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EXPOSURE BASES REVISITED

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Abstract

The paper has many purposes. They are: (1) to review the definition and selection of an exposure base and to clarify the distinction between the exposure base and variables which are used in classification; (2) to review the exposure bases currently in use for manually rated risks, and to note how the manual exposure base becomes less important as the risk size increases; (3) to highlight problems in the determination of an exposure base (including temporal mismatch, interpretive mismatch, and complexity of hazard); and (4) to discuss both the current controversy regarding the use of payroll as the exposure base for workers compensation and the recent change in the exposure bases for general liability.

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1. INTRODUCTION

The business of insurance presumes an exposure to loss: if there is no possibility of a loss, there is no need for insurance. However, if an entity does have an exposure to loss, it is desirable that the cost of transferring that loss to another party be proportional to the expected loss, which is assumed to vary with the size of the exposure base. Thus, the selection of an exposure base, which quantifies and proxies for the exposure, is a fundamental step in the insurance process.

The following discussion is limited to the property and casualty lines of insurance in the United States and is not intended to address the life, pension, or accident and health lines or foreign business; nor is it intended to be an exhaustive survey of all exposure bases or rating plans used by individual companies.

2. DEFINITION

The classic definitions of exposure and premium bases were supplied by Paul Dorweiler in his 1929 paper "Notes on Exposure and Premium Bases" [1]. In that paper, he wrote that "when critical conditions and injurable objects exist in such relationship that accidents may result there is said to be exposure" and ". . . premium funds are accumulated from charges called the rate collected per unit exposure. The exposure medium selected as the basis for the charge of the premium is known as the premium basis."

He notes that the premium basis cannot be selected arbitrarily: "Obviously, the premiums collected are to be proportional to the hazard which is measured by the losses. . . . The medium most desirable as a premium basis is the one possessing a combination of these two qualifications in the largest degree: 1. Magnitude of the Medium should vary with hazard. . . . 2. The Medium should be practical and preferably already in use."

Although the premium basis is somewhat less accurately referred to as the exposure base today, the definition and requirements are as correct and pertinent now as they were sixty years ago.

In their text *Insurance Company Operations* [2], Webb *et al.* expanded on Dorweiler's requirement of "practicality" by stating that "A

good exposure base should have three characteristics. First and foremost, of course, it should be an accurate measure of the exposure to loss. Second, it should be easy for the insurer to determine. Finally, it should be difficult for the insured to manipulate." Adding one more level of cynicism (or realism, as the case may be), we should also require that the exposure base be immune to manipulation by underwriters.

Underlying all of these definitions are two themes: the relatively simple and reliable development of correct premiums for the insurers (i.e., the exposure base should accurately reflect the overall exposure to loss, be simple to compile, and not be subject to manipulation) and equitable distribution of those premiums among the insureds (i.e., the exposure base should accurately reflect differences in exposure to loss). It is not surprising that some historically appropriate exposure bases are showing signs of failing to satisfy these two conditions. The bases may have functioned well—or at least without controversy—in a world where the risks were relatively well understood, the insured commercial population was regulated, the economic and social structures were stable, and the insurers used bureau rates. Changes in these external conditions and internal weaknesses in the underlying insurance structure are causing exposure base problems.

3. SELECTION OF AN EXPOSURE BASE

Before considering the impact of the changing environment, however, it is important to pause and consider the process involved in selecting an exposure base for a line of insurance.

The first step is to analyze the coverage offered and the coverage trigger to determine what factors influence the expected losses. Some of these factors will not be usable in the determination of premiums (see the *Comments* later in this section). Those which are usable will be divided into two groups: the first group, consisting of one factor, will be the exposure base, and the second group will be the rating variables, which influence the projected expected losses indirectly by affecting the rate.

This division is based on the simple theoretical equation:

$$\text{(number of exposure units)} \times \text{(loss cost per exposure unit)} = \text{expected losses.} \quad (1)$$

This is derived from the equation we define to be true:

$$f(\text{exposure}) = \text{expected losses.} \quad (2)$$

As will be discussed later, the true exposure is complex and changing, so we must simplify by selecting a proxy for the true exposure. This is the exposure base. The theoretical model is then quantified to become:

$$(\text{number of exposure base units}) \times (\text{loss cost per exposure base unit}) = \text{expected losses.} \quad (3)$$

Once the exposure base has been selected, projection of the loss cost per exposure base unit (usually by projection of frequency and severity) is the core of the ratemaking process. The loss cost generally varies with different combinations of the other factors. These combinations are known as the rating variables or class plan, and they may affect the loss cost through either the frequency or the severity or both. Equation (3) can also be written as:

$$(\text{number of exposure base units}) \times (\text{expected number of losses per exposure base unit}) \times (\text{expected dollars per loss}) = \text{expected losses.} \quad (4)$$

or

$$(\text{number of exposure base units}) \times (\text{frequency}) \times (\text{severity}) = \text{expected losses.} \quad (5)$$

The final step in the manual ratemaking process is the inclusion of expenses, which leads to the equation:

$$(\text{number of premium base units}) \times (\text{rate per premium base unit}) = \text{manual premium.} \quad (6)$$

In practice, the exposure base unit in equation (3) and the premium base unit in equation (6) are always the same and the terms are used interchangeably.

Thus, expected losses (and premium) do not vary only with the exposure base, but also with many other factors which are built into the rating variables. Any factor that affects the losses but has not been quantified in either the exposure base or the class plan will allow the company that recognizes it in underwriting to "skim the cream" of the business. In this way, simple classification plans provide the opportunity

for sophisticated companies to make profits by accepting only the better risks within a class.

In general, the factor selected as the exposure base should have a uniform multiplicative relationship with all of the expected loss costs and rates; i.e., within any rating class, the same rate will be used for one unit or fifty units (as opposed to requiring a higher or lower rate with increasing volume). Thus, a policy covering two physicians practicing the same specialty in the same territory will use the same rate but multiply it by two, producing twice the premium.[1]

It is also desirable that the factor selected as the exposure base be simple and have an obvious relationship to losses. In addition to making the plan easier to use, simplicity is likely to enhance its perceived equity, even if the technical accuracy is not improved.

It is important to make note of two things that exposure bases are *not*. First, the exposure base is not the true exposure. The exposure base is a proxy for the true exposure, which we are unable to know, both because it is constantly changing and because it is generally a function of a large number of variables. For example, the collision exposure of a private passenger auto is effectively zero when it is parked in a secure garage, somewhat higher when it is being driven on an isolated highway by an alert and competent driver, and substantially higher on a crowded street with a drunk driver. The exposure base (car-month) recognizes the average situation rather than these fluctuations in the true exposure to loss. As is noted later, there are even situations where the exposure base is zero, but a significant exposure still exists. The best way to keep this distinction clearly in mind is to think of the exposure base as the "units" designator (square footage, payroll, etc.) of a blank to be filled in on the premium calculation worksheet.

[1] This simple multiplicative relationship is occasionally modified later in the calculation of the premium, either to reflect some exposure effect or to recognize the decrease in unit expenses associated with larger policies. Examples include (1) the multi-car discount in private passenger auto, which reflects the reduced usage and improved loss experience on policies covering multiple cars, and (2) premium discount plans in workers compensation and other commercial lines, which reflect the decreased percentage of the premium required to cover fixed expenses for large premium policies.

Second, the exposure base is not a rating variable, although the dividing line between the two is somewhat arbitrary at times. In order to determine the correct manual premium for a risk, it is first necessary to classify the risk, based on whatever the rating variables are for the risk under consideration. Once the risk's classification is known, the rate for that classification is multiplied by the number of exposure units to produce the premium. As is noted above, the use of a variable in the exposure base implies a uniform and continuous multiplicative relationship between the variable and the expected losses; use as a rating element implies a discrete, nonlinear relationship. For example, physician-month is an exposure base; and coverage for two physician-months costs twice as much as the coverage for one physician-month. On the other hand, age is a rating variable; and coverage for Driver A, who is twice as old as Driver B, does not (usually) cost twice as much.

Comments

It is important to remember that, for most lines of business, the exposure to loss varies with a substantial number of factors. Some of these cannot be used in determining the premium because they are either indeterminate, too subjective, or fluctuate too rapidly. An example of such a factor would be the mood of an automobile driver—while it could be argued that a person who is angry (either momentarily or on average) is more likely to have an accident, this is not used in any rating scheme.

Some factors may have a demonstrable or assumed correlation with losses but may be socially unacceptable as a rating variable or exposure base. Foremost among these are race and religion; age and gender are still used in many private passenger automobile rating plans but are being attacked (and defended) on social equity grounds.

Other factors that are observable but not quantifiable are allowed to influence commercial lines rates through the individual risk rating plans. Schedule rating plans for commercial general liability, for example, allow modification of the rate based on upkeep of the premises and management attitude.

The variables that are left—those which are socially acceptable, quantifiable, and demonstrably related to the level of losses—may be used directly in determining the premium. The one with the most uniform relationship to the losses will be the exposure base. The others can be used in the classification plan.

A nonexhaustive list of the factors affecting the final premium for some of the major lines of business includes:

Property: construction, occupancy, location (territory), external hazards (technically called "exposure" but not in the same sense as the topic of this paper), internal protection (sprinklers, smoke alarms), external protection (local fire department and police), amount of insurance.

Automobile liability: driver's age, gender, marital status, driving record, and school record; business or pleasure use; mileage or distance to work; radius of operation; location (territory of principal garaging); truck weight; insurance limit; number of vehicles; claims experience (safe driving credit (personal) or experience modification (commercial)).

Automobile physical damage: car make, model and year for private passenger auto, or vehicle age and original cost new for commercial autos; number of vehicles; territory; deductible; claims experience.

Workers compensation: location (territory), occupation, claims experience (experience modification), payroll.

General liability: classification; territory; insurance limit; type of coverage (claims-made or occurrence); claims experience; square footage or acreage, payroll or receipts; new/discontinued businesses.

Some of these factors—notably territory—are proxies for more basic influences on the level of losses, such as cost of medical care, traffic density and tendency to litigate.

As these lists make clear, many factors affect the expected losses (and, therefore, the premium) in any given line or subline of insurance, but only one becomes the exposure base.

4. A SUMMARY OF THE MAJOR LINES OF INSURANCE AND THEIR EXPOSURE BASES

Property Coverages (Annual Statement Lines 1, 2, 12 & 25)

Glass coverage is rated on the square footage; all other coverages are based on the limit of insurance in hundreds of dollars, which is assumed to be related to the value of the property insured.

Homeowners and Farmowners Multiperil (Annual Statement Lines 3 & 4)

The property and crime sections of these policies generally use the insured value (in hundreds or thousands of dollars) as an exposure base. The liability section has an implicit exposure base of one household.

Ocean and Inland Marine (Annual Statement Lines 8 & 9)

These lines are essentially property coverages and are generally based on the insured value in whole dollars. However, there are numerous exceptions, since "inland marine" covers a multitude of sins.

Aircraft—All Perils (Annual Statement Line 22)

Aircraft hull coverage is rated on the insured value (in thousands of dollars); liability is based on revenue-passenger miles (or kilometers).

Burglary and Theft (Crime) (Annual Statement Line 26)

The crime coverages are rated on the insured value in thousands of dollars.

Boiler and Machinery (Annual Statement Line 27)

Boiler and machinery coverage uses the number of objects as its exposure base.

Credit (Annual Statement Line 28)

Credit coverage is based on the dollars of indebtedness.

Fidelity and Surety (Annual Statement Lines 23 & 24)

Fidelity coverages are rated on the number of persons; surety, on the amount of coverage (contract cost) in thousands of dollars.

Automobile (Annual Statement Lines 19 & 21)

All private passenger and commercial liability, no-fault, and physical damage coverage is based on the number of car-months.

Workers Compensation (Annual Statement Line 16)

There has been a great deal of discussion about the exposure base for workers compensation, but it remains payroll (limited payroll for officers and sole proprietors and partners) in every state except Washington.

Medical Malpractice (Annual Statement Line 11)

Hospitals and other health care facilities are rated on occupied beds and outpatient visits; premiums for health care providers (physicians & surgeons, dentists, optometrists, etc.) are based on provider-months.

General Liability (Annual Statement Line 17)

The exposures bases for the various general liability sublines and classes used to range from mundane (square footage) to mercenary (payroll) to morbid (number of bodies). Since the introduction of the Insurance Services Office (ISO) Simplification Program in 1986, most classes are now rated on either gross sales or payroll, although apartment exposures use the number of units, and rates for offices and lessors are based on area. There are numerous other exceptions, such as the use of number of tanks for underground tank pollution liability rating.

Reinsurance (Annual Statement Line 30)

Facultative reinsurance has as many different exposure bases as does primary insurance; treaty reinsurance is generally rated as a percentage of the underlying premium.

5. LARGE RISKS

Large risks are an exception to almost all of the above because they are frequently subject to either composite or loss rating plans that modify the usual exposure bases.

Under a composite rating plan, the risk's premium is calculated normally and then divided by a proxy exposure base, such as mileage or receipts for long-haul trucking firms. This gives a rate per proxy unit. When the policy expires, the firm's records are audited in order to determine the actual receipts (or mileage), and this is used to calculate the final premium.

The intention is to simplify the rating for insureds with hundreds of vehicles in their auto fleets or many insured locations. The proxy base should have at least some reasonable relationship to the expected losses, but it does not usually reflect the detail of the underlying exposure bases and classification systems.

If a large risk is loss-rated, the premium is calculated directly from its historical losses without any reference to the standard rating plans. In this case, it is correct to say that the exposure base is the risk itself and the rate is its expected losses. If, in addition, a composite rating procedure is used in order to reflect changes during the year, then a proxy base is introduced.

Recall equation (6):

$$\text{(number of premium base units)} \times \text{(rate per premium base unit)} = \text{manual premium} \quad (6)$$

In this equation, the rate is a classification or manual rate (the subject of Part 6). Such a manual premium is used directly only for small risks. The premium for a medium-sized risk is frequently modified by schedule rating and expense modifiers, which reflect characteristics of the individual risk, and experience modifications and dividends, both of which give some recognition to the risk's own experience. This changes equation (6) to give:

$$\text{(number of premium base units)} \times \text{(rate per premium base unit)} \times \text{(schedule modifiers)} \times \text{(experience modifiers)} = \text{manual premium} \times \text{modifiers} = \text{charged premium.} \quad (7)$$

If the risk is composite-rated, this equation is continued to:

$$\text{"charged" premium} = \text{(number of expected proxy units)} \times \text{(rate per proxy unit.)} \quad (8)$$

At the final audit, the actual number of proxy units is determined and multiplied by the rate derived above to give the final premium.

As the size of the risk increases, more and more weight is put on the individual risk, diminishing the importance of the manual rate. In the case of a very large, loss-rated risk, the normal underlying exposure base and class plan disappear, leaving:

$$\text{expected losses} + \text{expense load} = \text{charged premium.} \quad (9)$$

6. THE CHANGING ENVIRONMENT

There is a pervasive feeling that accurately forecasting losses in some lines of insurance has become impossible. The problem is frequently attributed to the degradation of the tort system, an increase in litigiousness, and the search for "deep pockets." These have clearly made it very difficult to accurately estimate the future frequency and severity of losses. However, in some cases, it may be more correct to say that we have not been able to identify an exposure base which successfully reflects these and other changes.

As we will see, many of the problems of mismatch between exposure bases and the underlying exposures for which they are proxies arise from the exchange of a steady-state universe for one subject to abrupt changes. Determining the expected losses is easy when all factors are constant; the demands become somewhat greater but are still generally manageable if constant change, such as a constant rate of growth, is introduced into the system (see, for example, S. Philbrick's paper "Implications of Sales as an Exposure Base for Products Liability" [3]). In recent years, these changes include emerging theories of liability, economic inflation, social inflation, changing insurance requirements and preferences, new products and services, increased tendencies towards acquisitions and divestitures, deregulation of industries such as trucking, technological advances, and the emergence of long-tail exposures. When severe discontinuities appear, the underlying correspondence between the expected losses and the exposure base can be disrupted beyond correction. The following is a discussion of three types of problems in the selection of the exposure base: temporal mismatch, interpretive mismatch, and complexity of hazard.

These problems should not be confused with the ever-present ratemaking problem of future shock. A failure to accurately predict the frequency and/or severity of future losses is usually a problem with our crystal balls (or other ratemaking tools), not the sign of a failing exposure base. For example, medical malpractice occurrence rates were historically inadequate in spite of having a coverage trigger which is rarely a matter of dispute.

Problems: Temporal Mismatch

As the tail of liability losses lengthens and coverage triggers are changed in order to ease pricing and reserving problems, the possibility of a temporal mismatch between expected losses and an otherwise acceptable exposure base arises. The two outstanding examples of this are claims-made policies and products liability.

Claims-made policies are triggered by the notice of a claim but rated on the normal occurrence exposure base, a physician-month in medical malpractice, for example. If the practice of medicine for a year causes a number of claims, some of them will generally be filed after the policy expires, giving rise to a loss under an occurrence policy but not under a

claims-made policy. No other candidate for the exposure base of a claims-made policy has been identified and the problem has been solved by the incorporation of a rating step to recognize the number of years since the retroactive date (i.e., the year in claims-made). The calculation of this modification is thoroughly discussed in "Rating Claims-Made Insurance Policies" by J.O. Marker and F.J. Mohl [4].

Careful evaluation of the trigger is necessary when making the adjustment, since, for example, the new CGL claims-made form is triggered when notification has been received and recorded by any insured or by the insurer. This may be a relatively long time before a formal claim is filed with the insurance company.

Products liability coverage is triggered by the injury, but the exposure base is sales (with the exception of the few classes where products coverage is included with the premises and operations coverage). If the trigger were based on the date of manufacture or if the product were to have a short lifespan, it appears that sales would be a reasonable exposure base (ignoring for a moment ratemaking problems arising from the long tail, social inflation, etc.). However, triggering coverage on the date of injury gives rise to a mismatch. The problem is most easily illustrated by the case of a manufacturer who has gone out of business and therefore has no sales but whose products are still being used and producing injuries. The situation is frequently encountered in the case of the acquisition of a company with a discontinued product line that is still in use or the evaluation of a conglomerate that has actively acquired and disposed of subsidiaries over the years.

One possible solution to this mismatch would be to change the exposure base to "products in use during the year." Unfortunately, while more precise in its reflection of the exposure, this is not an easily available figure; and it therefore fails the second test of a potential exposure base, namely that it be easily available and not subject to manipulation.

A more acceptable answer has been proposed by S. Philbrick in his paper "Implications of Sales as an Exposure Base for Products Liability" [3]. In this article, he also develops the adjustment methodology that could be used as an input to schedule rating to correct for the mismatch.

In general, the temporal mismatch problem can be solved, although the solution is likely to be inexact.

Problems: Interpretive Mismatch

The exposure base selected must be compatible with policy language that is sufficiently precise so that mismatch does not arise through deliberate or accidental misinterpretation of the coverage trigger. For example, a pollution policy meant to cover losses arising out of disposal activities starting after policy inception could be rated on tons of waste produced (or disposed of, if there is a lag between production and disposal). This is a reasonable *prospective* exposure base; but the policy language must be precise and enforceable or there is a possibility that courts will find coverage for losses from past disposal activities, for which a different exposure base would be necessary.

Without commenting on the appropriateness of the asbestos coverage theories used to date and ignoring the fact that products liability is already subject to temporal mismatch, the fact that it is possible for injury to one person to trigger many policies indicates that interpretive mismatch is also a problem for the affected products policies. Even if these policies had been rated on "products in use during the year," coverage would not have been expected from the policies triggered after the asbestos work stopped (the "injury in residence" and "manifestation" triggers).

Problems: Complexity of Hazard

In some cases, the problems are much more basic than those mentioned previously. The difficulty frequently lies in the first step of determining the exposure base; i.e., making a complete list of all factors affecting the level of losses. What, for instance, would be contained in such a list for directors and officers (D&O) insurance? Obvious candidates include:

— the number of directors and officers
— business activities
— (change in) revenues
— (change in) profits
— (change in) assets
— number of stockholders
— number of employees
— hiring/firing policies
— (change in) overall financial condition as rated by S&P
— (change in) stock price

— attractiveness as an acquisition
— responses to past acquisition offers (e.g., "poison pills")
— state of domicile
— response to any recent emergencies (accidents, etc.)
— recent changes in management
— . . . . ? ?

All of these are believed to have some bearing on the likelihood or size of D&O claims, which have been known to arise from abrupt changes in a company's stock price, resistance on the part of the directors to being acquired, and wrongful termination of employees. But is the list complete? Probably not. Even if it is, the numerical relationship of the factors to the loss level is unclear even for the most obvious candidate for the exposure base: does a company with twice as many directors have twice the exposure to loss? Probably not.

It could be argued that the general reluctance of the industry to offer this coverage is an outgrowth of our inability to determine a meaningful exposure base for it.[5] It is to be hoped that when (if?) we are able to correlate the losses with some other measurable factor, the "D&O crisis" will abate.

7. THE INTERNAL ENVIRONMENT

In fairness to the world at large, it must be admitted that not all problems with exposure bases arise outside of the insurance industry. Two serious problems are based on insurance company practices themselves: (1) exposure estimates can be (and are) manipulated in response to the competitive situation; and (2) even when the policy premium is based on the correct exposures, the coding of the exposure information into the computer records is often poor, with whole dollars frequently switched with "per hundreds" or "per thousands."

Mechanical rating and direct production of the statistical records from the policy rating files will solve the second problem, but control of the first is likely to be more elusive. Most companies track their average premium per policy rather than the average premium per exposure unit so that good exposure data is not considered necessary. In addition, competitive pressures tend to degrade the exposure data. In a very competitive (soft) insurance market, a low price can be produced in a variety of ways, a number of which are legitimate but frequently require

documentation, such as the aggressive use of schedule rating. In some instances, it is easier for the underwriter to "low-ball" the exposure estimate. In theory, such "errors" will be corrected when the policy is audited, but that is usually eighteen months in the future (and after the renewal). Under the calendar/accident year ratemaking used for many lines, audit premiums are reported and fully earned in the calendar year of the audit, not the calendar year(s) when the policy premium was earned. Thus, even in the case of perfectly correct audits, a severe mismatch between the premiums and losses can be introduced by low exposure estimates. In a steady state, the rates eventually respond to a systematic underestimation of the exposures; but when the insurance cycle changes quickly and the "low-balling" stops abruptly, the problem of excessive rates appears.

Thus, some of the practical mismatch between exposures and exposure bases can be attributed to the pricing practices of the industry as a whole, rather than a more esoteric theoretical failure.

8. CHANGING EXPOSURE BASES: CAUSES AND CONTROVERSY

Once established, the exposure base for a line of insurance tends to acquire an aura of sanctity. It is very difficult and very expensive to change the exposure base for a widely written line: difficult, because the historical data uses the old base, but the new rates must refer to the new base; and expensive, because data on both bases must be collected for at least one year prior to the change or all insureds must be contacted to determine their new exposure and then all policies must be rerated and reissued.

So why change? In theory, change could be caused by a better understanding of the nature of the exposure. In practice, this does not seem to be the case, either because a line does not become widely written until the exposure is reasonably well understood, or because the marginal gain is less than the cost, or because inertia is stronger than the profit motive. Thus, the two recent exposure base controversies have been forced on the industry by changes in the world that is being insured. One of these—in workers compensation—was caused by increasing discontent among insureds over inequities in the rating mechanism; the other—in general liability—was the result of both the industry's difficulty in keeping rates current and the increasing automation of commercial lines.

It should be noted that the frequent discussions regarding the use of driving record in place of age, gender and/or marital status in determining private passenger auto premiums concern only the rating plan, not the exposure base. To date, there has been very little discussion of the use of car-months, although Andrew Tobias in his book *The Invisible Bankers* [6] suggested a plan based on fuel consumption, and the National Organization for Women has proposed an odometer mileage exposure base.[7] However, as the workers compensation changes illustrate, the line between the exposure base and the rating plan is very fine, and a discussion which begins on one side of that line may well finish on the other.

Workers Compensation: Hours-worked vs. Payroll

The problem is simple: consider two construction firms, one of which is unionized and one of which is not. Assume they have the same number of employees, do the same type of work, and have the same expected number and type of losses. If the unionized company pays more per hour, it will have a higher payroll and, therefore, pay more for its workers compensation coverage. To the extent that its indemnity losses (based on lost wages) are higher, this premium difference is correct; however, to the extent that the losses arise from medical payments or are capped by the maximum benefits payable under state law, the difference is not justified in terms of expected losses. Obviously, there is no problem if the work is sufficiently different that separate classifications are used.

For many years, limited payroll—reflecting the limited benefits—was the exposure base for workers compensation (WC) in all states other than Washington, which used and still uses work-hours. In the early 1980s, the payroll limitation was removed. This change obviously made the problem worse.

In 1984–85, the perceived inequity became a matter of national debate between the National Council on Compensation Insurance (NCCI) on the one hand and insureds (both labor and management) on the other. It was caused not only by union/nonunion differentials, but also by the varying wage scales that appeared as a result of deregulation in many industries. Based on these differences, the insureds proposed both hours-worked and mixed hours-worked/payroll as exposure bases, while the NCCI preferred to retain unlimited payroll, because it is easy to verify

and it reduces the size of the annual rate revisions needed. Regulators were concerned that, whatever program resulted, it should be fair and encourage workplace safety.

Because wage level and unionization status are not recorded in the standard WC data, insurance records at NCCI and insurance companies could not resolve the question. Therefore, the state of Oregon did a special "Study of Premium Equity by Employer Groups." Obviously, the issue was not important to very large employers whose experience is fully credible, so the study addressed primarily the small (nonexperience-rated) and medium (experience-rated but not fully credible) employers.

NCCI's analysis of the Oregon data found no bias against either union or high wage paying employers among the small employers, but it did show that high wage paying and union employers in the medium-sized group developed lower loss costs per premium dollar (11% and 12% less, respectively). This result appears somewhat counter-intuitive, since one would expect, *a priori*, that the availability of experience rating would reduce the bias.

Among others, the Florida Labor/Management Council proposed a mixed rating base, using both payroll (for wage-related benefits) and worker-hours (for medical-related benefits).

Payroll won out in the exposure base arena, but concessions were made on the classification side. In California, each of six construction classes were split into two new classifications (high and low wage rates); in Florida, a table of credits based on wage rates was implemented for all contracting classes; in Oregon, the legislature authorized the collection of worker-hour data by the NCCI and the Oregon workers compensation division; and the NCCI-proposed Loss Ratio Adjustment Program (LRAP) was put into place in Oregon, Illinois, Maryland and Nebraska, although the approved version differed by state.

LRAP is a modification to the WC experience rating plan for the specific construction classifications shown to have problems. Its effect is to make the experience rating plan more responsive to the individual employer's three-year loss ratio. NCCI favored this response because it was problem-specific (i.e., did not affect other classifications), did not require an overall rate change, and encouraged workplace safety.

Thus, what began as an exposure base question was addressed by changes to various other parts (classification and experience modification) of the rating system.

General Liability: Area vs. Receipts

Virtually all of the public attention to the ISO's Commercial Lines Policy and Rating Simplification Project was focused on the expansion of the claims-made coverage form to all sublines of general liability (GL) and, to a lesser extent, the changes to the pollution coverage. However, this program, which became effective in 1986 and 1987, also encompassed a massive revision of the exposure bases for GL, in addition to substantial revisions to the forms, classification plans, and coverages of nearly all ISO lines (i.e., WC and surety were not affected because ISO is not the primary bureau for these lines; although it is an ISO line, professional liability was not revised).

In terms of the impact on insureds and insurers, the changes to the forms and exposure bases were much more important than the expansion of the claims-made form. This was partly true because the softening market in 1986 and 1987 meant that insurers and reinsurers were more willing to write occurrence coverage, so that the usage of claims-made was much more restricted than was originally thought. However, even if the hard market had continued, many insureds—and, in all likelihood, many smaller insurance companies—would have continued on occurrence policies, but no one escaped the other changes.

Each of the three major GL industry groups was brought to a single exposure base for all of their sublines and coverages.

Thus:

		Prior	
Group	*Current*	*Prem/Ops*	*Prod/Comp Ops*
Mercantile	Gross Sales	Area	Receipts
Manufacturing	Gross Sales	Payroll	Receipts
Contracting	Payroll	Payroll	Receipts

Some exceptions to the above remain. The most major of these are apartments, which were rated on area but changed to units, and office buildings, which were and are based on area.

The short diagram above conceals the true extent of the simplification. In order to calculate the premium for a small contractor before simplification, for example, the underwriter needed to know (1) the payroll . . . for the M&C coverage; (2) receipts . . . for the products/completed ops coverage; (3) total contract cost . . . for the contractual liability; (4) the building's fire rate . . . for fire damage legal liability; (5) the M&C property damage rate . . . for broad form property damage coverage; and the M&C bodily injury rate . . . for personal and advertising injury. Under the new structure, all of these coverages are based on payroll.

These changes were implemented for a variety of reasons, including (1) simplification of rating, both manual and mechanized, (2) sensitivity to inflation, and (3) sensitivity to economic cycles. It is, of course, very desirable to have an exposure base that incorporates inflation, fully or partially, since this reduces the need for frequent and relatively large rate filings.

The changeover was not easy for many reasons. Among the most important of the difficulties were the premium swings caused by the change of exposure bases.

ISO realized that the change from area to receipts (gross sales) would cause large premium swings for some insureds and filed a transition program along with the new policies. The transition program was meant to cap the premium effect of only the exposure base change. Using Dun & Bradstreet data, ISO calculated the average ratio of receipts to area for each class, territory and state and used this to convert the current area-based rates to the new receipts base. If an insured had a higher-than-average ratio of receipts to area, this would cause its premium to increase substantially. The increase (and decrease) was capped by the establishment of maximum and minimum ratios for each class, territory and state. The caps increased over five years to bring the insureds to their new premium gradually.

ISO's preliminary investigations indicated that the manufacturing and contracting classes did not have as much variability in their exposure

base ratios, so no transition program was developed for these classes. However, as companies began to implement the simplified policies, it quickly became apparent that there was a problem. This was exacerbated by the effects of the change to a combined single limit and the inclusion of other coverages in the base rate. ISO responded by filing a transition program for other than mercantile risks, but it used countrywide caps rather than varying them by state and territory.

On the whole, the expanded transition program was successful, but it was given very little credit. In many cases, the first renewal on the simplified forms followed the hardening of the market. This meant that premium increases due to changes in companies' rates and deviations were frequently blamed on the exposure base change. Premium increases from changes in the increased limits tables (also part of the simplification program) made this problem worse.

From the companies' viewpoint, the transition program was a mixed blessing. On the negative side, it represented another training and programming hurdle; it introduced another step in the rating process which will persist for five years for many risks; and it was difficult to explain to insureds. On the positive side, once it was expanded, it did what it was designed to do, and it provided a convenient scapegoat for rate increases.

One long-term result of the exposure base change which has been given relatively little consideration is the effect of using an audited exposure base for many risks that were previously rated on area. This increases expenses somewhat for the insurer (many of these risks have products coverage, for which an audit was already required) and increases uncertainty for the insured, since the final premium is not known until after the policy expires. Of course, many smaller risks will be audited by mail or by telephone; but this increases the opportunity for manipulation of the premium while decreasing the audit cost.

In light of the expense and confusion surrounding the change of exposure bases, it is reasonable to ask whether the insurance community—both insureds and insurers—is in a better long-term position than it was before the change. It is clear that the simplification program as a whole eliminated many inconsistencies in the rating process and vastly simplified policy rating. This could not have been accomplished without changing the exposure bases. To the extent that the automation of the

commercial lines has been accelerated, the program also decreased expenses. The price of these improvements was short-term upheaval and a possible long-term increase in audit costs.

The above points may well have been sufficient cause for the change, but it is also reasonable to ask whether receipts are a better exposure base than area for most mercantile risks. Recall that this should be judged on the basis of (1) ease of collectibility, (2) difficulty of manipulation, and (3) correct reflection of the underlying losses. To the extent, that the fringe coverages, such as contractual liability and fire legal liability, are rated more fairly (i.e., with greater precision) on other exposure bases, the simplification may have reduced the correct reflection of these underlying losses.

Since receipts are used for other purposes, most notably tax calculations, it is easy to collect the data. However, the use of receipts requires a post-expiration audit unless the insurer decides to forego the possible change in premium. While the risk may well have already required an audit for its products coverage, the change does mean that the premium for two coverages must now be checked. On the whole, it is difficult to say that there has been a net improvement on this point over area, which is relatively easily available (although requiring a detailed definition) and does not require an audit.

It has been amply demonstrated over the course of the last insurance cycle that both area and receipts can be manipulated by both the insured and the underwriter. It has been argued that the introduction of the audit step, especially if it is done by telephone and relies on the insured's reporting, increases the number of opportunities for manipulation.

With no clear advantage to either exposure base on the first two criteria, the question becomes one of correlation with losses. If the traffic of customers and suppliers through a mercantile establishment can be assumed to be correlated with the loss exposure, then receipts may be more closely correlated with losses. Thus, an establishment with a thriving business has more customers, more loss exposure, higher receipts and a higher premium. On the other hand, one must consider the effect of price on receipts: a store selling expensive imported shoes may have the same total receipts as a mass-market store but far fewer clients and a lower exposure to loss (unless "upscale" clients are more prone to sue).

Time will judge the appropriateness of the exposure bases. Any inequities between classes of business will be erased as the rates adjust to the information passed into the ratemaking process. The real long-term test will be within classes: whether a stronger correlation between a risk's exposure and its expected losses exists for receipts or area. Of course, even if receipts should fail this test, it may be easier to adjust the class plan in some way than to change the exposure base again.

9. CONCLUSION

The exposure base is a fundamental part of the distribution of loss costs among insureds, i.e., of the premium calculation. The tests that it must meet are relatively simple and clear, but changes in external environment and problems in the internal environment have made it more difficult to satisfy those tests. In addition, insurance coverages for which the exposure base is not immediately obvious have been developed or are more in demand. The insurance industry has reacted differently in the two cases where change was forced by outside conditions: adapting the classification and individual risk modification system in one case, and completely revising the exposure base and rating system in the other. The ISO Simplification was an example of some of the problems and responses to be expected in the course of a changeover, which can be studied as a prototype of the changes which are undoubtedly to come.

REFERENCES

[1] Paul Dorweiler, "Notes on Exposure and Premium Bases," *PCAS* XVI, 1929, p. 319; reprinted *PCAS* LVIII, 1972, p. 59.

[2] B. L. Webb, J. J. Launie, W. P. Rokes, N. A. Baglini, *Insurance Company Operations,* Volume II, American Institute for Property and Liability Underwriters, 1978.

[3] Stephen W. Philbrick, "Implications of Sales as an Exposure Base for Product Liability," *PCAS* LXVII, 1980, p. 181.

[4] J. O. Marker and F. J. Mohl, "Rating Claims-Made Insurance Policies," *Pricing Property and Casualty Insurance Products,* CAS Discussion Paper Program, 1980, p. 265.

[5] Thomas S. Bloom, "Liability Rating Scheme Faulted for '80s Crunch," *National Underwriter,* September 5, 1986, p. 8.

[6] Andrew Tobias, "Pay-As-You-Drive: How God Would Restructure Automobile Insurance," *The Invisible Bankers,* Washington Square Press, 1982, p. 230.

[7] Patrick Butler, Twiss Butler and Laurie L. Williams, "Sex-Divided Mileage, Accident, and Insurance Cost Data Show that Auto Insurers Overcharge Most Women," *Journal of Insurance Regulation,* Vol. 6, Nos. 3 & 4, March & June 1988, p. 243.