The Experience Rating of Workmen's Compensation Risks.

BY

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Definitions.

A workmen's compensation risk the premium for which is based in part upon the loss ratio developed for the individual risk is said to be *experience rated.* An experience rate is differentiated from a *schedule rate* by the fact that, as commonly used, the latter term is confined to a rate based upon a detailed inspection of the physical condition and hazard of the plant of the employer, and of his methods of operation. A *merit rate* may be either a schedule rate or an experience rate, or it may be a rate based partly upon inspection and partly upon experience. Experience rating is distinguished from profit sharing or mutual insurance by the fact that it has regard to experience under individual policies as distinguished from experience in groups or classes of policies or for the company as a whole.

Why Experience Rating is Desired.

Several conditions have given rise to a demand for some system of experience rating.

1. An employer who, through good fortune or good management, has fewer or less costly accidents than other employers in the same business or industry, regards his rate, justly or unjustly, as excessive, and insistently demands relief.

2. Under conditions of unregulated competition between insurance companies experience rating has in the past offered a convenient and specious means of granting discriminatory favors to particular policyholders and of conciliating agents and brokers controlling compensation and other collateral lines of insurance.

3. It may well be argued that by properly rewarding an employer for good experience and penalizing him for bad experience we have a cheap and easy means of encouraging organization for

safety and the guarding of machinery, thus conserving human life and limb.

Existing Systems.

Before passing to considerations of theory it will be helpful to refer briefly to four different systems that are in actual operation in the United States at the present time. These are:

I. The Massachusetts System.
II. The New York System.
III. The Ohio System.
IV. The Service Bureau System.

The Massachusetts System.

Under the Massachusetts "Plan of Experience Rating, 1916," promulgated by the Massachusetts Rating and Inspection Bureau and approved by the Insurance Commissioner, every risk which can supply the requisite payroll exposure is compulsorily subject to experience rating. The rate modification is based upon the experience for the entire period during which the risk has been insured for workmen's compensation, but not more than five years, "nor less than twelve months preceding a date six months prior to expiration of the risk." The amount of payroll during the period covered by the experience must be at least $25,000. A credit of ⅔ of 1 per cent. of the manual rate is allowed for each decrease in loss ratio of 1 per cent. below 45 per cent., the maximum credit being 30 per cent. of the manual rate. A debit is imposed of 1 per cent. of the manual rate for each increase in loss ratio of 1 per cent. above 65 per cent., the maximum being 30 per cent. The region between 45 per cent. and 65 per cent. is called the "neutral zone." In the case of risks also subject to schedule rating the application of the rule is modified so that the maximum credit for merit rating will not exceed 40 per cent. The loss ratio is determined by classifying accidents under the following heads:

1. Fatal.
2. Causing total permanent disability.
3. Causing dismemberment (further subdivided).
4. "Tabulatable" accidents (causing loss of time on any day other than the day of injury).

An assumed average number of weeks' compensation is stipulated to be applied in each of the above classes and this factor is multiplied by the weekly compensation actually awarded. Medical cost is taken at $11 per tabulatable accident. By summing the items thus obtained a hypothetical loss cost is derived from which the "loss ratio" of the risk is determined.

The New York System.

Under the New York "Rules for Experience Rating," promulgated by the New York Compensation Inspection Rating Board under date of January, 1915, and approved by the Superintendent of Insurance, risks may be experience rated upon application by a member company. The submission of such application is optional with the carrying company and this feature of the plan has led to such abuses that, following a suggestion from the Superintendent of Insurance, a special committee of the Board has been appointed to revise the system. To secure a rating, experience covering a period of not less than two years nor more than five years must be submitted, thus permitting to a certain extent the submission of employers' liability as well as workmen's compensation experience. The total payroll for the period of the experience must be not less than $25,000. Debits or credits are created according as the loss ratio developed is greater or less than 50 per cent. On risks where the payroll submitted is $100,000 or over, the maximum debit and credit is 30 per cent. for risks not subject to schedule rating, and 20 per cent. for risks which are subject to schedule rating. Credits and debits are somewhat less for smaller payrolls. The general method of evaluating the experience does not differ materially from that employed in the Massachusetts system.

The Ohio System.

The present Ohio system is fully described by Mr. Emile E. Watson, actuary of the Industrial Commission of Ohio, in a paper read before the National Association of Industrial Accident Boards and Commissions on April 26, 1916. Save as applied to contracting risks, the Ohio system is one of debits only, the premium rates of the Ohio fund being "preferred" rates. The maximum debit is 24 per cent. of the preferred rate. The method of applying the experience is based partly upon the number of compensatable accidents, partly on their cost, partly on their gravity, and partly on the base rate for the classification. In the case of contracting risks, for reasons stated by Mr. Watson, a system of credits only has been devised. The Ohio credit system appears to be a notable improvement over the Ohio debit system. The Ohio system appears in general to be unnecessarily complex and difficult to understand, although it doubtless achieves in many cases the results intended of it. It would not be practicable for use in states where compensation insurance is written competitively.

The Service Bureau System.

A fourth system of experience rating in actual use is that employed by member companies of the Workmen's Compensation Service Bureau in states where no special system is provided and where experience rating is permitted by the supervising authorities. So far as the actuarial and statistical principles involved are concerned, this system does not differ greatly from the Massachusetts and New York systems.

The Influence of the Size of the Risk on the Rule for Rating.

Aside from arguments against experience rating based upon the opportunities which it may offer for abuse when used in competition and upon the expense and administrative difficulties which in practice are involved, the chief theoretical objection urged by its opponents is that it tends to violate the fundamental principles of insurance by running counter to the laws of average. This objection deserves the closest scrutiny and I venture to believe that a full analysis thereof will disclose the entire underlying theory of the subject.

If we consider any workmen's compensation risk individually and apart from other risks we shall expect that at the end of any policy year the losses will not exactly balance the pure premium. It may fairly be said that under a given policy the actual loss will always be greater or less than the pure premium or expected loss, since those cases where the actual and expected losses are exactly equal are coincidences so rare as to be negligible.

The difference between the expected loss and the actual loss for a particular risk during a particular policy period I shall refer to as the *deviation* of the experience. This deviation may be regarded as made up of two component parts, which it will be shown call for two radically different methods of treatment in any sound experience rating plan. These two parts are:

A. The error in the pure premium, considered as an average premium, which arises from the fact that it does not exactly measure the true expectation of loss. This error measures the departure of the hazard of the risk from the hazard of average risks within the classification. I shall call that part of the deviation arising from this error the *hazard deviation.*

B. That deviation of the actual loss from the expected loss which is the result of chance, assuming that the pure premium exactly reflects the true expectation of loss. This deviation I shall call the *chance deviation.*

Consider the properties of these two kinds of deviation. The hazard deviation might doubtless be attributed to a considerable number of mutually independent causes. For the purposes of the argument, however, it is unnecessary to analyze it further except to say that, in a general way, it reflects the fact that rate makers are human; that the statistics underlying our basic pure premiums are inadequate and defective; that industrial conditions are in a constant state of flux; that schedule-rating systems based upon physical or objective features of the risk are of necessity to a large extent arbitrary. While it is certainly possible as time goes on to continuously reduce the hazard deviation, it can never be wholly eliminated. Efforts to correct it, however, by means of experience rating should not be permitted to supplant efforts to secure constantly better classification of risks and constantly increasing accuracy in the pure premium and in schedule rating. The attractive and laudable idea of the use of experience rating to encourage safety measures and organization contemplates a modification of the hazard deviation. By offering hope of reward the employer is to be induced to make changes in the plant which reduce the expectation of loss.

But the most useful fact to be observed in connection with the hazard deviation is that it grows increasingly important, relatively to the chance deviation, as the size of the risk measured by the payroll exposed, or preferably, by the expected loss, increases. Thus, on a very large risk, the experience on that risk alone as distinguished from the general experience in the classification to which it belongs is really of greater weight in determining the price at which it may equitably be underwritten than the manual premium itself. If a single risk were large enough to practically comprise a large industry in itself, it could be rated entirely upon its own experience, without reference to the experience on any other risk. I do not attempt in this connection to define in dollars and cents exactly the limit at which a risk may be regarded as "very large." It must, however, be large enough to cause the probable deviation due to chance to be fairly small.

Under the head of chance deviation, must be considered those departures of the actual loss from the expected loss under a particular risk which arise from the operation of the laws of probability, excluding absolutely deviations arising from the fact that the pure premium does not accurately represent the true expectation of loss. (By *true expectation of loss* is meant the product of the manual pure premium rate multiplied by the payroll, on the assumption that, as an average rate, it exactly reflects the *a priori* hazard of the risk.) With respect to these chance deviations, we first observe that they may be either positive or negative—that is to say, the actual loss may be greater or less than the expected loss. Positive deviations may be infinitely great—that is, under an ordinary workmen's compensation policy there is no limit in law or in theory to the size of the loss which may arise. On the other hand, negative deviations are strictly limited to the amount of the expected loss itself. In other words, we can never save more than the office premium less the expenses. These considerations explain why it is so difficult to construct an experience rating system under which the debits will equal the credits, a difficulty which is entirely apart from the practical problem of providing debits which will materialize in actual operation.

By far the most important property, however, of these deviations arising from chance is the fact that the percentage of deviation to premium (not the absolute amount of the deviation) varies inversely as the expected loss—that is to say, it becomes smaller and smaller as the pure premium exposed to risk increases. It is clear then, that in dealing with this element of the problem we have to do with a subject which may properly and advantageously be subjected to exact mathematical analysis.

It is because of this fact that when the expected loss is small the probable chance deviation is great that an experience rating system purporting to be a measure of physical or moral hazard—that is, of the hazard deviation, is inapplicable to small and average-sized risks. In other words, for a small risk—and I do not undertake here to define exactly within what limits a risk is to be considered small—deviations due to chance so far outweigh deviations due to difference in physical or moral hazard that these quantities become almost incommensurable in magnitude. The only "experience rating" properly applicable to chance deviations must amount to nothing more or less than a system of partial self-insurance or its equivalent.

It is most unfortunate that statistics analyzing the loss ratios under workmen's compensation policies arranged according to the size of the policy are almost wholly lacking. Through the courtesy of Dr. E. H. Downey, however, I am able to present the following table based upon data compiled by the Industrial Commission of Wisconsin under date of August, 1915, and covering the experience in Wisconsin on 2,195 individual policies:

WISCONSIN EXPERIENCE—2195 POLICIES.

Loss Ratio, %.	Number of Policies.	Premiums.	Average Premium.	Losses.	Average Loss Ratio, %.
0..	1,738	$ 65,312	$ 37.58	$ 0	0
1–10..	124	38,772	312.68	1,893	4.9
11–40..	138	58,864	426.55	17,320	29.4
41–100..	82	46,444	566.39	31,158	67.1
Over 100..	113	19,883	175.96	57,277	288.1
Total......	2,195	$229,275	$104.45	$107,648	47.0

It will be noted that over 75 per cent. of the policies experienced no losses whatever and that over 50 per cent. of the losses arose from about 5 per cent. of the policies.

An analysis at one time made of the business of the New York State Insurance Fund showed that out of 6,373 policies in force at the time of the investigation, 5,436 were for semi-annual premiums of from $5 to $50; 455 from $50 to $100; 346 from $100 to $500; 68 from $500 to $1,000; and 68 over $1,000. The average premium for six months for the 68 policies carrying a premium of $1,000 and over was $6,124. Out of 250 policies selected at random with semi-annual premiums under $100 and greater than the minimum premium, there were only 24, or a little less than ten per cent. of the total, under which any losses whatever had been paid or reported for the six months period under review. Of these losses,

17	were for less than $50
5	were between $50 and $100
2	were $100 or over
24	total

These figures furnish, perhaps, extreme illustrations, but they serve all the more clearly to show that among small risks chance plays an overwhelmingly dominant role in determining the experience under individual policies. In dealing with small policies it is interesting to note that the only experience rating system which would produce sufficient charges to offset the credits must be a system of partial self insurance or its equivalent.

Partial Self Insurance.

A plan tentatively brought forward in a memorandum of the Superintendent of Insurance of the State of New York dated February 17, 1916, provides just such a system. It contemplates a contract written at a reduced rate of premium and providing for extra charges for experience to be based in some manner upon either the number of accidents or the cost of accidents arising during the policy term. An objection to this method is that it uses debits only, and that the collection of debits has in the past carried with it certain difficulties of an administrative nature which are believed to make them undesirable. The practical objection to debits, however, has arisen in large measure from several conditions which would not apply to the debits provided by the plan described. The first difficulty has been the indisposition of the company or broker to apply debits where they increased the premium, for fear of dissatisfaction on the part of the assured. But where in the past the policyholder has objected to premium increases, it must be remembered that these increases were based upon a more or less mysterious system of schedule rating which was not definitely described in the contract. Under the plan referred to any dissatisfaction would be largely, if not wholly, eliminated, for the reason that the policy provision would be so clear that any employer could figure out his experience rate himself, and that furthermore, he might properly and without involving any discrimination, be given the opportunity to elect whether the policy should be written under this plan at all.

There are two forms which it appears that such a plan might take. The policy might provide that at its termination the premium shall be subject to increase by an amount equal to, say, $100 for each accident arising during the policy term which has cost at least $100; or if the accident has cost less, that then the premium shall be increased by the actual cost of the accident. This scheme involves certain practical difficulties and delays in determining the actual cost of the claims arising during the policy period which might prove an impediment to its smooth operation. These difficulties, however, could be avoided by providing that for every compensatable accident arising during the policy term—a compensatable accident being defined as one resulting in an award of compensation under the act—there shall be added to the premium a certain fixed sum. The amount of this addition could easily be determined promptly at the close of the policy year, since it is merely necessary to know whether or not the accidents arising are compensatable, and this is about the simplest information that could be demanded with respect to any experience. It would be possible to very accurately estimate the reduction in advance premium which could be granted under a provision of this kind, although it is likely that certain modifications of the percentage might be advisable in the case of a few special classifications. The chief practical objection to such a plan is that the advance reduction in rate which could properly be offered would be so small as in all probability to prove unattractive. There is a general lack of appreciation of how comparatively large a proportion of the premium is required to pay for the comparatively rare serious losses.

Application to Large Policies.

It is with greater profit that we may consider the applicability of experience rating to large policies. These large policies comprise the risks on which there is the most pressing demand for experience rating, the payrolls and premiums exposed being sufficiently large to make the experience have some reasonable meaning. But these cases represent only a small percentage of the total number of policies in force. It may not be unreasonable to assume that in the average company there are not over, say, five per cent. of the workmen's compensation risks for which there is a legitimate demand for a modification of the rate based upon the experience of the risk. When we consider that under such a law as that of New York an accident to a single employee may cost as much as $10,000, it becomes apparent that any system of experience rating which purports to be universally applicable to risks of all sizes, or even to the majority of risks, must contemplate a vast amount of expensive and meaningless office work.

The principal theory upon which experience rating has been defended is that it serves to reflect the moral hazard of the risk. This theory is very fully developed in an article by Mr. D. S. Beyer in the *Economic World* of April 15, 1916. Under the Massachusetts and other plans in actual use, it is apparent that the dominant idea is that of measuring the moral hazard as distinguished from providing partial self insurance. Such a plan necessarily fails to live up to its pretensions when applied to small risks, since, as is well said by Mr. Beyer in the article referred to:

> ". . . the good or bad experience of a plant *may be due merely to its size*, and the logical working out of the general law of averages. For example, the average-sized Massachusetts plant of eighty employees should not have more than one fatal accident in fifteeen years, if it conforms with the general average of the industries of the State. The plant with ten employees should not have more than one fatality in 120 years; it should not have an accident involving two weeks' lost time more than once in three years, and in low hazard industries once in ten years."

When, therefore, we attempt to apply experience rating to small plants it is obvious that what we are doing is not so much reflecting the moral hazard as tampering with the law of averages. For a very large risk, on the contrary, assuming the basic rate to be correct, the deviation of the actual loss is determined almost wholly by the moral hazard and scarcely at all by the influence of chance.

Fundamental Tests.

The fundamental problem of devising an experience rating plan which will be of general application is to so harmonize the idea of partial self insurance and the idea of experience as an index of the physical and moral hazard as to cause the plan to produce consistent and equitable results within the limits laid down for its application. The test for any plan intended for general application should be made by applying it to a large number of concrete cases in the following classes:

(*a*) Small risks.
(*b*) Medium-sized risks.
(*c*) Large risks.

No plan may be considered to pass the test unless, as respects small risks taken as a class, it produces debits at least equal to the credits, and that, as respects the medium-sized risks taken as a class it produces debits nearly equal to the credits. In respect of the large risks, I believe it will be found that any equitable experience-rating plan will result in somewhat greater credits than debits, for the reason that large risks are, as a matter of fact, better than small risks in the same classification. This, then, would mean that as respects the large risks it is not necessary, and indeed, probably undesirable, that the debits produced should exactly balance the credits. The ends to be sought can in my judgment be best obtained by (1) exempting altogether the smaller risks—say those where the annual premium is less than the average value of one fatal accident —from the operation of the plan; (2) providing a "neutral zone" which will vary with the size of the risk and (3) providing a scale of maximum debits and credits which decrease as the size of the risk decreases. Special care should be taken that credits are not made too large.

Actual Experience vs. Average Accident Values.

Most plans in actual use provide for the basing of the modification in rate upon a loss ratio derived from average claim values as distinguished from actual experience. This is said to reduce the operation of chance in the experience. If all compensatable accidents were given equal weight this might be true, but it is difficult to follow the force of this argument so long as death claims, total permanent disabilities, etc., are separately rated. Any system of average loss ratios would probably be satisfactory to the employer so long as it produced a figure which was less than the actual loss ratio. Where, however, the hypothetical or fictitious loss ratio produced by the use of averages exceeds the actual loss ratio under the risk, dissatisfaction with the rate sooner or later ensues. The objection has been raised to the use of actual experience that it is not possible to ascertain the facts sufficiently soon. It is my experience that ninety days after the close of a policy period the number of open cases remaining are diminished to such an extent as to make their valuation on the basis of actual tables entirely feasible and satisfactory. The fluctuations in experience due to the chance incidence of large claims may be sufficiently controlled by other features of the rating plan. The use of actual experience avoids the absurdities which invariably result in particular cases from a system of weighted averages and consequently makes a more practical appeal to the employer. Under an average value system, it is possible for a debit to be assessed against an employer which is obviously not required by the actual experience under the policy. Especially if "tabulatable" accidents are used in preference to "compensatable" accidents an average value system gives wide scope for manipulation and ambiguous interpretation. An experience-rating plan to inspire confidence, should be based upon actual and not upon fictitious or hypothetical experience.

Payroll *vs.* Premium as a Measure of Size.

The size of a risk is ordinarily measured by the amount of the payroll exposed. But for purposes of considering the departure of actual experience from expected, the size of the hazard is indicated by the expectation of loss—in other words, the pure premium. The governing consideration, from the standpoint of probabilities, is the proportionate effect which one or more serious losses would have upon the experience under the risk. Thus, $100,000 payroll at a rate of $1 gives a premium of $1,000; $100,000 at a rate of $10 gives a premium of $10,000. A death loss costing $5,000 increases the loss ratio in the case of the first risk 500 per cent., while it increases the loss ratio in the case of the second risk by only 50 per cent. Consequently, it is clear that although these two risks carry the same payroll they should not be treated according to the same rule for experience rating purposes, since the first risk is exposed to a much more fluctuating loss ratio than the second risk. Furthermore, if the premium is taken as the measure of size, we avoid all question of the treatment of subordinate classifications, such as clerical office force, drivers, etc. In a manufacturing or contracting risk, for example, the clerical office payroll is relatively of slight importance in measuring the size of the risk for insurance purposes. By using the premium as the measure instead of the payroll, the clerical office employees are automatically given their true weight.

Prospective and Retrospective Rating.

In actual practice, the experience upon a risk, where it has been allowed to affect the rate at all, has usually been applied to modify the premium for a policy period succeeding that in which the experience was developed. This manner of applying experience has been described as *prospective.* Where, on the contrary, experience is applied to modify the rate for the period during which the experience was developed, the risk is said to be rated in a *retrospective* manner. Under the retrospective plan, the modification in rate is always effective for the insurance carrier under whose policy the experience occurs. Under the prospective plan it happens that when a risk changes hands, the carrier securing the renewal may be required to apply a rate based upon the experience of the risk with some other carrier. Furthermore, the actual result to the policy holder is quite different under the two systems, since under the prospective system the *percentage* of credit or debit derived from *past* experience is applied to a *future* premium. Since the payroll of the employer may fluctuate materially from period to period, especially in the case of contracting risks, it is obviously impossible to obtain results under a prospective system which are free from discrimination. To the extent that experience rating measures the moral hazard of a risk, there is some justification for the prospective manner of application, even when it goes so far, as in Massachusetts, as to use parts of the experience over and over again for a number of years. To the extent, however, that such rating is of the nature of self insurance there would seem to be no such justification. The practical appeal of the prospective system arises from the fact that it frequently enables a concession in the advance rates of premium to be made at the time of soliciting the business. This consideration has apparently outweighed the scientific arguments for a retrospective system in determining the plans which have been actually adopted for use. A practical advantage of the prospective system is that it makes it easier to collect any debits which may arise from bad experience. In choosing between a prospective and retrospective plan, the language of the policy contract should be given careful consideration, and if a retrospective plan is to be adopted, it should be made certain that the debits will be legally collectible. Since the premium has to be adjusted at the end of the policy term for payroll audit, the retrospective system has the advantage of bringing the adjustment for experience generally coincident in time with the adjustment for payroll audit. A serious disadvantage in the use of the prospective system is the constant temptation which arises thereunder to so resolve all questions involving personal judgment as to result in as favorable a rate as possible. This temptation is largely removed under the other plan.

Competitive Abuses.

No student of compensation rate-making should fail to read a brief on the subject of experience rating prepared by Mr. Theodore E. Gaty, and submitted to the Superintendent of Insurance of New York, on February 17, 1916. This brief was reprinted in the New York *Journal of Commerce* of February 21, 1916. Mr. Gaty demonstrates very clearly that the history of experience rating is in large measure a history of competitive abuses. It is shown that the early liability rates which purported to be based upon individual experience and which were known as "special rates" arose not from any desire to secure superior equity as between employers, but simply as a means of defense against competitive inroads upon premium income. Under such conditions it was quite natural that scientific considerations had very little to do with determining the rate, that discrimination between policyholders was frequent, and that many of the insurance companies, particularly the smaller ones, were forced to call on their stockholders for large contributions to surplus. With such a history, it naturally follows that special pains should be taken that any experience rating system of the present day should be safeguarded in every possible way against competitive abuses.

Conclusion.

It is difficult at this time to present an impartial general survey of a subject so controversial. In this paper, however, I have endeavored to give the arguments on both sides of the principal questions concerning which there exists marked diversity of opinion. It is hoped that the paper is one which can be profitably used by students endeavoring to get a comprehensive view of the general subject. I shall feel quite content if I have succeeded in indicating how much is yet to be done to properly develop a scientific theory of experience rating, and how great is the necessity for adequate statistics relating to this subject.