THE CENSUS METHOD

BY

LAURENCE H. LONGLEY-COOK

A New Approach to the Analysis of Casualty and Property Insurance Statistics for Rate Making

"The old order changeth, yielding place to new."

Introduction

One of the tenets of insurance rate making is that statistics should be developed on the broadest possible base. With simple classification systems and rating plans which were common to all companies, this ensured overall adequacy of the premiums charged and permitted companies to vie one with another to persuade agents to give them a larger share of the better business.

This form of competition is rapidly being replaced by competition at the customer level. Rating plans are devised by individual companies to attract good business by offering lower rates where they can be justified. The development of these new rating plans requires many skills, not the least being the determination of the correct rate levels for new benefits and classification groups. The actuary has had to develop many new techniques and abandon some old tenets to solve these problems. The "broadest possible base" serves no purpose here except as a bench mark. The development of good rate indications from comparatively small bodies of data is a challenging problem. One facet of it is the rapid and convenient analysis of data with numerous classification breakdowns. This brief paper is concerned with this analysis and associated problems.

Present Procedures

The problem of analyzing rate making data must be viewed against the background of recent developments and some short review of the present position seems desirable. In order to clarify our thinking we will consider private passenger automobile insurance written by a company which is a member or subscriber to the National Bureau of Casualty Underwriters. This business provides an excellent example of the problem of numerous classification breakdowns. There are classifications by state, territory within the state, type of automobile, use of automobile, age of automobile, age and sex of driver, type of coverage, liability limits and merit rating class. For very many years such studies for automobile and practically all other classes of casualty insurance were made by what is known as the policy year method. For each classification all policies issued in a particular year, say 1950, were investigated from the date of issue of the policy to the subsequent policy anniversary, the losses arising from accidents occurring in the policy year being compared with the number of cars exposed to risk of loss.

Since for some policies in the 1950 experience the period of investigation will begin on January 1, 1950, and end on January 1, 1951, while for some

other policies it will begin as late as December 31, 1950, and end on December 31, 1951, the 1950 experience cannot be developed until some time in 1952.

In recent years it has been found that the length of time needed to develop loss data and the difficulty in interpreting trends, because a loss occurring in 1951 may belong to either policy year 1950 or 1951, were not acceptable and a different method known as the calendar-accident year method has been generally substituted. Under the calendar-accident year method the losses arising out of accidents occurring in any calendar year are compared with the "earned exposure" in the calendar year. If a policy insuring a single car is effected on August 1, 1960, it will have 5 months exposure to accident, or 5/12 earned exposure in 1960.

Each company reports its writings and exposures quarterly to the National Bureau by classification and term. For every cancelled policy each company must calculate the individual unearned exposure. The method used by the National Bureau proceeds as follows. To calculate the earned exposures for 1960 first take the policies issued for a term of one year and sum the following:

1/8	of	the	policies	issued	in	the	1st	quarter	of	1959
3/8	"	"	"	"	"	"	2nd	"	"	1959
5/8	"	"	"	"	"	"	3rd	"	"	1959
7/8	"	"	"	"	"	"	4th	"	"	1959
7/8	"	"	"	"	"	"	1st	"	"	1960
5/8	"	"	"	"	"	"	2nd	"	"	1960
3/8	"	"	"	"	"	"	3rd	"	"	1960
1/8	"	"	"	"	"	"	4th	"	"	1960

Then do similar calculations for 6 months policies and also for policies of other terms.

Of course the actual calculations can be accomplished more simply on machines, but it should be noted that

1. no allowance is made for uneven distribution of writings over each quarter of a year,
2. cancellations are not handled in a strictly correct manner,
3. companies must calculate individual unearned exposures for canceled policies.

Further, it can be readily appreciated that this is a complicated and expensive procedure for developing earned exposures. The only recent simplification is the exclusion from the reporting instructions of endorsements subsequent to issue on non-audited automobile business. Even with modern electronic data processing equipment the calculation of earned exposures for all the classification breakdowns by this procedure is at least tedious and most likely not practical for an individual company.

The Census Method

The census method uses the calendar-accident year approach but uses a simplified procedure for developing the earned exposure for the calendar

year. Instead of trying to calculate as accurately as possible the earned exposure over the calendar year 1960, we can take a census of the number of automobiles actually insured in the classification on July 1, 1960. Under normal circumstances this will be as accurate a measure of the exposure as the more complicated method just described. However, if greater accuracy is required, we can take the mean of the number of automobiles insured on January 1, 1960, and January 1, 1961, or even use three tabulations of the automobiles insured—or censuses of the in-force as they are better described —one at January 1, 1960, one at July 1, 1960, and one at January 1, 1961. For detailed classifications the greater accuracy obtained by using more than one census is a will-o-the-wisp because the loss data cannot be sufficiently credible. Where total exposure in all classifications is required more than one census may be used or a control maintained with accurately calculated earned premiums. With the census method term does not enter into the development of exposure; canceled policies are simply excluded and endorsements can be ignored.

For a company maintaining an in-force tape or punched card file the method should be considerably cheaper and the classification codes will be really accurate since all, or practically all, the classification coding needed for rate making will be included in the in-force file.[1] Even for a company with more old-fashioned records there should still be appreciable savings.

It may be remarked that the census method has been used for many years for the investigation of the mortality of insured lives and its accuracy has been fully tested in this field.

Census Method Without In-Force File

It is desirable to consider in a little further detail the application of the census method when no detail in-force file is maintained. A company will maintain a file of detail statistical cards (or a corresponding electronic tape). Terminated policies are not excluded from the file which is normally maintained by calendar quarter. When a policy is cancelled the original card is not removed but a cancelled card is added. It is from this file that summary cards are prepared for annual statement and other company records.

Let us suppose we wish to make a detailed study by classifications too numerous to show up on the summary cards. We will further assume that the study is a special one and data for the study have not been accumulated. With the present method of calculating earned exposure and with the census method, we must go to the detail cards and extract all those which were in force (or could have been in force if not cancelled) for the calendar year or years being investigated. Under the present method we must proceed to calculate earned exposures by the method already described. For the census method we need tabulate only the number of cards issued prior to, and terminating after, the date of any census we require, treating cancelled cards as negative items. No term analysis or calendar quarter of issue is required.

[1] The exclusion of impossible codes, common to many electronic programs, only scratches at the surface of inaccurate coding of statistical data; but, with an in-force file used for rating where the coding determines the rate, coding errors are most unlikely.

It is apparent that the census method will be very much less laborious. For an investigation which is made annually both methods are more simple, but the relative advantage of the census method is unchanged.

One difficulty inherent in the present bureau statistical plan for automobile, which can easily be rectified, must be mentioned. At present we record the policy term (by code) and the number of car-months of exposure. Under the census method we do not need the number of car-months but the number of cars. To illustrate we must distinguish readily between two cars insured for 6 months and one car insured for a year, each of which have 12 car-months exposure.

Electronic Processing

Note must be taken of the progress certain companies have made in simplifying the development of statistical data. While some companies have been content to take their standard procedures and put them into their electronic program, others have made radical changes. Since electronic programs are generally keyed to a monthly cycle of recording, the preparation of a statistical tape, corresponding to the file of statistical cards previously developed, can be avoided if the portion of each statistical report corresponding to each month's writings (including endorsements and cancellations) is developed each month. This avoids all sorting of the data from the production order in which it is kept: Sorting is an expensive electronic processing procedure. For each report a tape will be maintained showing earned exposures, losses and other information to be shown on the final report. This tape is fed to the memory units of the machine once a month and all additions and subtractions to the report resulting from the month's operations incorporated. The data are then returned to tape form. In the method the actual earned exposures for the current and subsequent calendar years will be recorded so that no record of unearned premiums or unearned exposures has to be kept. For some reports the number of classifications presents a capacity problem. This can be overcome by recording about 90% of the business in the main classification and taking the remainder to an exception tape for further analysis.[2]

These procedures are directly applicable to the census method. The development of the contributions to a census at a particular date from each month's writings and cancellations is more simple than the development of the contributions to the earned exposure for a particular year.

Endorsements

At a recent meeting of the Society, Mr. Stellwagen stressed the great expense at present involved in coding endorsements. Mr. Harmon Barber has suggested that a great amount of unnecessary coding, key punching and tabulation is wasted on endorsements which can easily be avoided. The National Bureau statistical plan for automobile business does not require the reporting of endorsements other than those at date of issue on non-audited

[2] For instance, since Philadelphia producers will normally come in sequence, territories close to Philadelphia only need be considered in running the portion of the business from Philadelphia agencies.

business and the census method does not require endorsements for its calculation of exposures. However, a large amount of coding, key punching and record keeping is still generally required to include the small monetary sums involved in endorsements in company accounts. It is proposed that for practically all lines of business all monetary endorsements, other than endorsements at issue and audit premiums, should be coded only to state and major lines of business and excluded for all classification studies. All premiums on such endorsements could be considered as earned when written so they will not be involved in unearned premium reserve calculations. Someone will raise the problem of premium tax for townships and municipalities, but since endorsements involving reductions in premium are probably about as common as those involving increases in premium, I believe our accountants could sell the idea of coding endorsements to state only.

Application to Homeowners

Complex detailed classification systems occur only in lines with a large number of units insured and we need consider here only the application to the Homeowners policy, although the census method is applicable generally. Under present statistical procedures the calculation of earned premiums for all classification breakdowns is intolerably involved.

The census method would allow a proper pure premium approach to Homeowners rate making if the amounts of dwelling insurance were recorded, either exactly or in fairly narrow intervals. At present the standard statistical plan provides only for broad group classification of amounts of insurance. Many will desire to continue the loss ratio approach however. In applying the census method to calculate earned premiums for this approach a census of premiums in force is required. Here either 3-year or 1-year premiums can be used but not a combination of both without first dividing the 3-year premiums by three or multiplying the 1-year premiums by three. When there is no in-force record, the "original premium", recorded by many companies on their cards for cancelled business, must be used for the census of the premiums in force. Otherwise the method involves no new problems and could readily be used by an individual company and should not be difficult for Bureau operations.

Conclusions

The adoption of the census method for statistical analysis for rate making and research should have the following advantages:

(1) The analysis of data with complex classification systems would be considerably simplified.

(2) The statistical file would no longer be required for companies maintaining a detail in-force file for policy writing and billing.

(3) No calculation of earned exposures or earned premiums by classification would be needed.

(4) The statistical coding and detail key punching of endorsements

could be completely eliminated for practically all lines of business.

(5) For Bureau reports no classification of business by term or calendar quarter would be required. (Term would be required where the loss ratio method is employed.)

(6) Greater accuracy would result where a detail in-force file is used for statistical work.

(7) The consequent reduction in key punching and processing of statistical data should save the insurance industry many millions of dollars.