.57	3.83	0.2311	0.8280
240	0.55	3.28	0.2124	0.8433
252	0.54	2.74	0.1986	0.8580
264	0.50	2.24	0.1751	0.8733
276	0.47	1.77	0.1568	0.8884
288	0.43	1.34	0.1366	0.9033
300	0.38	0.96	0.1150	0.9183
312	0.32	0.64	0.0922	0.9340
324	0.27	0.37	0.0741	0.9486
336	0.20	0.17	0.0523	0.9622
348	0.12	0.05	0.0299	0.9759
360	0.05	0.00	0.0119	1.0000

Notes :

(2) Based on selected payment pattern from industry data.
(3) (3t) = (3t−12) − (2t).
(4) (2) x [(1.0 + 0.05) ^ {((1) − 6) / 12}].
(5) (5t) = [Sum (4t+12) to Month (360)] /(3) x [(1.0 + 0.05) ^ ((1) / 12)].

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SAMPLE SELF–INSURER
Workers Compensation

Exhibit 11

Summary of Program Costs

(1) Estimated Retained Losses	1,042,359
(2) Estimated Discount Factor at 5%.	0.838
(3) Expected Losses, Discounted at 5%.	873,810
(4) Discounted Losses at	
(a) 75% Confidence Level	1,048,572
(b) 90% Confidence Level	1,354,405
(c) 95% Confidence Level	1,616,548
(5) Estimated Program Expenses	
(a) Claims Handling	72,965
(b) Loss Control	31,208
(c) Administration	46,813
(d) Actuarial, CPA, Legal	31,208
(e) Assessments	31,208
(f) Reinsurance	156,042
(g) Total	369,446

Notes:

(1) From Exhibit 9, (7).
(2) From Exhibit 10, (5).
(3) (1) x (2).
(4) (3), adjusted by risk margins derived from a simulation of Sample Self–Insurer's experience.
(5) Estimated as follows:
Claims Handling: 7.0% of Losses.
Loss Control: 2.0% of Premiums.
Administration: 3.0% of Premiums.
Actuarial, etc.: 2.0% of Premiums.
Assessments: 2.0% of Premiums.
Reinsurance: 10.0% of Premiums.
(5g) (5a)+(5b)+(5c)+(5d)+(5e)+(5f).

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SAMPLE SELF-INSURER
Workers Compensation

Exhibit 12

Estimation of Rates

(1) Discounted Losses at	
(a) Expected Level	873,810
(b) 75% Confidence Level	1,048,572
(c) 90% Confidence Level	1,354,405
(d) 95% Confidence Level	1,616,548
(2) Estimated Program Expenses	
(a) Claims Handling	72,965
(b) All Other	296,480
(3) Estimated Discounted Program Costs at	
(a) Expected Level	1,231,435
(b) 75% Confidence Level	1,406,197
(c) 90% Confidence Level	1,712,030
(d) 95% Confidence Level	1,974,173
(4) Estimated Payroll (00's)	384,450
(5) Estimated Rates at	
(a) Expected Level	3.20
(b) 75% Confidence Level	3.66
(c) 90% Confidence Level	4.45
(d) 95% Confidence Level	5.14

Notes:

(1) From Exhibit 11, (3) and (4).
(2) From Exhibit 11, (5).
(3) (1) + [(2a) x .838 (discount factor from Exhibit 10, (5))] + (2b).
(4) Provided by Sample Self-Insurer.
(5) (3) / (4).

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SAMPLE SELF-INSURER
Workers Compensation

Exhibit 13

Calculation of 1993 Standard Premium

Class	Estimated Payroll (00's)	Published Rate	Manual Premium by Class
(1)	(2)	(3)	(4)
8010	$62,820	$6.90	$433,458
8058	22,200	6.90	153,180
8107	1,060	10.60	11,236
8111	15,250	10.90	166,225
8232	58,170	13.30	773,661
8742	215,810	1.25	269,763
8810	9,140	0.80	7,312
Total	$384,450		$1,814,835
(5) Experience Modification Factor			0.98
(6) Expense Constants			$5,000
(7) ARAP Surcharge			$26,250
(8) Estimated Standard Premium			$1,809,788
(9) Estimated Premium Discount			$249,364
(10) Estimated Net Premium			$1,560,423

Notes :

(2), (5), (6), (7), (9) Provided by the Sample Self-Insurer.
(3) From industry rate pages, effective January 1993.
(4) (2) x (3).
(8) [(4),Total x (5)] + (6) + (7).
(10) (8) - (9).

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SAMPLE SELF-INSURER
Workers Compensation

Exhibit 14

Estimation of Program Feasibility

(1) Estimated Discounted Program Costs at	
(a) Expected Level	1,231,435
(b) 75% Confidence Level	1,406,197
(c) 90% Confidence Level	1,712,030
(d) 95% Confidence Level	1,974,173
(2) Estimated Net Premium	1,560,423
(3) Estimated Savings / (Deficit) Assuming Costs Emerge at	
(a) Expected Level	328,988
(b) 75% Confidence Level	154,226
(c) 90% Confidence Level	(151,607)
(d) 95% Confidence Level	(413,750)

Notes:

(1) From Exhibit 12, (3).
(2) From Exhibit 13, (10).
(3) (2) – (1).

SAMPLE SELF-INSURER
Workers Compensation

Calculation of Indicated Reserves

Year	Estimated Expected Losses	Experience Relativity Factor	Estimated Percentage Unreported @ 12/92	Indicated IBNR @ 12/92	Case Reserves @ 12/92	Estimated Reserves @ 12/92
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1988	$623,166	0.900	10.63%	$59,631	$150,500	$210,131
1989	618,550	0.900	16.03%	89,243	175,500	264,743
1990	172,580	0.900	23.11%	35,889	55,000	90,889
Total	$1,414,295			$184,764	$381,000	$565,764

Notes:

(2) From Exhibit 7, (4).
(3) From Exhibit 8, (10).
(4) Derived from Exhibit 6.
(5) (2) x (3) x (4).
(6) Provided by Sample Self-Insurer.
(7) (5) + (6).