TITLE: INFLATION SENSITIVE EXPOSURE BASES FOR GENERAL LIABILITY INSURANCE

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The existence of inflation sensitive exposure bases is not new to the property and casualty insurance business. Payroll and receipts exposure bases have been used for many years in General Liability and Worker's Compensation Insurance, even predating the formation of the CAS. In property insurance, through insurance to value programs and stated amount of insurance rating, the exposure base tends to be sensitive to inflationary movements.

While all these areas provide opportunities for extensive discussion, we will limit ourselves in this paper to discussing the exposure bases found in General Liability Insurance (Other Than Professional) as provided in Division Six of the ISO Commercial Lines Manual. The ISO rate structure currently uses inflation sensitive exposure bases for the Manufacturers and Contractors and Products Liability sublines. Additionally, a great amount of time and effort on the part of ISO insurer committees and staff has been spent investigating the possibility of more extensively converting general liability rating to inflation sensitive bases. In the following sections of this paper we will present:

i. A short historical review of the use of inflation sensitive exposure bases;

ii. A description of the current exposure bases as well as some of the reasoning behind why these bases are appropriate;

iii. An evaluation of how well the current exposure bases meet the objectives of an ideal exposure base;

iv. A description of ratemaking problems involved in accurately adjusting the historical exposures to future levels in order to perform a review of the adequacy of current rates for use in future periods;

v. A discussion of the problems involved with attempting to extend the use of inflation sensitive exposure bases to another major General Liability subline i.e., Owners, Landlords & Tenants (OL&T).

I. BACKGROUND

(a) Early Proceedings

The proper calculation of risk premium is greatly dependent upon the appropriateness of the exposure base which is used to quantify the hazard presented by a particular insured. The total premium volume, as well as the premium for a particular class of insureds or even a particular risk within that class is greatly affected by the exposure base that is used. The question of what exposure base is appropriate for a line of insurance has been the subject of much attention from the casualty actuary over the years. In fact, Volume I of the Proceedings of the Casualty Actuarial Society (then the Casualty Actuarial and Statistical Society of

America) contains a paper by Albert H. Mowbray[1] on the payroll exposure base, and another paper by Eckford C. DeKay[2] regarding the division of payroll in measuring exposure.

Again, in 1920, Mr. Mowbray presented an excellent paper concerning the actuarial problems encountered in developing the 1920 worker's compensation rate revision. One of the many interesting sections of this paper details the information which was gathered to estimate adjustments needed to reflect wage and price inflation. In this age of government indices, econometric forecasting and persistent high inflation, these early attempts on the part of our predecessors might seem crude, however further examination would probably show them to be innovative and quite acceptable in the era in which they were developed.

(b) What Requirements Should an Exposure Base Fulfill?

In attempting to decide on what exposure base is the most appropriate for a given type of insurance, many factors must be considered, actuarial as well as underwriting, marketing, and increasingly in modern times, social. Paul Dorweiler in his paper "Notes on Exposure and Premium Bases" presented to the CAS in 1929 defines the most desirable exposure base as ".. possessing a combination of these two qualifications in the largest degree:

(1) Mowbray, Albert H. "How Extensive a Payroll Exposure is Necessary to Give a Dependable Pure Premium." (PCAS Volume I. page 24)

(2) DeKay, Eckford C., "Division of Payroll." (PCAS Volume I, page 275)

(1) Magnitude of Medium (Exposure Base) should vary with hazard.

(2) The Medium (Exposure Base) should be practical and preferably already in use."[3]

While these two qualifications alone would produce a highly satisfactory exposure base, we believe that one additional consideration is necessary in order to ensure an appropriate exposure base:

(3) The exposure base should not be prone to easy manipulation by the insured.

Any exposure base which meets these three criteria should be fair equitable and efficient from both the insurer's and insured's points of view.

(c) What Problems are Created by the Current General Liability Exposure Bases?

A cursory look through the General Liability section of Insurance Services Office's Commercial Statistical Plan (CSP) will show that there are a great number of different exposure bases which could be applicable to any single general liability risk. For example, a particular risk could have its OL&T coverage based upon area or admissions, while any Product Liability coverage might be on receipts or number of units produced, and if it had an M&C (Manufacturers & Contractors) exposure, this coverage might be based upon payroll. A risk which would include various combinations of these coverages would be quite common and the

(3) Dorweiler, Paul, "Notes on Exposure and Premium Bases" (PCAS Volume XVI, page 319)

multiplicity of different exposure bases is costly to both the insurer and the insured. In the process of rating any risk, each one of these exposure bases must be measured or estimated in order to compute the risk premium. The complication of having to collect all the different exposure bases increases the amount of expenses that the premiums must cover, and this cost to the insurer is reflected in higher expense loadings which pass the cost onto the policyholder. In addition, the policyholder has the added expense of having to keep account of the exposure bases so that the insurer can audit them during and/or after the close of the policy period.

This multitude of exposure bases applicable to individual risks has also been used as an effective argument against the development of experience rating plans based upon a premium at present rates approach. From an actuarial point of view, the most equitable way to evaluate how an individual risk's experience deviates from the average contemplated in the current manual rate is to test the insured's past losses, adjusted to reflect current economic and business conditions, against the premium that would be generated by the current manual rate. This type of experience review should produce more equitable results by policyholder, and will reflect any changes that had been made to manual rates and/or class rate differentials.

The collected premium rating plans which are currently in use compare past losses with past collected premiums, and cannot,

by their very nature, take into account any changes which have happened since the experience period. The assumption which underlies the validity of collected premium rating plans is that, as losses rise over time in the interval between the experience period and the period of the proposed rates, premiums will also rise proportionately because of rate changes. This assumption has been reasonable in the past, however, under volatile situations where large changes in losses or premiums take place suddenly. premiums at present rates plans are actuarially preferable. These plans would also be more practical if GL exposure bases were more uniform and inflation sensitive.

So the current situation in general liability insurance is that the multitude of exposure bases causes considerable expense to the companies and ultimately the policyholder because of complicated premium calculations, and also causes other problems due to the need to simplify rating procedures in other areas, such as individual risk rating.

II. CURRENT INFLATION SENSITIVE EXPOSURE BASES IN GENERAL LIABILITY INSURANCE

(a) General

Currently, in General Liability, two of the three major sublines have an inflation sensitive exposure base. These sublines are Manufacturers and Contractors (PAYROLL EXPOSURE BASE) and Products (SALES/RECEIPTS EXPOSURE BASE). The early considerations in

setting up exposure bases concentrated on the appropriateness of the selected base as a measure of risk or hazard not just for the line in general (overall adequacy), but also for distinguishing between risks in the same class who had an actual difference in inherent hazard, and thus a difference in cost to the insurance company (individual equity).

In the more recent past, however, the presence of persistent economic and social inflation coupled with increasing opposition to rate increases from regulators and consumer groups have led insurance companies to view inflation sensitive exposure bases as a great boon. These bases have the effect of enabling the companies to automatically increase premiums charged policyholders as the economic forces which affect prices are reflected in the policyholder's payroll or receipts without securing prior regulatory approval. In addition they mitigate the need for general rate level changes since theoretically this need should be limited to the difference between the inflationary effects reflected in the exposure base and those same effects (both economic and social) on the goods and services provided by the insurance policy. Regulators are much less likely to disapprove or delay requests for needed rate level changes when these changes are of a relatively minor magnitude.

(b) Manufacturers and Contractors

Up until the late fifties the exposure base for Manufacturers and Contractors was payroll limited to a maximum of $100 per week per person. Then in the late fifties and early sixties, most states approved a change in payroll limitation to $300 per week per person. This limitation remained in effect until the middle seventies when the change was made to unlimited payroll as the exposure base. Currently more than seventy five percent of the jurisdictions have the unlimited payroll as the Manufacturers and Contractors exposure base. Of the remaining jurisdictions, all except one are at the $300 limitation; that one is at $200 per week per person. (See Exhibit 1 for a listing of current payroll limitations and effective dates).

When the original $100 per week payroll limitation was established this amount represented a wage that was many times greater than the wage that the average worker was making and thus had very little effect on the payroll used as the exposure base. The limitation only affected the contribution of higher paid executives to the exposure base, and this was appropriate since these executives did not present the company with an exposure to loss commensurate with their earnings. Over the years, as wages increased the $100 limitation had an ever increasing effect upon the exposure and so the limitation was changed as noted above. Each time that the

limitation was raised, offsets were applied to the class basic limit rate so that, on the average, there would be no initial increase in premium realized due to the change in limitation.

The Manufacturers and Contractors liability policy covers the insured against liability caused by an occurrence arising out of the ownership, maintenance and use of the covered premises and the manufacturing or contracting operations of the named insured in progress. This insurance applies to all premises and all operations of the insured. This coverage is intended to protect the insured against harm done to members of the public, and in general does not apply to employees, although there are circumstances where an employee could be considered a member of the public. In light of the coverage provided, the payroll of the insured should reflect the level of business activity, and thus the exposure to loss. However, there are situations where the correlation between salaries and exposure may not be the best, but a discussion of these will be left to another part of this paper.

One departure from the use of unlimited payroll which deserves mention is in regard to executive officers and individual insureds and co-partners. Rule 4-E- j, k, Page GL-2 of Division Six of

the ISO Commercial Lines Manual requires that for executive officers, the payroll used should be the average weekly payroll limited to no more than $300 per week and no less than $100 per week. For individual insureds or co-partners a flat $10,400 annual payroll should be used.

These limitations serve two purposes. In the first instance, the maximum limitation on executive officers is meant to limit the exposure from these persons since the company's exposure to loss is not directly proportional to the salary of a highly paid executive officer who probably spends a large part of his or her time away from the actual manufacturing or contracting area. This would be especially true for large, diverse operations. The minimum limitation on executive officer payroll and the flat dollar amount for individual insureds or co-partners is meant to ensure that the insurer receives some payroll amount for these employees. This is important because the "payroll" of an executive officer or individual owner or co-partner can be very easily manipulated so that they are receiving very little if any actual remuneration, and are taking a salary in the form of distribution of profits. This is especially so in the case of small businesses where the owner operates like any other employee and so would present the same type of hazard as any other employee. Without a payroll minimum, it is possible that the insurer would be collecting very little if any exposure data for this individual. Both of these rules address areas where inequities could arise in the premium

charged individual risks. However they have one significant drawback in that they are dollar amounts which do not respond to inflationary movements without first gaining regulatory approval. In order to rectify this situation, the latest revision to the General Liability rules proposes that these limitations be changed to:

(1) Executive Officers - Four (4) times the statewide average weekly wage. This is an upper limitation, not a flat amount to be charged in each case.

(2) Individual Insureds or Co-Partners - One and one half (1.5) times the statewide average weekly wage. This is a flat amount to be charged in each case.

In this way, the concepts embodied in the original rule are maintained, and at the same time, the amounts are allowed to reflect the effects of inflation over time.

(c) Products Liability

As previously mentioned, the exposure base for products liability is receipts for most classes. This exposure base is not affected by any limitation as was the case with the early payroll base for Manufacturers and Contractors. In rating products liability, each different product classification is rated separately and the total premium is the sum of all the individual pieces. For large insureds, it can be a costly and complex procedure to try to itemize receipts by product class and in that case the composite

rating plan is useful. This plan allows the development of a rate which will be related to some convenient exposure base, maybe total receipts, so that an itemization of receipts by product is not necessary. This produces a large expense savings to the company and policyholder, while at the same time utilizing an exposure base which will reflect movements in cost. Adjustments in the rate can be made when general rate level changes are implemented and experience rating plans can be applied so that the ultimate premium charged will closely approximate the premium that would have been charged if the normal manual procedure had been followed.

Product Liability is a large and complex line with many different variables affecting profitability. This line probably has more uncertainty associated with it than any other line. The trend toward strict liability, long product life, long term exposure hazard and many other factors combine to make successful pricing and underwriting of product liability very difficult. The existence of an inflation sensitive exposure base is a great boon in this unpredictable line, but the base is not without its shortcomings. Subsequent sections of this paper will explore for both products and manufacturers and contractors just how well the exposure bases track the hazard from risk to risk and from one phase of the "underwriting cycle" to another.

III. EVALUATION OF HOW WELL THE CURRENT EXPOSURE BASES MEET THE OBJECTIVE OF AN IDEAL EXPOSURE BASE

In this section an attempt will be made to examine how closely the existing exposure bases for, first M&C, then products, meet the objectives for an ideal exposure base presented in Section I (b).

(a) Manufacturers & Contractors

Certainly the payroll exposure base for M&C is easy to obtain for individual risks, if only because that information must be obtained anyway for Workers Compensation. Furthermore the payroll is easily obtainable from tax records. Payroll is also a good base because it can be easily audited and is not easily subject to manipulation by the insured.

Of great interest to the actuary is the question of how equitable is payroll; i.e. how well does it measure the risk. First of all, it is probably true that payroll is a more equitable exposure base for Workers Compensation than for third party liability simply because Workers Compensation is a first party coverage and the number of potential claims should be directly proportional to the number of workers. Even for Workers Compensation however, the question exists of whether the hazard is greater for higher paid than lower paid workers. In many situations, the answer is probably no and, for this reason, the wages included in rateable payroll were capped in past years. For third party liability, the relation between number of expected claims and numbers of workers is somewhat more tenuous, although it does follow that

for larger operations, more claims should be expected. It is certainly also true that different businesses, having identical payrolls, can have widely differing degrees of contact with bystanders who may be injured in work situations. Hence the M&C rates on a payroll exposure base should vary substantially by type of industry (example: rates for the construction industry and utilities are generally much higher than rates for manufacturing workers). Although a payroll exposure base is generally reasonably equitable for M&C, listed below are several interesting situations where inequities exist:

(1) Subcontractors Problem

Consider two contractors, each with identical, fairly small, payrolls. The first business employs no subcontractors, while the second takes on a major project and employs many subcontractors. Since the rateable payroll of the direct contractor would not include the subcontractors payroll, the two risks would pay the same premium. However the second contractor incurs much more potential liability because he can be sued, under vicarious liability, for torts committed by his subcontractors. Ideally, the solution would be to sell the prime contractor coverage for vicarious liability, at a rate lower than the rate charged for direct liability coverage, with that rate multiplied by the payroll of the subcontractor. Unfortunately, the payroll of the subcontractor is not always easily

obtainable, especially if the subcontractor does not purchase liability or Workers Compensation insurance from the same insurer. A rate for vicarious liability could perhaps be based on the receipts paid by the contractor to the subcontractor. This however would also present problems since the receipts may or may not include the rather substantial cost of materials, which can be purchased by either the contractor or subcontractor.

(2) Low vs. High Salaried Worker Problem

Consider two construction companies A and B. A hires only skilled workers and pays them well. B hires unskilled workers and pays poorly. A will pay more premium, although logic suggests that A will have better loss experience.

A related problem situation might be where two manufacturing firms A and B coexist where A is profitable while B is on the verge of bankruptcy. Firm B may be forced to neglect its facilities and the resulting deteriorations may cause accidents affecting the public. The increased loss potential of firm B is, of course, not reflected in the unit of exposure.

When actual risks are rated, differences such as those mentioned above which are not measured by the exposure base are considered by the underwriter using experience and schedule rating plans.

It is evident that these plans, as well as a large degree of underwriting flexibility and sound judgement are necessary to rate the many possible varieties of commercial risks.

(b) Products

Products uses a sales, or receipts exposure base for most classifications. Like payroll for M&C, receipts has the advantages of simplicity and availability and receipts generally cannot be easily manipulated by the insured. It is also generally true that receipts are proportional to number of products sold, which should be proportional to the expected losses. There are however some fundamental difficulties with the way products liability insurance is rated using receipts which are explained below. The reader may note that although the problems are listed, no obvious solutions are listed underneath. We do not pretend to know any obvious, simple solutions to most of these problems.

(1) High priced high quality products vs. low priced low quality products

This is a simple equity problem where 2 manufacturers of, e.g. chain saws, purchase products liability insurance. The first manufacturer sells an expensive, safe, quality product, while the second manufacturer sells a low budget product with minimum safety features. The first manufacturer pays higher premium for the same number of chain saws even though he manufactures a safer product and should expect fewer claims.

A partial solution to this inequity might be to use number of products, rather than sales dollars as the exposure base. Sales volume is more easily auditable however. It is also inflation sensitive, an important advantage, which will be discussed in depth later.

(2) Products sold many years ago may cause claims today

One interesting aspect of products liability coverage is that it is generally sold on an occurrence basis. This essentially means that if a one year policy becomes effective on January 1, 1981, coverage will apply to all accidents occurring during 1981. Some of those accidents may be caused by dangerous products which were actually manufactured and sold many years before. This is a particularly common situation today as both the states of technology and of legal attitudes are changing and products once considered reasonably safe may today be considered needlessly hazardous.

Now consider two manufacturers (A and B) of durable products (e.g. printing presses) with identical sales volume during 1981. The only difference between the two manufacturers is that A has been in business much longer than B and therefore has already sold many presses which can possibly cause claims during 1981. Thus, although the manual premiums would be identical, the loss potential of A is much greater.

One possible theoretical solution to this equity problem might be to change the provisions of the standard products policy to cover not all accidents occurring within the policy period, but instead, accidents on all products manufactured during the policy period. If coverage applied that way, then there really would be a direct correspondence between the units of exposure for a particular policy period and losses expected to result during that policy period.

This alternate type of coverage has two fatal flaws however. First, it is often difficult or impossible to determine exactly when a product was manufactured, especially many years afterward. Second, if coverage were based on the date of product manufacture, products claims for a particular policy year would be reported practically endlessly for durable products. The "tail" could last perhaps 40 to 50 years and it would be completely impossible to calculate rates for that type of coverage. (Even with current coverage provisions, products liability insurance has a very "long tail" and ratemaking is therefore a difficult and imprecise art.)

(3) Subcontractor Problem

Assume two manufacturers, A and B, produce identical products with identical sales volume. A manufactures

the entire product, while B purchases sub-assemblies from subcontractors and only assembles the components. Although A probably is likely to incur more losses, the manual premium for both will be identical.

(4) Manufacturer/Retailer vs. Manufacturer Problem

Assume two insureds A and B, who each manufacture the same number of identical products. A is a manufacturer/retailer, while B is a manufacturer who sells to retailers. Thus A's receipts reflect retail prices, while B's receipts reflect wholesale prices. Thus B's manual premium might be much lower than A's premium although the loss potentials are almost the same.

(Actually, A should expect slightly more claims than B because of A's retail operations. However if the product is one which needs no assembly or modification by the retailer, the potential liability of the retailer may be negligible.)

(5) Large vs. Small Risk - Aggregate Limits

As a general rule, products policies are sold with an aggregate limit. This protects the insurer from catastrophic situations where seriously defective products are mass produced and distributed and result in many thousands of serious injuries and claims. The manual premium for a given aggregate limit of, say

$1,000,000 in conjunction with a per occurrence limit of, say $500,000, is calculated as follows: The basic limits rate for 25/50 basic coverage is multiplied by an increased limits factor for 500/1000 coverage. The product equals the rate for 500/1000 coverage. (500 per occurrence/1000 aggregate.) That rate is then multiplied by the sales volume to obtain the manual premium for the risk.

Now consider two risks (A and B) manufacturing identical products, but A produces twice as much sales volume as B. The manual premium for A will be double that of B. The expected losses, however will be less than double because both risks are limited by the same aggregate limit.

In this situation, for the rating of the two risks to be completely equitable, the increased limits factor should vary with size and be slightly lower for the larger risk. This is because the larger risk is more likely to accumulate enough claims to exceed the aggregate limit and therefore the aggregate limit represents a more significant limitation on coverage for that risk. Practically, however, it would be very cumbersome to have many different tables of increased limits factors for different risk sizes since it is also necessary to have different increased limits

tables for different groups of classes; some products tend to cause much more severe claims than others. Furthermore, when reasonable aggregate limits are purchased which substantially exceed the per occurrence limit, it is very unlikely that the aggregate limit will be reached since a multitude of large claims must occur. Hence although a theoretical inequity exists when identical increased limits tables are used for large and small risks, the inequity is generally slight (compared to some of the other inequities mentioned).

(6) Multiple Product Manufacturer - Aggregate Limits

This problem is a variation on the previous one. In determining the premium for a manufacturer of several products, the rate for each product is multiplied by the receipts for that product, and then these are added together to produce the final premium. This appears to be a reasonable procedure and it is not obvious that any inequities result. However, the following example will illustrate the problem:

A manufacturer of a wide range of food products has his products broken down into ten different classifications. His premium for a 500/1000 liability limit is calculated as described in (5) above for each product, and then added together to produce the premium for 500/1000 limits. However, if he had bought a different policy for each product classification his total

premium would have been the same, but he would have had an aggregate limit for all products of $10 million instead of $1 million.

Many manufacturers do not limit themselves to one product and even though the degree of inequity in this case is small, it is present and difficult to evaluate.

(7) Completed Operations Exposure Base

Completed Operations is generally considered to be a subset of products liability insurance. A typical example of a completed operations risk might be a building which has already been constructed, but is insured against, for example, windows on upper floors breaking due to poor design, injuring pedestrians below. The exposure base for completed operations is receipts. Ideally, these would be the receipts paid the construction company to build the building.

In many practical situations, however, a construction company may have built many structures over the years which have long been paid for, each of which must be covered in any particular year. Since it would be very complicated to relate the manual premium to the receipts charged for the buildings actually covered, the manual

premiums are often related to the current year's receipts, which can include payments on uncompleted operations. Here again we have a situation where the exposures do not necessarily track the loss potential, especially in situations where the current level of business activity for a risk has changed from past levels.

If one conclusion can be reached from the foregoing discussion it is that receipts is certainly far from an ideally equitable exposure base for products liability insurance. The real problem, however, is that nothing else is much better. Actually, the determination of products liability premiums for individual risks is as much an art as a science. It really should be done by experienced underwriters who can evaluate the difference between an individual risk and the average risk and appropriately apply rating plan modifications to the manual rate.

IV. INFLATION SENSITIVITY OF RECEIPTS AND PAYROLL

One of the best features of payroll and receipts as exposure bases for general liability insurance is that they are inflation sensitive. This is very advantageous in these days of double digit inflation because inflation causes the total dollar amount of insurance losses to rise, necessitating frequent large rate revisions. Since it is often difficult for insurers and rating organizations to achieve frequent large rate revisions, especially in states requiring prior

approval of rates, insurers often lose money during periods of rapid inflation. If inflation sensitive exposure bases are used. the growth in losses will tend to automatically be tracked by a growth in premiums during inflationary periods, minimizing the need for politically unpalatable rate level changes.

Some of the questions on this subject that will be explored in this section are:

(a) Do inflation sensitive exposure bases really reduce the need for rate increases?

(b) Do GL losses tend to increase at a greater rate than payroll and receipts exposures? If so, why?

(c) Do exposures and losses tend to react the same way to economic cycles? Does the use of payroll and receipts tend to dampen or enhance the underwriting cycle for GL?

(d) Do methods exist whereby we can estimate future levels of premiums using forecasts of government data relating to payroll and receipts? Can anything be done to forecast future losses using forecasts of government data?

Again, please do not expect solid answers to all of these questions. However, these are areas that ISO Staff along with the ISO General Liability Actuarial Subcommittee are exploring currently and in which interesting progress has been made.

(a) Do Inflation Sensitive Exposure Bases Reduce the Need for Rate Level Changes?

This question is probably the easiest to answer and that answer appears to be yes. We can show that past ISO rate changes have been greater for OL&T, which is not rated on an inflation sensitive exposure base, than for M&C (especially) and Products. Although this may not be true in any one year, it does tend to be true over the long run, as shown in Exhibit 2 for a 7 year period.

(b) Do General Liability Losses Increase at a Greater Rate than Payroll or Receipts Exposures?

It is true that GL losses have increased more rapidly over the past decade than total payrolls and receipts. This can easily be shown to be true by comparing the total paid and incurred general liability losses from Bests, with several government indices (i.e. total wages for Manufacturing and Construction industries for M&C, total sales of durable goods for products). These data are listed on Exhibit 3 and indicate that, from 1970 to 1979, total incurred GL losses have increased by 413%, while inflation sensitive exposures have increased 151% (sales of durable goods) and 119% (manufacturing and construction payrolls).

The reasons for this are obvious to any actuary who has been familiar with commercial liability insurance ratemaking over the past several years. Losses increase because of increases in severity and frequency. Severity increases partially because of inflation but also because, over time, juries place a higher value on "pain and suffering". Claim frequencies can increase

also because consumers are becoming more aware of their ability to sue businesses or professionals when they are not satisfied. The concept of "fault" has also eroded over time, especially for products where often a manufacturer can today be liable for any accident involving his product, even if the accident was beyond the control of the manufacturer or caused by product misuse. Furthermore many of the legal defenses which were available in the past (e.g. privity of contract) are no longer available. It can therefore be concluded that inflation sensitive exposure bases help to adjust GL rates but they can by no means eliminate the need for rate changes.

(c) Are Payroll and Receipts Exposure Bases Out of Phase With Losses?

It may also be noted that payroll and receipts do not rise at a uniform rate over time. They are very sensitive to business cycles. This is especially evident when we recognize that M&C mostly includes contractor's exposure (approximately 80% of M&C premium is contractors premium). The construction industry is an industry which has very substantial peaks and valleys with the overall business cycles. Furthermore, for products, the largest portion of products premium correspond to industries that manufacture durable goods. Receipts in these industries are also very sensitive to economic cycles.

Thus, inflation sensitive exposure bases by no means guarantee a smooth annual increase in premiums closely correlated with the consumer price index. Instead, what can be expected is an erratic fluctuation correlated with the year to year changes in

sales of durable goods and payrolls in the construction industry. It is interesting to note whether variation in losses over time are in phase or out of phase with variations in exposures and premium.

Below is listed a series of annual changes in total general liability losses (both paid and incurred) as reported in Bests, along with comparable annual changes in total sales of durable goods and manufacturing and construction worker payrolls. The sales and payroll data are obtained from the Bureau of Labor Statistics.

	Percent Changes In			
Year	Losses		Durable Goods	Mfg. & Construction
To/From	Paid	Incurred	Sales	Payrolls
'69/'68	+10.9%	+12.7%		
70/ 69	+10.7	+22.2		+ 6.5%
71/ 70	+13.6	+19.4	+14.3%	+ 9.5
72/ 71	+21.4	+22.7	+14.6	+10.5
73/ 72	+19.0	+12.0	+11.2	+12.3
74/ 73	+20.0	+21.2	- 1.4	+ 4.5
75/ 74	+15.7	+ 8.7	+ 8.7	- 5.8
76/ 75	+ 8.2	+20.4	+18.7	+ 9.1
77/ 76	+18.2	+12.7	+13.6	+12.4
78/ 77	+12.8	+51.1	+12.0	+17.1
79/ 78	+20.5	+15.9	+ 6.4	+13.8

First, note that the means and standard deviations of the above series equal:

	Mean	Standard Deviation
Paid Losses	+15.5%	4.3%
Incurred Losses	+19.9	10.9
Durable Goods Sales	+10.9	5.5
Mfg./Construction Payrolls	+ 9.0	6.0

We note that all four series have very significant deviations about the mean values. Next we calculate coefficients of correlation between the four variables to determine whether the deviations from the mean are in or out of phase with each other.

COEFFICIENTS OF CORRELATION

Paid Losses vs. Durable Goods Sales	-0.562
Paid Losses vs. Mfg. & Construction Payrolls	+ .073
Incurred Losses vs. Durable Goods Sales	+ .089
Incurred Losses vs. Mfg. & Construction Payrolls	+ .511

The above results indicate that there is no clear statistical correlation between the annual changes in payroll or sales and the changes in either paid or incurred general liability losses.

We have thus far established that:

(1) The average annual percentage rate of change of inflation sensitive exposures has an expected value which is positive and also has a substantial expected average deviation from the mean.

(2) The deviation from the mean is a fairly random variable that is not well correlated to deviations in losses over time.

In ratemaking, a principal objective is to estimate expected values of premiums at present rates and losses at a future point in time when the proposed rates will be in effect. Trend factors are necesary to project the past experience into the future and, when an inflation sensitive exposure base is used, trend factors must apply to premiums and exposures as well as losses.

At ISO, a common technique has been to use Bureau of Labor Statistics data to, first, index exposures from the mid-points of past policy years to the present. Second, to project to the future average date of proposed rates, the most recent average annual change in the BLS data is calculated and projected into the future assuming a constant annual percentage change in exposures. Since we know that the exposures do not increase at a constant rate, a new uncertainty is introduced into the ratemaking calculation. The following simplified example should illustrate this point:

Suppose that the four most recent quarterly values of manufacturing and construction payrolls are:

Quarter Ended	Total Payroll Index	Quarterly Percentage Change
9/30/79	332.30	
		+1.0%
12/31/79	335.64	
		+1.5%
3/31/80	340.70	
		+1.7%
6/30/80	346.52	

The average quarterly percentage change, along an exponential curve of best fit, is given by the following equation:

$$\ln (1+b) = 0.3 \ln(1+.017) + 0.4 \ln(1+.015) + 0.3 \ln(1+.010)$$

To an excellent degree of approximation, the above equation can be simplified to yield:

$$b = 0.3 \times 1.7\% + 0.4 \times 1.5\% + 0.3 \times 1.0\% = 1.41\%$$

The 1.41% average quarterly change is projected into the future to one year past an anticipated effective date of, say, January 1, 1981. Thus the data is projected from the mid-date of the last quarterly value of payrolls, 4/15/80 to 1/1/82, an elapsed time of 1.71 years. The exposure projection factor therefore equals $(1.0141)^{1.71 \times 4} = 1.10$.

Although the 1.10 represents a reasonable expected value of the exposure projection factor it will turn out to be either too high or too low because the quarterly (or annual) values of the total payroll index fluctuate randomly over time. In this case, the (10 year) average annual change in manufacturing and construction payrolls equals 9.0% (quarterly value equals 2.2%), while the standard deviation equals 6.0% (quarterly value equals 3.0%). Thus a 1.71 year projection factor has projected value equal to $1.090^{1.71} = 1.16$, with one sigma lower and upper bounds of $1.090^{1.71} \div 1.060^{\sqrt{1.71}} = 1.075$ to $1.090^{1.71} \times 1.060^{\sqrt{1.71}} =$

$1.252^{(4)}$. Thus the 1.10 previously calculated could reasonably be expected to actually range anywhere from 1.075 to 1.252. Using similar reasoning, the projection factor for the Durable Goods Sales base could reasonably be expected to range from $1.109^{1.71} \div 1.055^{\sqrt{1.71}} = 1.113$ to $1.109^{1.71} \times 1.055^{\sqrt{1.71}} = 1.280$.

The conclusion of all this is that the use of an inflation sensitive exposure base brings the advantage of a rating base that tracks inflation, but it also brings the disadvantage of introducing a new element of uncertainty into the ratemaking formula. If the exposure base were fixed (example: number of units) no projection need be made of the exposures expected in the period of the proposed rates. We know that the value will remain unchanged in relation to the number of risks insured. If payroll is the exposure base, however, even if the total number

(4) Assume that the quarterly value of percentage change is represented by a random variable X_i for the ith quarter with mean u_x and standard deviation σ_x. The overall percentage change Y over n quarters can be represented as:

$$\ln(1+Y) = \ln(1+X_1) + \ln(1+X_2) + \ln(1+X_3) + \ldots + \ln(1+X_n)$$

To an excellent approximation:

$$\ln(1+Y) = X_1 + X_2 + X_3 + \ldots + X_n$$

Therefore ln (1+Y) can be represented as a random variable with Mean nu_x and standard deviation $\sqrt{n}\sigma_x$

Mean value of $1+Y \approx e^{nu_x} \approx (1+u_x)^n$

1σ upper bound $\approx e^{nu_x+\sqrt{n}\sigma_x} \approx (1+u_x)^n(1+\sigma_x)^{\sqrt{n}}$;

1σ lower bound $\approx e^{nu_x-\sqrt{n}\sigma_x} \approx (1+u_x)^n / (1+\sigma_x)^{\sqrt{n}}$

of businesses insured remains constant, payrolls can be expected to rise in a 1.71 year period anywhere from 7.5% to 25.2%. Similarly, total sales can rise from 11.3% to 28.0% if total number of insureds remain constant. This additional uncertainty increases the volatility of rates over time and can serve to amplify the peaks and valleys of underwriting cycles.

(d) Use of Econometric Forecasts to Determine Projections of Payrolls or Receipts

It is evident that the projection factors described above can never be calculated exactly because they are predictions of the future. The accuracy can be improved over the exponential line of best fit method if a capable data forecasting service is used to evaluate future values of sales or payrolls. An organization that prepares these forecasts, such as Data Research Institute, would first hypothesize the conditions expected in the overall economy within the next 1, 2 or 3 years such as presence or absence of imported oil embargoes, recessions, or the levels of government spending and taxation. They would then apply a model based on past data which relates these kinds of information to past indices of prices, wages, etc. to obtain future projections. An analysis of the track record of DRI indicates that they have projected indices such as the Total Sales of Durable Goods more accurately than can be done by simple exponential extrapolation. To illustrate, at several dates in the past, attempts were made by DRI to forecast

the Total Sales of Durable Goods index expected during 1979. The actual value of the index turned out to equal 213.0. Below, the various forecasts are listed as a function of time:

Date of Forecast	Forecast of Durable Goods Sales	Percentage Error
4/25/77	208.7	- 2.0%
9/25/77	211.1	- 0.9
11/25/77	208.1	- 2.3
3/23/78	211.5	- 0.7
6/24/78	212.5	- 0.2
9/24/78	210.5	- 1.2

Similar forecasts were made for the year ended June 30, 1980 when the actual value equalled 211.4.

The forecasts were.

	Forecast	Error
9/25/77	219.0	+ 3.6%
11/25/77	216.2	+ 2.3
3/23/78	222.2	+ 5.1
6/24/78	224.6	+ 6.2
9/24/78	219.8	+ 4.0
11/26/78	213.6	+ 1.0
2/27/79	217.5	+ 2.9
5/21/79	220.8	+ 4.4

Note, that, interestingly, the forecasts do not necessarily become more accurate as the time interval of the forecast is reduced. The results however, definitely appear more accurate than the results to be expected using exponential extrapolation. Currently, the ISO ratemaking methodology uses econometric forecasts to estimate future values of inflation sensitive exposures. Losses, on the other hand, are projected by exponential extrapolation of historical insurance data since no government indices are evaluated by forecasting services, such as DRI, which yet appear to correlate well with general liability losses. The ISO General Liability Actuarial Subcommittee is currently studying relationships between GL losses and government economic data which can be used to develop models which, in the future, will make use of forecasting services.

V. SHOULD AN INFLATION SENSITIVE EXPOSURE BASE BE USED IN OWNERS LANDLORDS AND TENANTS INSURANCE?

This question has been the subject of extensive study by ISO staff and company committees over the past several years. These studies have involved the desirability as well as the practicality of using a receipts exposure base in place of the current area exposure base.

It is obvious that an inflation sensitive exposure base is desirable from the standpoint of the companies as well as the standpoint of the insurance regulator. From the company's

standpoint, it allows for more moderate rate level changes, since the proper inflation sensitive exposure will track the effects of monetary inflation on the losses covered by the insurance policy. Also, because it does track the monetary inflation, there will be less adverse effects on companies when requested rate level adjustments are either denied or delayed.

From the regulators' point of view, any increase in rates is unpopular, and large increases are especially so. Anything which mitigates the need for frequent, large increases, requiring the approval of the insurance regulators, should be welcomed by the regulators.

On the side of practicality, one of the main questions is whether the information can be easily collected and verified. Through meetings and discussions held between ISO staff and company people, the conclusion has been that this information should be readily available for the use of company auditors.

Based upon indications that the change to an inflation sensitive exposure base is both desirable and practical for OL&T, ISO has been working on developing this type of base. In the process of the developmental work, ISO asked its member companies to participate in a survey of current risks which provide information

regarding the current exposure base (area) and the proposed exposure base (receipts). In response to this survey ISO has received information on approximately 50,000 individual risks. This information was used to develop factors by class which would convert the current rate per 100 square feet to a rate per $100 of receipts.

It had been recognized from the beginning that these by class factors would be averages, and that there would be some dispersion of individual risks about the average. However, this dispersion was expected to be small, and it would be handled by a transition program which, for a very limited length of time, would limit the swings, both up and down, that an individual risk would experience solely as a result of the change in the exposure base. The survey results indicated on the other hand that the dispersion about the average factor was much larger than had been originally anticipated and that there would have to be a lengthy transition program, and also possible dislocation of large segments of the market.

In light of these developments, ISO is investigating whether it is feasible to obtain information from non-insurance sources to either verify or refute the results of the limited survey. In addition, member companies have been asked to consider whether

or not they are willing to live with the longer transition period as well as possible large market dislocations. As of this writing, the jury is still out regarding these questions. While none of the problems encountered so far indicate that the inflation sensitive exposure base is neither desirable nor practical for OL&T once it is established, they do highlight the practical problems that can be encountered when any type of major change is implemented.

One question which has not been fully addressed so far, and a question which has a great impact on the way the insurance buying public will perceive the change in exposure base, is whether area or receipts is a more equitable exposure base for distributing costs between different insureds. There have been many sound rational arguments put forth which purport to demonstrate how one or the other exposure base is better. It is possible that receipts may be much more equitable for some classes of risks, while area or number of units may be more equitable for others. It is probably true that the same answers cannot be correct for the diverse multitude of commercial risks. No data is yet available however which compares losses by class with proposed, inflation sensitive exposures by class. More

precisely, no data has yet been available which shows that individual risks losses correlate more closely to inflation sensitive exposures than to fixed exposures.

Currently, the General Liability Actuarial Subcommittee of Insurance Services Office is attempting to learn more about the question of relative equity. The available data is limited, and assumptions will have to be made but at least a test to determine whether the judgement that receipts is more equitable than area is being attempted. At this time, these studies are in their preliminary stages, and no concrete conclusions are available.

In conclusion, while the theoretical practicality and desirability of an inflation sensitive exposure base for OL&T are very strong factors in favor of such a change, the initial problems of transition period and market dislocations and the long term question of individual equity are factors which must be considered before implementation.

VI. CONCLUSION

The purpose of this paper has been to demonstrate certain facts. First of all, the authors hope that they have conveyed some understanding of the strengths and weaknesses of payroll and receipts as exposure bases for commercial liability insurance. Obviously, the product of exposures times manual rates does not always give the right answer when rating a commercial risk. In

fact, because of the wide range of possible situations discussed in the paper and also because commercial risks often employ risk managers who understand insurance, any insurer who doesn't understand all of the specifics on the risks insured will probably encounter adverse selection. In contrast to personal lines where manual rate x exposures generally equals a reasonable premium, in commercial lines, rating plans and educated judgement are essential to determine equitable premiums.

The second important fact which hopefully has been demonstrated is that inflation sensitive exposure bases are helpful in coping with severe inflation, but they also have disadvantages. The key disadvantage is that rates cannot be calculated quite as accurately with an inflation sensitive exposure base since the calculation must include an estimate of future exposures. Any inaccuracy in the ratemaking calculation increases the volatility of rates over time and, we believe, enhances the peaks and valleys of underwriting cycles.

ACKNOWLEDGEMENTS

Most, if not all, of the ideas expressed in this paper have been discussed and debated at meetings of the ISO General Liability Actuarial Subcommittee and the ISO Ad Hoc Committee on Comprehensive Rates. Many valuable ideas have originated in these forums in recent years which have substantially improved general liability ratemaking and rating. We thank the individuals involved with these committees for their input.

Exhibit 1

Manufacturers and Contractors
Payroll Limitations as of 11/1/80

STATE	LIMITATION	EFFECTIVE DATE
01 Ala.	Unlimited	8/1/76
02 Ariz.	Unlimited	2/1/77
03 Ark.	Unlimited	8/1/80
04 Calif.	Unlimited	6/1/75
05 Colo.	Unlimited	8/1/80
06 Conn.	Unlimited	2/1/77
07 Dela.	Unlimited	8/1/75
08 D.C.	Unlimited	10/1/76
09 Fla.	Unlimited	6/1/76
10 Ga.	Unlimited	10/1/77
11 Ida.	Unlimited	6/1/75
12 Ill.	Unlimited	9/11/75
13 Ind.	Unlimited	6/1/75
14 Iowa	Unlimited	8/1/75
15 Kans.	$300	4/6/60
16 Ky.	Unlimited	8/1/76
17 La.	$300	6/1/76
18 Me.	Unlimited	8/1/75
19 Md.	Unlimited	1/1/78
20 Mass.	Unlimited	10/1/80
21 Mich.	Unlimited	6/1/75
22 Minn.	Unlimited	7/1/76
23 Miss.	Unlimited	5/1/78
24 Mo.	Unlimited	10/1/80
25 Mont.	Unlimited	6/1/75
26 Neb.	Unlimited	11/1/76
27 Nev.	$300	1/15/58
28 N.H.	Unlimited	3/1/78
29 N.J.	Unlimited	1/1/76
30 N.M.	Unlimited	10/1/77
31 N.Y.	Unlimited	1/1/78
32 N.C.	Unlimited	9/1/80
33 N.D.	Unlimited	1/1/78
34 Ohio	Unlimited	6/1/75
35 Okla.	Unlimited	11/1/75
36 Ore.	Unlimited	6/1/75
37 Pa.	Unlimited	
38 R I.	Unlimited	10/1/76
39 S.C.	$300	1/15/58
40 S.D.	Unlimited	11/1/77
41 Tenn.	Unlimited	1/1/79
42 Texas	$200	8/21/68
43 Utah	Unlimited	10/1/77
44 Vt.	Unlimited	10/1/78
45 Va.	Unlimited	10/1/77
46 Wash.	Unlimited	12/1/77
47 W. Va.	$300	5/28/58
48 Wisc.	Unlimited	6/1/75
49 Wyo.	Unlimited	7/1/75
52 Haw.	Unlimited	12/1/78
54 Alas.	Unlimited	6/1/75
58 P.R.	Unlimited	10/1/78

Exhibit 2

ISO Rate Level Changes

Year	OL&T		M&C		Products Liability	
	Percent	Index	Percent	Index	Percent	Index
1974	+47.4%	1.474	+ 8.0%	1.080	0.0%	1.000
1975	+21.3	1.788	+28.0	1.382	+117.3	2.173
1976	+21.0	2.163	+12.3	1.552	+ 35.7	2.949
1977	+ 9.7	2.373	+ 8.9	1.690	+ 3.1	3.040
1978	+ 6.4	2.525	+ 0.2	1.693	+ 0.1	3.043
1979	+15.8	2.924	+ 0.2	1.696	- 1.6	2.994
1980*	+ 6.9	3.126	- 2.3	1.657	- 0.7	2.973

*Through September 30, 1980

BEST'S
COUNTRYWIDE
GENERAL LIABILITY INSURANCE*

Year	Direct Premiums Written	Direct Premiums Earned	Direct Losses Paid	Direct Losses Incurred
1968	1,496,003	1,436,377	526,956	720,155
1969	1,724,013	1,631,413	584,559	811,419
1970	2,157,247	2,009,869	646,985	991,880
1971	2,397,477	2,269,829	734,715	1,183,997
1972	2,555,363	2,475,549	891,950	1,452,810
1973	2,726,004	2,657,193	1,061,349	1,627,181
1974	3,023,752	2,913,450	1,273,367	1,972,359
1975	3,953,732	3,680,883	1,472,779	2,143,543
1976	5,760,777	5,320,547	1,592,847	2,580,180
1977	7,843,621	7,232,038	1,883,010	2,908,967
1978	9,129,189	8,744,277	2,123,560	4,395,508
1979	9,550,657	9,405,115	2,558,984	5,092,565

*This data includes Professional Liability insurance for all years since Professional Liability was combined with GL in the NAIC annual statement from prior to 1975.

Manufacturing and Construction Total Payrolls (Countrywide)*

Year	Manufacturing Annual Payroll (millions)	Index	Construction Annual Payroll (millions)	Index	Average Index Ø
1969	$ 135,954	1.000	$ 33,634	1.000	1.000
1970	134,693	.991	36,439	1.083	1.065
1971	137,527	1.012	40,534	1.205	1.166
1972	154,284	1.135	44,642	1.327	1.289
1973	174,226	1.282	50,037	1.488	1.447
1974	184,873	1.360	52,117	1.550	1.512
1975	181,363	1.334	48,698	1.448	1.425
1976	206,700	1.520	52,611	1.564	1.555
1977	234,260	1.723	58,994	1.754	1.748
1978	266,071	1.957	69,587	2.069	2.047
1979	294,658	2.167	79,716	2.370	2.329

*U.S. Bureau of Labor Statistics Data

Ø Average index equals 20/80 weighting of manufacturing and construction indices since M&C premium approximately divides into 20% manufacturing, 80% construction. This reflects the fact that contractor's rates are higher than manufacturer's rates.

Total Annual Sales of Durable Goods*

Year	Sales (billions)	Index
1970	$ 84.95	1.000
1971	97.10	1.143
1972	111.25	1.310
1973	123.73	1.457
1974	122.00	1.436
1975	132.65	1.562
1976	157.43	1.853
1977	178.83	2.105
1978	200.30	2.358
1979	213.03	2.508

* U.S. Bureau of Labor Statistics Data. Durable goods sales are shown here because products liability insurance premiums tend to be concentrated in durable goods classifications.