A REVIEW OF THE STATISTICAL PROBLEMS OF CASUALTY COMPANIES

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The complexity of statistical problems which today confront actuaries and statisticians of casualty companies would seem to indicate the desirability of a review of these problems as a whole in order to obtain a better perspective as to the value of statistical work and the methods used in arriving at results. Especially does it seem appropriate that such a review should be made at this time when the element of the expense of conducting casualty lines of insurance is so strongly in the foreground. It is felt that the broadest possible viewpoint should be taken in making such a study with the end in view of linking each component part of the statistical program with the rest, outlining methods of procedure and calling attention to any possible opportunities for further improvement.

The rapid development of casualty lines of insurance during the past decade has been productive of numerous statistical problems which must be dealt with. Within the field of the casualty technician there may be enumerated the following lines of insurance: Accident and Health; Workmen's Compensation; Employers' Liability; the various forms of Automobile Insurance; Public Liability lines, including Owners', Landlords' and Tenants', Manufacturers' and Contractors', Teams, Theatre and Elevator together with the allied Property Damage lines; Fidelity and Surety; Burglary; Plate Glass; Steam Boiler; Fly Wheel; Engine; Electrical Machinery and others of less importance. The mere multiplicity of lines of insurance, each with its own peculiarities, makes it evident that in meeting the statistical requirements of all there must be solved a set of statistical problems sufficiently diversified to necessitate the most careful study and concentration.

These statistical problems may be grouped under two major headings,—those encountered in the preparation of accounting records and those met with in collecting and compiling experience data. The two divisions are of course not absolutely independent

of each other inasmuch as we find items occurring in one group which are necessary in the preparation of items in the other group. Accounting records are necessary for annual statement requirements and in this connection there are such problems as the computation of unearned premium reserves, claim reserves, written premiums and paid losses by line of insurance. There also falls within this group the allocation and analysis of expenses by line of insurance. The preparation of certain Home Office records such as Agency or Branch Office Production Records also may be classed as coming under this heading.

In complying with annual statement requirements and in the preparation of various Home Office records the procedure for each line of insurance may be considered to follow along practically the same general lines. The allocation of written premiums and paid losses to line of insurance and the compilation of production records need hardly be dealt with at length. These records are prepared in much the same manner for all lines of insurance and involve simply the assignment of written premiums and paid losses to each specific line of insurance and to state, branch office or agency as required. Written premiums are assigned when the proposal or application for insurance first comes into the Home Office and paid losses are allocated as each claim payment is made. The premium record in addition to annual statement requirements is necessary in the determination of state and federal taxes.

Unearned premium reserves are usually computed on the monthly pro rata basis. Under this method written premiums are posted to the proper month of expiration and to these amounts must be added or deducted any additional premiums or cancelations which may affect the amount of premiums in force. The unearned premium reserve is determined by applying to the premiums in force as of the date of determination the proper percentages representing the pro rata portion of the policy period which has yet to run and for which the premiums are therefore not yet earned. These percentages are determined on the basis that the premiums of a given month became effective as of the middle of that month. It goes without saying that it is necessary to use a different set of percentages in determining the unearned premium reserve on annual policies and on those written for longer or shorter periods. For example, a great

many Accident and Health policies are written for periods of three and six months, whereas in Public Liability Insurance we find a large number of policies which run for a period of three years. Obviously the unearned portion of a six months' Health premium at the end of the fourth month would be represented by an altogether different percentage than the unearned portion of a three year Elevator Public Liability premium at the end of the fourth month. This outlines briefly the method of determining unearned premium reserves on the so-called monthly pro rata basis. There is another method known as the "50% basis" which involves a similar procedure, with the exception that the percentages representing the unearned portion of the premium are applied on an annual rather than a monthly basis. Under this method the unearned premium reserve is computed as though the total premium writings of a given year became effective as of the middle of that year. For example, at the end of a given calendar year the unearned premium reserve on all annual policies written in that year would be considered equal to 50% of the premiums in force; on all two year policies written in that year the unearned premium reserve would be equal to 75% and on all three year contracts equal to 83⅓%; etc. The use of this latter method presupposes a uniform distribution of business throughout the year and is accordingly not as accurate as the monthly pro rata method.

Claim reserves may be determined by one of several different methods. There is the notice average method which may be satisfactorily used in evaluating recent losses by companies having a sufficient volume of experience to produce a dependable average claim cost per notice reported. Under this method the average cost per notice is determined on the basis of the company's past experience and is of course checked from time to time with the latest experience developments. In setting up the reserve it is simply necessary to apply the average cost per notice to the number of notices received. However, in following this procedure which is used particularly in arriving at Accident and Health claim reserves, it is customary to evaluate long term claims by the use of a claim reserve table which is based upon past experience and indicates the incurred loss to be expected on the average for a claim which has run for a given length of time as of the date of valuation. In applying the notice average method

an estimate must be made with respect to losses which may have been incurred but which have not yet been reported to the company. This estimate is best made by a study of developments of previous experience. Another method of setting up claim reserves is to estimate for each individual claim its ultimate expected incurred cost. Death claims are always evaluated on this basis. Outstanding compensation claims due to their very nature are best reserved for on an individual estimate basis. In this connection it would be well to mention that in setting up Workmen's Compensation loss reserves in the annual statement it has been required that for the two most recent years the reserve for unpaid compensation losses shall be equal to 65% of earned premiums less loss and loss expense payments which have already been made. We are all familiar with the recent criticism of this requirement which at the present time does not provide adequate claim reserves for the two latest policy years.

For Automobile Liability and other Public Liability lines the claim reserves set up in the annual statement are determined by application of certain fixed amounts to the number of suits outstanding for a given policy year or period. These average amounts per suit have been determined on the basis of past experience and are intended to cover not only the ultimate cost of the losses themselves but also of any legal expense involved. For annual statement purposes there is a requirement similar to the requirement outlined above in connection with compensation reserves, with the exception that 60% of the earned liability premiums less loss and loss expense payments is required as the legal reserve for the two latest policy years. In the case of Liability reserves this legal requirement appears to be fully adequate at the present time.

The allocation and analysis of expenses for each of the various lines of insurance is a combined accounting and statistical problem which has engaged the attention of all casualty company technicians especially within the past year or two. The New York Casualty Experience Exhibit which was required this year for the first time calls for the subdivision of expenses of each of the casualty lines into its component parts. The problems involved in meeting this requirement will not be discussed in this paper, although it might be mentioned in passing that the determination

of expenses for each line of insurance is most important due to its bearing upon the question of ratemaking. For a complete discussion of the problems involved reference should be made to papers written by Messrs. Hull, Craig, Van Tuyl and Tarbell appearing in the Proceedings of this Society and to Mr. Elston's paper published in the Transactions of the Actuarial Society of America. Whereas as yet no uniform procedure has been adopted by the various companies in making this allocation and analysis of expenses, it is altogether probable that the investigations which many of the companies have carried on during the past year or two will in time be productive of some standard method which will be accepted by the majority. This field is perhaps the most fertile one for further investigation and should therefore be productive of the most progressive results in the future.

We have just given consideration to the question of properly determining the expense portion of insurance rates and now we turn to the matter of compiling and collecting experience data which are just as necessary for proper ratemaking. This is a subject which requires much consideration, especially in the case of a company writing several different lines of casualty insurance. Whereas there are certain general characteristics of experience data which may be said to be common to all lines, it is nevertheless true that the variations in the special items peculiar to each line of insurance make the preparation of experience data almost a problem for each line in itself. Certain items will be necessary in the correct formulation of Accident and Health rates for example which are not a part of the insurance hazard covered under other lines. Here we would be interested in such features as the accident rate or rate of morbidity by age or possibly by occupation, whereas in determining compensation rates we are interested in the amount of loss cost per $100 of payroll exposed in various industrial classifications. For this reason, therefore statistical plans outlining methods of collecting experience statistics for each line of insurance have been prepared by various central organizations. Thus we have the Personal Accident and Health Statistical Plan issued by the Bureau of Personal Accident and Health Underwriters, the Workmen's Compensation Statistical Plan issued by the National Council on Compensation Insurance, the Automobile Statistical Plan issued by the National

Bureau of Casualty and Surety Underwriters, etc. Each plan has been designed for the primary purpose of collecting and compiling all experience data necessary for the establishment of the underlying pure premiums or loss portion of insurance rates. Furthermore, the plans have been constructed in a manner which permits a certain degree of flexibility in carrying out other investigations which may be of value in connection with rate-making problems. Thus under the Accident and Health Statistical Plan a study may be made of the experience data grouped according to size of policy and also the relative importance of certain diseases as causes of sickness claims may be studied. Likewise, under the Compensation Statistical Plan valuable information may be obtained respecting the relative importance of certain machine hazards in producing accidents. Another point which has been taken into consideration is that the plans have been made uniform insofar as has been possible with respect to any points which they may have in common. By way of illustration, the state and city codes which are used in the various plans have been standardized, although of course for certain lines of insurance such as Automobile and Burglary it is necessary to use a much more finely subdivided code than in other lines. Whether or not the plans have been unified to the extent which might be possible is a question which might well be made the subject of further investigation by representatives of the various central organizations. It is perhaps needless to say that the whole system of statistical procedure should be outlined in a manner which will produce the necessary results in as efficient a manner as possible, whether it be for a company conducting a single line of insurance or a company writing fifty lines. After the statistics have been collected there should be uniform methods of presenting the compiled experience in order that whoever has to deal with the experience on a number of different lines will readily be enabled to recognize the desired information. This is possible in preparing exhibits of unearned premium reserves, outstanding losses, written premiums, etc., and there is no reason why it should not be carried out in making experience exhibits. Some lines of insurance will of necessity require the reporting of the experience in more detail in certain respects than others but the general presentation of experience should follow a uniform outline.

The experience data for each type of insurance may be divided into two major groups—exposure and losses. Each of these groups in turn may be broken up into a number of subdivisions, some of which may be classified as general to all lines and others as peculiar to the particular line in question. Under exposure there are such general subdivisions as the identification, classification and location of the risk, the date of issuance of the policy, number of units of exposure and amount of premium. In like manner under losses we have the general subdivisions—identification, classification and location of the risk, date of issuance of the policy, date of accident, cause of accident and amount of loss. Whereas it has been stated that the foregoing subdivisions are general to all lines, it is understood that such items as classification of the risk, units of exposure and cause of accident vary for each individual line. For Accident and Health Insurance the classification of the risk refers to the accident hazard of the assured's occupation, whereas in Compensation the risk is classified according to specific industrial operations. The exposure under Accident and Health is measured in terms of the number of months the individual was insured, whereas under Compensation the exposure is expressed in terms of number of dollars of payroll over the insured period. The cause of accident code used in Accident and Health Insurance is not as finely subdivided as the cause of accident code used in Compensation Insurance, although under Accident and Health there is of course necessary a complete disease code which is not needed in compiling Compensation experience which involves occupational accidents only.

Brief consideration might be given to the special items which depend upon the hazards covered by each individual line of insurance. Special items in connection with Accident and Health experience are the age and occupation of the insured, the duration of disability, nature of injury and the splitting of losses to indemnity and medical amounts. In collecting Workmen's Compensation experience losses are also analyzed to medical and indemnity payments and such other special information as type of disability, manner of occurrence, nature and duration of injury as well as the weekly wages of the injured employee is required. In reporting Automobile Liability experience it is necessary to secure information relative to the

amount of excess premiums and losses over and above the standard 5/10 policy limits. The same is true with respect to other Liability experience and in the case of Property Damage experience excess premiums and losses above the standard policy limit of $1,000 are required. The Burglary Plan calls for information respecting the use of different types of alarm systems, etc. Under the Plate Glass Plan the item of salvage is required in connection with claims, etc. Compensation experience is segregated by states, whereas Automobile experience is not only divided by states, but also by cities with a population of 25,000 or more; by territories surrounding the cities; and by territories representing the remaining portion of each state. Similarly the miscellaneous Liability experience must be reported by state and for certain of the larger cities and, furthermore, within New York City and Boston by territorial zones. Burglary experience is reported by state and the important cities and counties within each state. Plate Glass experience is segregated to states and important cities and within certain cities to zones. Thus it is seen that, whereas there is a certain homogeneity underlying all of these plans, there is nevertheless for each of the various lines a number of modifications of the general outline.

The collection and compilation of the statistics necessary in the case of a single line company does not prevent the complexity of procedure nor the need for the same degree of efficient "dovetailing" as is found necessary in a company writing multiple lines. As long as the single line company compiles its statistics in such form that they may be readily combined with the experience of other companies there is nothing to prevent that company from using whatever methods it may care to in arriving at the information desired. Since experience statistics are often compiled by central organizations from punch cards submitted by member companies it is evident that each member must necessarily make use of a uniform card in reporting its experience data. At first glance it might seem that this would work a hardship in the case of the single line company since where there is but one line on which to collect and compile experience data it might be possible to prepare accounting records and experience records from the same set of cards. However, it is felt that even in the case of a single line company it is preferable to prepare accounting records and experience data from different

sets of cards. Following this procedure a duplicate set of punch cards could be prepared for the experience data and submitted to the central organization.

Next let us consider the statistical problems met with in the case of a company writing several lines of insurance. Here there must be more attention given to deriving the utmost in results from the statistical organization of the company. An example of such a company is one writing Compensation, Automobile Public Liability, Property Damage and Collision and the various Public Liability lines. The collection and compilation of experience is naturally a more complex problem than in the case of a single line company for whereas the information desired follows the general outline the special items are considerably varied as already pointed out. The preparation of Compensation experience involves a tremendous amount of statistical work. For each policy year the experience data must be compiled by state and industrial classification. Since there are approximately thirty Compensation states and about eight hundred classifications and since this experience known as Schedule "Z" must be compiled twice for each policy year, it is evident that in the case of a company transacting a countrywide business it will be necessary to prepare approximately forty-eight thousand reports for each policy year. Each classification experience consists of a report of payroll and premium earned in the policy year together with a detailed analysis of loss payments by type of disability. Also individual reports of all major accidents are required. In collecting Compensation experience there are even more details taken into consideration than this. For instance, information is required with respect to cause of accident, manner of occurrence, nature and duration of injury together with such special information as weekly wages of the injured employee. The purpose of this additional information is primarily for use in the establishment of proper Compensation rates. Cause of accident and manner of occurrence are necessary in providing a check of the time values in the Schedule Rating Plan. Nature and duration of injury provide the basis of the Standard Accident Distribution. A study of the trend in average weekly wages has been used in establishing manual rate levels.

The reporting of Automobile experience also is a task of no

mean proportion. Whereas the number of classifications is much smaller than in the case of Compensation, being about one hundred and twenty-five in number, the experience on each classification must be split up into a much finer group of territorial subdivisions, these being about two hundred and seventy-five in number. In this connection it has been found very advantageous to use master punch cards for each classification experience by territorial subdivision, the master cards being prepared upon the completion of the policy year experience. The various lines of Liability Insurance add to the statistical work involved, although these do not present the same amount of detail necessary in compiling Compensation and Automobile statistics. In compiling experience on certain lines such as Accident and Health, Burglary and Plate Glass, perhaps the procedure most generally followed has been to submit duplicate punch cards to the central organization and have the experience compiled for all companies combined, rather than have the tabulation of experience made up in individual company home offices.

Another element in the statistical problem confronting the multiple line company is the necessity for compiling experience as soon as possible after the completion of the policy year. Especially important is this in connection with workmen's compensation experience in order that rates may be revised on the basis of experience which will be representative of the conditions to be expected during the period for which the rates are to apply. The tendency is more and more in the direction of a speeding up of the process of compiling and reporting experience data and the result is that more of the work must be completed in the early part of the year than was formerly the case. This speeding up is likely to result in a peak load on the statistical department during the early and middle parts of the year followed by a slack period in the later months. The companies through the medium of the central rating organizations must lay down statistical programs which will produce as nearly as possible a uniform distribution of work throughout the year. For certain lines of insurance it is not necessary to revise the rates each year and consequently the compiling of detailed classification experience for those lines may be placed upon a biennial instead of an annual basis, the experience on certain of these lines being reported in one year and on others in the year

following. This procedure has been adopted by the National Bureau of Casualty and Surety Underwriters in the outline of its statistical program as recently adopted. However, workmen's compensation and automobile experience must be reported each year inasmuch as these two lines are of such importance that it is highly desirable that a review of the rates should be made annually.

Thus it is evident that the company writing a great variety of casualty lines must plan its statistical procedure in a most careful manner. Every effort possible must be made to prevent duplication and to apportion the statistical work as efficiently as possible. Even though there might be sufficient volume of business in each line of insurance to justify the use of full time clerks exclusively in the preparation of statistical data for each line by itself, it might be possible to effect a saving by organizing one group of coders for items which were more or less common to a certain group of lines of insurance and apportion the coding of special items peculiar to the individual lines among clerks trained for that purpose alone. In the organization of a multiple line company the following grouping of statistical work might be suggested:

1. Accident and Health
2. Workmen's Compensation—Employers' Liability—the various Public Liability lines other than Automobile together with the allied Property Damage lines
3. Automobile
4. Fidelity and Surety
5. Burglary, Plate Glass, Steam Boiler, Fly Wheel, Engine and Electrical Machinery Insurance.

Statistics play a most important part in present insurance practice. They are necessary in determining the component elements of insurance manual rates and are of much importance in other ratemaking procedure. Through the medium of statistics a company is enabled to review its loss ratio experience by line of insurance and thus govern itself with respect to its underwriting procedure in the lines affected. Statistics form the basis of annual statement requirements and expense analyses which play such an important part today in determining the attitude of state insurance departments as respects the adequacy or inadequacy of rates. There is of course the danger that the

statistical program will become top-heavy and the companies will find themselves confronted with the necessity for getting out a volume of statistics altogether disproportionate to the value derived therefrom. To this end, therefore, there should be a constant checking up of details in the various statistical plans for in this particular field of endeavor much depends on details. It may be that certain types of insurance will permit of statistical treatment under a combined or master statistical plan. The forms on which the statistics are collected, in most instances punch cards, may be brought into uniformity to a greater extent than they are at present. Some companies doubtless have already made considerable progress along this line and in one instance at least that I know of a standard form of punch card is being used for the preparation of experience data on several different lines of insurance. Study along this line might well be undertaken under the auspices of this Society for it is felt that such investigation would be productive of worthwhile returns in the form of time, effort and money saved to the various casualty companies in the carrying out of their statistical work.