SOME CONSIDERATIONS IN DETERMINING INCURRED CLAIMS USED IN THE COMPUTATION OF DIVIDENDS UNDER GROUP ACCIDENT AND HEALTH INSURANCE

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I. INTRODUCTION

IN DETERMINING the apportionment of divisible surplus accruing with respect to a policy year's experience under a Group Accident and Health policy, the claims incurred in the policy year usually are the biggest single charge against the policyholder's premium. Consequently, it is important that the charge be an accurate portrayal of claims properly attributable to the policy year.

In recent years, group policyholders have become very cost-conscious, and, in reviewing their financial experience leading up to the computation of the dividend, they have examined closely the charges made by the insurance carrier not only for expense, risk spread, and contingency reserve, but also for incurred claims. This examination has required frequent explanations of what to us in the insurance industry are two straightforward concepts, namely, paid claims and a reserve for future claim payments.

The determination of incurred claims for dividend purposes has an effect upon the results of a company's group operations in areas other than its dealings with its policyholders. Without the proper establishment of a claim reserve to be used in determining the charge for incurred claims, the experience of a given group case and the over-all experience of the company's group operation would be incorrect representations of the facts. This is true not only of the reserves set up in the dividend operation, but also of the reserves for future Group Accident and Health claim payments which are required in Exhibit 9 of the annual statement. These reserves account for a very substantial sum of money, and an accurate estimate is essential in order to have a meaningful picture of the company's experience. In addition, an insurance company is required to estimate a liability for incurred dividends attributable to the calendar year for which the statement is being prepared, and the estimate must reflect a reasonable charge for incurred claims of individual group cases. As will be discussed later, claim reserves for dividend purposes present problems which are different from those involved in Exhibit 9. That claim reserves

are of great importance in presenting an accurate picture of the company's Group Accident and Health experience is further indicated by the extent to which such reserves are reviewed by auditors and examiners.

This paper will consider first the two basic ingredients of incurred claims, namely, paid claims (Section II) and claim reserves (Section III), and will then consider how these two ingredients are used to determine incurred claims charged against a given group policyholder (Section IV). A separate section (Section V) is included to discuss incurred claims on those group policies which cover so small a number of people that the case's own experience may fluctuate too widely to have real meaning. Since much the same considerations apply to the determination of rate credits by companies issuing nonparticipating business, references to dividends should be interpreted to include the nonparticipating counterpart. In these discussions it is assumed that the period under observation is a typical policy year which is 12 months long.

II. PAID CLAIMS

Paid claims are usually defined as money actually disbursed during the policy year for claims. However, even this simple definition is subject to different interpretations, depending upon when the money is considered disbursed under the company's accounting system. For example, there are at least two commonly used methods of determining when a disbursement has been made. A company might operate its bookkeeping system on the so-called "issued draft" basis, under which a claim payment is treated as a disbursement at the time that a bank draft has been issued for the claimant. On the other hand, a company operating on the so-called "paid draft" basis would treat a claim payment as disbursed only at the time the bank draft has cleared through the normal banking channels and has been charged against the insurance company's account in its own bank. As of any point in time the total accumulated paid claims over the lifetime of the group policy will be higher for a company on an issued draft basis than if such company were operating on a paid draft basis. For any one policy year, other than the first policy year, it would normally be expected that paid claims determined by the two methods would be substantially the same.

The method of accounting does not affect the true policy year incurred claims. Therefore, since the two methods of accounting produce different amounts to be charged against the policy as paid claims as of a given point in time, the method of accounting must also affect the amount of claim reserve required. If more claims have been charged against the case as an actual disbursement, then a smaller amount is needed to be

held as a reserve for future disbursements. Thus, a company changing its accounting system from a paid draft basis to an issued draft basis, or vice versa, would wish to reconsider the level of claim reserves held.

III. CLAIM RESERVES

Claim reserves are established as part of the determination of incurred claims for both annual statement and dividend purposes. In either case, the reserves are designed to perform the following two functions:

1. Allocate to the proper year all payments on claims which were incurred in that year, and thereby produce realistic year to year experience.
2. Hold back sufficient money from surplus to provide for the payment of all future amounts on claims already incurred, even if no further premium is received.

The Part 8 Group Insurance Study Notes of the Society of Actuaries discuss in some detail the determination of reserves required for Group Accident and Health coverage in Exhibit 9 of the annual statement and such reserves are a good starting point for discussion purposes. Briefly, the method described therein is to determine from past experience the percentage of the total amount to be paid on a particular month's disabilities which will have been paid by the end of the month of disability, by the end of the next month, etc. Such percentages would be derived separately for different forms of Accident and Health coverage, such as weekly income insurance, hospital insurance, surgical insurance, etc. A series of such percentages over the last few years will give a reasonable indication of what may be expected in the year for which the statement is being prepared. The claim reserve is established by applying to the amounts paid from date of disability to December 31 the appropriate percentage which will reflect how much money is yet to be paid. Such procedure would be followed separately for each month's new disabilities, and the results added to produce a reserve estimate.

Other methods of determining claim reserves are also used. For example, it is possible to obtain from prior years' experience the total amounts paid after December 31 on all claims incurred prior thereto (including claims incurred in prior years) and express these amounts as percentages of the company's total paid claims in the last three calendar months. A series of such percentages over the last few years will serve as a guide to the appropriate percentage to apply to the last three months' paid claims in the year for which the annual statement is being prepared, to estimate future payments on claims already incurred. Again such percentages would logically differ by type of coverage.

Whatever method is used to determine claim reserves, it is obvious that the real "proof of the pudding" is in the testing, in the subsequent year, of the claim reserve established against the actual claim lag which emerged. Such a test of December 31 reserves used in the annual statement is required in Schedule O of the following year's statement.

Claim reserves established in the dividend calculation may have to be determined by a method different from that used in the annual statement, for at least the following two reasons:

1. Any particular group policy is considerably smaller than the company's over-all business, and the reserve determined for an individual group policy by an annual statement claim reserve formula may fluctuate widely from year to year. This is somewhat a function of the type of formula used for annual statement claim reserves, but it is true to some extent in any formula.

2. Equity between different policyholders requires that claim reserves vary by plan of insurance within a particular type of coverage. Individual cases are to stand on their own feet for dividend purposes and the use of an average reserve factor based on the annual statement formula will produce a reserve which is too high for some plans of insurance and too low for others. Excessive reserves on a particular group case are not available for use on other cases where the reserve is deficient.

To remedy the problem presented by the smallness of the case and its fluctuations in year-to-year experience, it is possible to relate a portion of the claim reserve to some base or index which is more stable than either of the two discussed above for the annual statement. For example, one part of the claim reserve could be equal to a factor multiplied by claims paid in the last three months of the policy year, and another part of the reserve could be equal to a different factor multiplied by a more stable base, such as the premium earned during the policy year or the total claims paid during the policy year. Either of these last two bases produces a claim reserve which is relatively stable, and yet each is related to either the expected or actual claim experience. If a portion of the reserve is based on premium earned for the policy year, it is necessary to adjust the reserve factors in situations where the normal expected relationship of claims to premiums is distorted by size discounts granted to the larger group policyholders or by experience discounts granted to any group policyholder. Of course, a company would have to avoid using a base which achieves complete stability by being unrelated to expected claim lag.

The problems involved in maintaining individual policyholder equity are not simple to resolve. Separate percentage factors for determining claim reserves are required for different types of group coverage, and a large variety of factors for different plans within a particular coverage is complicated. Thus, we must arrive at a suitable compromise between equity and cost considerations. At best, a company probably would go no further than broad groupings of plans within a particular coverage, as the slight variances in the reserve for only minor differences in plan benefits are not accurately determinable. It would seem appropriate to make some differentials by plan, in at least the following areas:

1. Presence or absence of deferred maternity benefits, which could represent a large portion of the claim lag.
2. Short versus long durations under weekly indemnity programs.
3. Low versus high deductibles and maximum limits under major medical coverage.
4. Short versus long durations under hospital and medical plans.

It is within these broad areas that conflicting equity and cost considerations must be reconciled.

There are two other approaches to determining claim reserves for dividend purposes. With respect to claims which have already been reported, and hence are pending as of the end of the policy year, it is possible to make a claim-by-claim estimate of future expected payments, based upon an analysis by trained claims personnel or upon statistical data related to type of disability, age and sex. This process might be quite burdensome if there were a large volume of claims, unless it could be done mechanically as a routine part of a data processing system. However, such an individual claim review may produce more accurate year-to-year estimates, and this method has been used by some companies. In any case, a further estimate is required for unreported claims.

The above-described factor methods of determining claim reserves are based upon a factor determined from the company's over-all experience on a particular group of plans of insurance but applied to a base or index determined from the particular policy on which the reserve is being calculated. If the group case is large enough, it is possible to derive the factor itself from prior years' experience of the same case. Even on a relatively large case, such factor will fluctuate from year to year, and the fluctuation in claim reserves might produce problems in dealing with a policyholder.

As was mentioned in Section II, the level of claim reserves established is dependent upon the accounting system used by the company for determining paid claims. In addition, the claim reserves produced as part of

the dividend calculation, even though determined by a formula which is different from that used in the annual statement, should nevertheless produce approximately the same over-all dollars of claim reserve as the method which is used in the annual statement.

A somewhat different problem is presented by accidental death and dismemberment coverage, on which there is a relatively low claim frequency. Unless the group policy is of large size, some companies may feel it is not appropriate to try to establish a factor relationship to produce estimates for such claim reserves. For this coverage it is possible in most situations to obtain a satisfactory result by deferring the dividend calculation a short time past the policy anniversary, in order to allow late claims to be reported, and then inquiring whether the policyholder knows of other claims to be charged against such policy year. All valid reported claims would be charged against the year's experience, and the relatively small number of claims reported thereafter would be charged against the following year's experience. When it is questionable whether the group policy will renew for the next policy year, it seems appropriate to defer the dividend calculation for a somewhat longer period of time. In situations where the characteristics of the case indicate a probable delay in reporting, it may be necessary to use a reserve determined by formula; this situation may arise on association-type cases.

IV. DETERMINATION OF INCURRED CLAIMS

The first method of determining incurred claims is the one in general use, which follows closely the method employed for converting paid items to an incurred basis in the annual statement. This approach consists of adding to the paid claims for the policy year a claim reserve which is appropriate at the end of such year, and subtracting therefrom the corresponding reserve at the end of the prior policy year.

While the generally used approach does produce an equitable incurred claim picture, it is subject to the criticism that it does not indicate whether the reserve which was established at the end of the prior policy year was a good measure of the actual claim lag which develops. For this reason it may be desirable to consider incurred claims determined as follows:

Claims paid during the current policy year on disabilities incurred during such policy year, plus

claim reserve established at the end of the current policy year, plus

claims paid during the current policy year on disabilities incurred prior to the current policy year less reserve established at the end of the prior policy year.

This second method of considering the incurred claims has the advantage of bringing together for comparison purposes the reserve established at the end of the prior year and the actual amount of claim payments during the current year which arose out of prior disabilities. Thus, the first two components show the incurred claims for the current year and the third component corrects the prior year reserves from an estimated to an actual basis.

With the long benefit periods available under major medical coverage, and the growing interest in long-term weekly income plans, it may be desirable to modify the second formula to recognize specifically the possibility that claim reserves are required at the end of the policy year not only for disabilities occurring in the current policy year but also for those occurring in prior policy years. In this situation a third formula might be described as follows:

Claims paid during the current policy year on disabilities incurred in such year, plus

claim reserve established at the end of the current policy year for disabilities incurred in such year, plus

claims paid during the current policy year on disabilities incurred prior to the current policy year, plus reserves established at the end of the current policy year on disabilities incurred prior to the current policy year, less claim reserves established last year.

For this method the first two components describe the incurred claims on a more precise basis and the third component again acts as a correction of the prior year reserves.

It will be seen that the three methods described above will produce the same aggregate amount of charge for incurred claims. The only differences between them are the manner in which various parts of the incurred claim picture are presented and compared to each other, and the administrative costs of obtaining statistics in the required format. It will be noticed that over a period of years all claim reserves will directly or indirectly be corrected from an estimated to an actual basis, and as the three methods have been presented above such correction occurs in the following year. It is for this reason that such reserves are sometimes referred to as "washable" reserves.

If incurred claims are determined by either the second or third method, each of which specifically compares the claim reserves to the actual claim lag, it is necessary to consider what method should be followed if last year's claim reserves do not equal the actual claim lag against which

they were established (including as claim lag for the third method the current estimate of future payments on last year's claims). The most practical and common treatment for the difference between the claim reserve established at the end of the prior year and the actual claim lag is to charge or credit such difference as part of the determination of dividends for the current policy year. In this manner, such difference is treated as a "balance forward" charge or credit for the current policy year. Although such "balance forward" is an interesting figure to have available, because it tests the adequacy of the prior year's reserve, it nevertheless does not disturb the prior year's dividend experience.

Another possibility is to recalculate the prior year's dividend, so as to substitute the actual amount of claim lag for the claim reserve established at the end of the prior year. This could result in either a larger or a smaller earned dividend for the prior policy year. To the extent that a larger dividend is called for, a company might find itself in the position of having to make an immediate cash settlement. To the extent that a lower dividend is produced, the company would be in the position of asking the policyholder to refund a portion of the prior year's paid dividend. This could present a difficult problem, even if the dividend paid for the prior policy year had been paid with the understanding that it was in the nature of an estimate.

To the extent that the current policy year is earning a dividend in excess of the difference between the claim reserve at the end of the prior policy year and the actual claim lag, the same result would be obtained in each of the two methods of handling such difference. It is true that the two methods will allocate the experience differently to the current and previous policy years, but the experience over the two years will be the same. However, if the current policy year is not producing a sufficient dividend, a recalculation of the prior year's dividend could give rise to the anomalous situation of allowing a refund of the excess reserve (through a recalculated prior year dividend) at a time when the current policy year experience was operating in the red.

In considering the appropriateness of a specific method of treating the difference between the prior year reserve and the actual claim lag, it is interesting to see what result would be obtained if it were not necessary to use claim reserves. In this instance the dividend for the prior policy year would not be determinable until all of the claim payments belonging to it had been made. This would require so long a period of time that it probably is not a practical arrangement in most instances, but it does develop the true picture of the incurred claims for the prior policy year. By waiting until the picture was complete, the employer would receive a

dividend for a given policy year which would be based upon his actual experience during that year. This dividend would be in no way affected by whether subsequent policy years were operating in a favorable or unfavorable position. On the basis of this reasoning, it might seem appropriate, as soon as the actual experience is known, to make immediate settlements, both plus and minus, in areas where the second or third method for obtaining incurred claims is used and the claim reserve for the prior policy year is substantially different from the actual claim lag. The difficulty arising where the final settlement requires reimbursement from the policyholder has already been mentioned.

The foregoing approach assumes in effect that a particular policy year's experience is to stand on its own feet. However, it is fairly general practice in group insurance to have some portion of excess first year expenses amortized over renewal years, and to use a contingency reserve and risk-spread charge which reflects some form of accumulated experience. Thus, there are important areas in which we recognize that each policy year's experience under a Group Accident and Health policy is not complete by itself. In addition, claim reserves, or other reserves, must of necessity be estimates and not guarantees, and, since they are determined as the best available estimate, it seems logical to have each year's experience automatically correct for overstatements and understatements in the claim reserves used in the prior policy years. This points to the use of a "balance forward" treatment of the overstatement or understatement in prior years' claim reserves. Of course, this approach, in the second and third methods of obtaining incurred claims, will produce the same year-by-year results as the first and generally used method, as described in the first paragraph of this Section. In following this practice a company must be sure that its claim reserves are essentially correct and equitable, since an overstatement in such reserve, which is refunded only to the extent that current policy year experience permits, could be viewed as an additional contingency reserve held by the insurance company. To the extent that claim reserves are established below a reasonable level, a strain is put on the company's surplus.

V. POOLING

In recent years, Group Accident and Health insurance has been sold to relatively small groups of employees. This is true not only of package plans written on groups of 10 to 24 lives, but also on standard group coverages issued to groups of 25 lives or more but still of relatively small size. If dividends were calculated for such cases using incurred claims determined by the methods described above, there would be a consider-

able fluctuation in year-to-year experience. This is true not only because the claim reserves would fluctuate, but also because the paid claim experience would fluctuate. Consequently, some companies have adopted a pooled experience approach to the smaller group cases, by calculating incurred claims as though all homogeneous pooled cases were really one large case. Under this approach the incurred claims of the policy, determined by the company's usual methods, are partially or fully replaced by a standard measure of expected incurred claims. This measure might be a percentage of the premium, or some number of dollars per insured life. In either event, the expected incurred claim experience would be determined from the past history on similar size group cases, and could be followed from year to year and adjusted for trends. Such a measure of expected claims would be based upon the average of a block of business, but would vary for different Group Accident and Health coverages. For example, expected claims assumed for weekly income coverage would be different from those assumed for accidental death and dismemberment coverage. This is obviously necessary where a flat amount per life is used as a pooling charge, and it might be necessary even where a percentage of premium measure is used, since premium rates for different coverages do not necessarily assume the same ratio of expected claims to premiums. While it would be possible to differentiate for broad groups of plans within a particular type of coverage, too much refinement may be unnecessary in view of the degree of over-all accuracy of the approach used.

DISCUSSION OF PRECEDING PAPER

J. B. MACDONALD:

While whether a company operates on the "issued draft" or "paid draft" basis has little effect on the true incurred claims, it can be quite important to a Canadian company. Under Canadian law a separate fund must be kept for Accident and Health business. This fund is originally established by a transfer from the company's surplus, and in a stock company it may be increased by further transfers.

The Dominion government applies a solvency test to the A & H fund which in brief compares the assets with 115% of the sum of total liabilities (including the unearned premium reserve) plus an additional 10% of the unearned premium reserve. If a company is not well-established in the A & H field, this test may cause problems. If a company operates on the "paid draft" basis, the drafts issued, but uncashed, must be treated as a liability and so increased by 15% in the test. With the normal amount of outstanding drafts this can be a substantial sum and have a pronounced effect on the solvency test. On the "issued draft" basis this problem does not arise.

In the Crown Life we calculate the Annual Statement reserve for incurred but unreported claims from the premiums collected in the month of December. These premiums are multiplied by the following factors: regular cases with maternity, 2.00; regular cases without maternity, 1.15; major medical cases, 3.00; reinsurance received, 2.80. There has been a general upward trend in these factors, but the ones quoted appear to be adequate. The high factor for reinsurance received is occasioned entirely by one large case.

L. S. WAGENSELLER:

A paper on any aspect of Group dividend computations is welcome, since this subject has received so little attention in the *Transactions*.

One might suppose that the most precise and universally understood figure in a Group Accident and Sickness dividend or experience-rating calculation would be that of incurred claims. Yet we see some rather bizarre sets of specifications or assumptions with respect to incurred claims when we are asked for dividend estimates or projections on potential cases. For example, the expert drafting those specifications may ask for a statement of how much has been included in the company's "retentions" as reserves for unreported claims or for deferred maternity benefits, or other similar items. Yet, perhaps we in the industry are at least par-

tially responsible for some of the confusion on this score among those with whom we deal. Can we have been just a bit too ingenious in devising novel presentations of our figures and practices, with the result that major differences in treatment are implied where they do not in fact exist?

Consider, for instance, the effect on a prospective policyholder of a letter from one company stating that they do not establish reserves for incurred but unreported claims but charge an estimate of such claims and, when their amount becomes known in the next policy year, reflect the resulting credit or deficit in the accounting for that next year. Is it not at least possible that he may hastily conclude that there is a significant distinction between a reserve for unpaid claims and an estimate of them? I believe that actuaries and others in the insurance industry can increase the general understanding of this technical subject by speaking or writing clearly and candidly on it, whenever called upon to do so.

Mr. Pike presents two alternatives to the method most commonly used in developing or exhibiting the amount of claims incurred during a given policy year. He rightfully observes that obtaining the necessary statistics for either alternative would entail some additional administrative costs. It seems to me a further objection to either alternative would be that virtually every policy would develop a corrective adjustment practically every year which might be felt to require justification to the policyholder, no matter how small the adjustment might be. These alternatives carry an implication that it is possible to estimate claim liabilities under each policy with a high degree of accuracy. Fluctuations in experience over short periods of time and the almost limitless variables represented by different groups would make it highly fortuitous if these estimates were precisely borne out in very many cases, even in the large group category. For one thing, the data on which a company bases its factors or formulas for dividend use are frequently the claim lag studies conducted for Annual Statement purposes. These studies may measure well the lag prevalent at the end of the calendar year when mail schedules are generally subject to further delays than at almost any other time of year. Partially offsetting this bias inherent in December 31st data would be a seasonal drop over the holiday period in the claim rate in cases involving postponable hospitalization or surgery. For these and other reasons producing seasonal variations, the results of claim lag studies as of a December 31st date are likely to be only a first approximation to the lags prevailing at policy anniversaries scattered throughout the calendar year.

I had hoped the author might comment on some of the special problems in determining claim reserves under major medical plans. When an individual incurs a series of medical expenses of different types which

qualify for benefits under that type of plan, it is often not readily apparent whether those benefits constitute one claim or more than one. This decision is naturally fundamental to the determination of incurral dates, on which all our statistics for Annual Statement and policy year claim reserves are based. Since the bills for medical expenses may come in from different sources (doctor, hospital, surgeon, etc.), they can be received in a different sequence from that in which the services were rendered, and can bear varying diagnoses, thus sometimes making more difficult the decision as to which expenses are truly related.

This question of what constitutes a claim is of particular importance in cases where the benefits available under the plan have some attributes of a disability annuity for a term of 3, 4 or possibly more years. An employee or dependent may have some chronic or recurring condition—not necessarily disabling—which requires medical attention at more or less regular intervals, year in and year out. As a result, benefits may be payable year after year, subject only to any limits in the plan on maximum benefits for a calendar year or other twelve-month period, and to a lifetime maximum. Also, the benefits payable would be subject to reimposition of the deductible clause annually under a plan with a calendar year or other specified benefit period.

Here the carrier must decide whether all future benefits payable on account of that condition constitute a single claim or whether they represent a series of separate claims, each of which starts with a satisfaction of the deductible provision. If the former, the claim liability set up at the end of the year of inception of the claim (and each year-end thereafter) should make provision for all future payments on that claim, not just those payable before the end of the calendar year or other benefit period. By so doing, the full cost of the claim is, in effect, assessed against the premium for the year in which it originated and, while this might seem somewhat harsh where coverage with respect to the claimant is kept in force by continued payment of premiums, it would appear to be the sounder course. Unless claim reserves are set up on this basis as each such claim arises, the accumulation of a number of such claims under a policy as the experience matures could ultimately pose a threat to the financial stability of the plan and the premium rates charged. Clearly, where the plan provides a maximum amount of benefit applicable to each illness or disability, the claim liability should take into account all future payments for any given disability.

Technically, an insurer could adjust its evaluation of potentially long duration major medical claims to a terminated policy basis, where that basis produces a smaller liability under the terms of the plan. For example,

one plan we have written provides that if an employee or dependent is totally disabled when insurance is terminated, expenses for medical services received up through the end of the calendar year following the year of termination will be considered for benefit payments. If it were assumed that no further premiums were payable under the plan after the valuation or dividend date, the claim liability for medical expenses arising thereafter would be limited to benefits payable for services received within no more than two years after such date, and only with respect to persons totally disabled on that date. Such assumption would be consistent with the specific requirement of the Convention Blank Instructions that Exhibit 9, Part 1 claim reserves "should be set up on the assumption that all insurance under policies containing an extension of benefits will be terminated on the statement date." However, this requirement was inserted not too many years ago, probably with a view to having carriers recognize and provide for a contingent liability under weekly benefit, hospital and surgical plans then prevalent which they might not otherwise have been inclined to consider. Under these circumstances, it would seem to be more of a minimum requirement than a maximum one.

Carried over into the area of dividend computations, the sounder practice would likewise seem to be to have the claim reserves reflect a "going group" philosophy rather than the "terminated group" one. Otherwise, there could be the danger of effectively overpaying dividends in the early years of a plan and having the resulting favorable net cost serve as a basis for plan liberalizations or rate adjustments which could not be maintained comfortably in later years after the experience had become more mature. Both the carrier and the policyholder have a common interest in the continued financial stability of a Group major medical plan and this interest bespeaks a reasonably conservative approach to the determination of claim reserves in early years of a plan of insurance which is still in the developmental stages.

FRED H. HOLSTEN:

The appearance of this excellent paper in the *Transactions* should add a good deal of authority to concepts that we have individually been trying to get across to policyholders and other nonactuaries. My discussion does not contribute anything further in this respect, but, instead, offers a mathematical approach to the matter of dividend claim reserve formulas, factors and bases. Simplifications and approximations would usually be made afterwards for practical application, but meanwhile a mathematical discipline has facilitated an orderly and consistent analysis of the problem.

In many respects, the approach is similar to that which has been proved most helpful in electric circuit analysis and other physical problems. One would start by picturing the entire chain of events, from incurral of a claim to the recording of its payment in the experience account maintained for the group, as a physical system which is essentially linear in behavior—that is, its basic lag characteristics are not affected by variations in claim load. Insurance companies are generally prepared to handle fairly extreme variations in claim load without significant additional delay so that, barring extreme and prolonged epidemics and disruptions in other elements of the system (for example, labor troubles at the policyholder end, unusual mail delays, and banking channel disruptions) this requirement of essential linearity should exist for all practical purposes.

Next, one would define the characteristics of this system by means of a function, $a(t)$, which gives the annual rate of claim payment at time t (in years) resulting from an annual rate of claim incurral represented by a unit step function, $s(t)$—that is, a function which is zero for $t < 0$ and has a value of unity when $t \geq 0$. The $a(t)$ function can be readily pictured as one that is zero at $t = 0$, remains so for a time, then gradually starts to grow with increasing rapidity at first but later more and more slowly, and finally levels out at a value of unity.

The difference between $s(t)$ and $a(t)$—designated as $b(t)$—is therefore the annual rate at which claim liability is built up in the system in response to a unit step function. Ignoring negative values of t as being of no interest, we have:

$$b(t) = 1 - a(t).$$

The accumulated claim liability and accumulated claims paid up to time t with the unit step incurred claim input would be respectively:

$$B(t) = \int_{t=0}^{t} b(t)\, dt$$

$$A(t) = \int_{t=0}^{t} a(t)\, dt = t - B(t).$$

Having the function $a(t)$—or its complement $b(t)$—for a given system (that is, a combination of a given claim administration method, type of benefit, and other variants that it is felt desirable to recognize), the annual rate of claim payment response ($k(t)$, say) of this system to *any* annual rate of incurred claim input ($i(t)$, say) which is zero when $t < 0$ can be obtained by superposition of all the infinitesimal unit steps (positive or negative) into which $i(t) - i(0)$ breaks down, giving:

$$k(t) = i(0) \cdot a(t) + \int_{x=0}^{t} i'(x) \cdot a(t-x) \, dx,$$

where

$$i'(x) = \frac{d}{dx} i(x).$$

Since

$$i(t) = i(0) + \int_{x=0}^{t} i'(x) \, dx,$$

the annual rate of change in claim liability is then:

$$w(t) = i(t) - k(t)$$

$$= i(0) \cdot b(t) + \int_{x=0}^{t} i'(x) \cdot b(t-x) \, dx.$$

The accumulated claim liability is:

$$W(t) = \int_{t=0}^{t} w(t) \, dt$$

which, after substituting for $w(t)$, reversing the order of integration to reduce the double integral, observing that $B(t)$ is zero for values of $t < 0$, and integrating by parts, gives:

$$W(t) = \int_{x=0}^{t} i(x) \cdot b(t-x) \, dx.$$

(This, as well as the expressions for $k(t)$ and $w(t)$ can be expressed in other forms by making a change in variable or by integrating by parts.)

The accumulated claims paid with this general incurred claim input would be:

$$K(t) = \int_{t=0}^{t} k(t) \, dt = I(t) - W(t), \qquad \text{where } I(t) = \int_{t=0}^{t} i(t) \, dt,$$

$$= \int_{x=0}^{t} i(x) \cdot a(t-x) \, dx.$$

The general approach to valuing the claim liability at a given time for a particular situation, or of arriving at a working formula for a general class of situations, would then be:

(1) Determine the function $b(t)$ for the claim administration method, type of benefit and other variants thought desirable to recognize. In general, $b(t)$ will be in the form of a table of numerical values, although possibly an empirical mathematical function may be found which reasonably reflects its characteristics.

(2) Determine a reasonable relationship between $i(t)$ and some measurable data available for the group.

(3) Use (1) and (2) in the $W(t)$ formula and apply approximate or numerical integration to arrive at a practical result.

Step (1) could be based on data giving the response of the system to a known type of incurred claim input—for example, data of the form appearing in the Part 8 Group Insurance Study Notes as described by Mr Pike. Here, by combining data for all calendar months of incurral that have experienced their complete run-outs of paid claims (if necessary, more of the data may be utilized by completing, by comparison, the run-outs for other months of incurral) there is obtained, for a given dollar amount, I, of claims incurred in a given month, the accumulated amount of paid claims to the end of that month, the next month, etc. In other words, setting $t = 0$ at the beginning of the month of incurral, we would have $K(\frac{1}{12})$, $K(\frac{2}{12})$, etc. Assuming claims to have been incurred uniformly over the month of incurral, the function representing the annual rate of incurred claims entering the system is

$$i(t) = I \div \tfrac{1}{12} = 12I \qquad \text{for} \qquad 0 \le t < \tfrac{1}{12}$$

$$= 0 \qquad \text{for} \qquad t \ge \tfrac{1}{12}.$$

While the formula for $K(t)$ could be applied, it is apparent that $i(t)$ consists of the difference between two unit step functions with the steps one-twelfth of a year apart. The accumulated paid claim response is the superposition of the two responses to each of these two terms separately, *i.e.*,

$$K(t) = 12I \cdot [A(t) - A(t - \tfrac{1}{12})].$$

(Note the second term $= 0$ for $t < \tfrac{1}{12}$.)

Equating the formula values to the observed values ($\bar{K}(t)$, say) there are then obtained in turn for the tabulated values of $A(t)$:

$$A(\tfrac{1}{12}) = \frac{\bar{K}(1/12)}{12I}, \qquad \text{since } A(0) = 0,$$

$$A(\tfrac{2}{12}) = \frac{\bar{K}(1/12) + \bar{K}(2/12)}{12I}, \qquad \text{etc.},$$

whereupon tabulated values of $a(t)$ are obtained by approximate numerical differentiation; and $B(t)$ and $b(t)$ values follow from basic formulas.

Step (2) would generally consist of relating $i(t)$ to some measure of the

exposure at t—such as the annual rate at which premium is being earned, $P(t)$—multiplied by the expected ratio of claims to this exposure, $q(t)$. In general, $q(t)$ can be expected to vary somewhat with t (because of seasonal variations, for one thing) and takes on an individual value for each group. However, in practical application it could, for smaller groups at least, be assumed constant (q) over the period that most of the liability is developing (e.g., the recent few months on most types of Group A & S benefits) and could be based on over-all experience for the benefit involved rather than the individual group's experience. For further practical purposes on smaller groups (at least where the premium has not changed much over the last 12 months) it could also be assumed that $P(t)$ is constant over the liability development period at a value equal to, say, the last 12 months' premiums (P)—an item of data already available for dividend purposes. All factors in $i(x)$ would then move outside the integral in the general formula for $W(t)$, leaving

$$W(t) = q \cdot P \cdot \int_{x=0}^{t} b\,(t-x)\,dx$$

$$= q \cdot B\,(t) \cdot P\,.$$

In the most common situation, t would have values of 1, 2, etc., at successive dividend determinations, and for most benefits the $B(t)$ values—even $B(1)$—would be essentially equal to, and could be taken as, the ultimate value $B(\infty)$, so that $W(t)$ would be the product of a factor depending only on benefit and plan and the last 12 months' premium (with more than one benefit under a coverage having premium P, the sum of the individual benefit factors would be used). However, for certain long lag benefits—such as major medical—allowance could be made for $B(1)$ being significantly less than $B(\infty)$ in the claim reserve factors.

Of course, when durations of less than one year are involved, modifications introducing duration would also have to be made even in the case of relatively short lag benefits. Modifications would also have to be considered for application to groups where $P(t)$ had changed substantially during the previous 12 months.

For larger groups the actual claim ratio experience of the individual group might be introduced. One method of doing this would be to assume that (for purposes of obtaining claim reserve formulas and factors) q could be obtained by relating the last m months of paid claims (where m could, for example, be taken as 12) to m months of earned premiums during a period set back from the paid claim period by a number of months equal to or a bit less than the average lag in months between claim incurral and claim payment.

It is interesting to note that $B(\infty)$ is exactly equal to the average lag in years (L) from the date of incurral to date of payment. To show this, consider a unit of claims incurred uniformly over s years. The average annual rate of claim incurral will be $1/s$ and, following the method previously used when s was $1/12$, we have:

$$k(t) = \frac{1}{s} \cdot [a(t) - a(t-s)].$$

If s now approaches zero, there is obtained as the annual rate of claim payment at time t in response to a unit of claims incurred at $t = 0$:

$$k(t) = a'(t),$$

where

$$a'(t) = \frac{d}{dt} a(t).$$

The claims paid between t and $t + dt$ are thus $a'(t)\, dt$, so that the average lag in years is:

$$L = \int_{t=0}^{\infty} t \cdot a'(t)\, dt.$$

Integrating by parts, and using the previously given relationships for $a(t)$ and $A(t)$,

$$L = [B(t) - t \cdot b(t)]_{t=0}^{\infty}.$$

From the known characteristics of the situation, it will be noted that as t approaches infinity, $b(t)$ must approach zero at a more rapid rate than $1/t$, so that $L = B(\infty)$.

It is also interesting to note that if the rate of claim incurral, $i(t)$, has been changing uniformly (that is, has been a linear function t) for some time, the rate of claim payment, $k(t)$, will tend to reflect the rate of claim incurral L years before—that is $i(t - L)$. This can be demonstrated quite readily by direct application of the general formula for $k(t)$, applying other basic relationships, and then letting t become large.

Also, as previously indicated, the $a'(t)$ function gives the rate of claim payment in response to a unit of claims incurred at $t = 0$. The maximum of this function will almost invariably occur when t is less than L, so that the incurral of a given amount of claims at a given time will, in general, be reflected most strongly at a time somewhat less than L years later. This consideration and that of the preceding paragraph furnishes a rough sort of justification of the previously indicated basis for approximating q on larger groups.

One final point: It is not essential to determine factors and formulas for the entire claim liability in one operation. In the case of certain benefits —deferred hospital maternity is an example—it might be more convenient (and better suited to the dates kept on the claim records) to consider only the liability from the date the claim "qualifies." This latter date is the date the claim satisfies all requirements necessary for it to qualify for accrual of benefits (entry into the hospital, in the example cited). The liability between the date "incurred" and date "qualified" would then be determined separately. (This separation was formerly required in Exhibit 9 of the Annual Statement.) In this case $i(t)$ would be the annual rate at which claims are *qualified*.

Similarly, it might be convenient to determine the response at some earlier stage than final claim payment accounting. For example, in the case of the Waiver of Premium benefit under many Group life policies, it would be more convenient to determine the lag only up to the date the claim is *reported*,—and so define $k(t)$, $w(t)$, $W(t)$, etc.—and to measure separately the liability for reported but still unpaid claims by the familiar valuation methods based on a disabled life continuance table.

<div style="text-align:center">JAMES B. ROSS:</div>

Mr. Pike has produced a very readable paper which draws together in one place most of the qualitative aspects of Group Accident and Health claim reserves and incurred losses. This paper might well be practical "required reading" for personnel actively engaged in Group actuarial or Group renewal underwriting work.

In the section dealing with "Paid Claims" Mr. Pike distinguishes between the "issued draft" and "paid draft" bases. Drafts, of course, need not be employed and a number of companies use checks as the claim payment instrument. Beyond this it is possible to account for Group Casualty claim payments in ways other than the "issued draft" or "paid draft" methods.

One company maintains in its Trial Balance as "paid Group Accident and Health losses" figures which represent the total of claim vouchers processed completely through the Group Casualty claim paying system. In order to qualify for entry on the company's books the claim payment must have been completely audited, and a punched card created therefor. This has the disadvantage that the financial transactions between the company and the various banks with which it does business are not in accord with the internal Trial Balance indications of "paid Group Accident and Health claims"; this is of some concern because the machinery of the banking system operates more rapidly than the company's checking

and auditing machinery, so that at any moment of time the accumulated Group Accident and Health claim account as shown in the Trial Balance is understated when compared with the total of checks or drafts cashed at the banks. The claim reserves, while calculated by conventional methods, do recognize this disparity and make full allowance for accumulated lag. Thus it is possible to construct accurate incurred figures on both a calendar year and a policy year basis.

This approach to Casualty claim accounting does have some distinct advantages as against either of the methods Mr. Pike discusses. The splits by state and by incurred date of the paid Group Accident and Health claim account required by the Annual Statement can be conducted without approximation by analyzing the punched cards which support to the penny the company's Trial Balance claim account. For internal control records by minor line of coverage the paid claim disbursements on each line total to the aggregate Group Accident and Health claim disbursement. Of course, the paid claims which enter into the experience settlement with each policyholder balance in the aggregate to the paid claims shown by the company Trial Balance.

Under "III. Claim Reserves," Mr. Pike indicates that one approach is to examine the experience for several prior years for amounts paid after December 31 on all claims incurred prior thereto. This approach does not take full advantage of the considerable volume of claim run-out experience which does not happen to cross the year end. Generally speaking, I should think it more desirable to follow the first method outlined, which utilizes the entire run-out experience. The concentration of attention at the December 31 mark overlooks to some extent the problem of determining claim reserves at the conclusion of the various policy years, an important desideratum since financial settlement with the policyholder is dependent on this item. The Group Accident and Health business varies seasonally, however, and the run-out experiences of claims incurred in the various months are enough different to warrant special attention. For Annual Statement purposes then, since the factors derived will be applied only to the subsequent December 31 situation, there is some merit in looking only at the experience centering around the end of the year.

Mr. Pike touches on a very intriguing idea when he says: "With respect to claims which have already been reported, and hence are pending as of the end of the policy year, it is possible to make a claim-by-claim estimate of future expected payments, based upon an analysis by trained claims personnel or upon statistical data related to type of disability, age and sex." As Mr. Pike points out, companies running a large volume of Group Accident and Health claims must throw out any formalized program of individual claim scrutiny by trained claim personnel. Individual

claim "tabular reserves," analogous to the tabular reserves held on disabled life income claimants, could theoretically be constructed by large-scale data processing equipment from the accumulated history of the individual claim to date. Mr. Pike mentions that such an approach might take account of type of disability, age, and sex; it would seem desirable in such a program to take account of maximum benefits payable and any information which could be relayed to the computer as to the status of the claimant at the date of last payment. For example, if claims are paid in the field, the field claim personnel may have a strong feeling from the papers that all the bills are in. On such claims no reserve need be held. However, it would appear foolhardy to adopt a claim reserving system using electronic data processing equipment in which the subjective opinion of the field claim examiner as to the probability of future payments played any *major* role.

To implement such an individual claim reserving system would require that the separate payments on a particular claim be assembled from what could be very widely distant sectors in the claim accounting system. For example, a claim incurred in January might have a first payment in January, a second in February, and a third in August. Under this seriatim approach it would be necessary to assemble all three payments at the time of the August reserve calculation to properly compute the tabular reserve. There are substantial practical problems involved in assembling basic data for use in the tabular reserve tables; such data when obtained can be useful in other fields, such as structuring the initial gross premium scale for the various coverages.

The seriatim method, while subject to the criticism that reserves for incurred but not reported claims must be separately estimated, has two striking advantages:

1. Reserves are associated with individual claims and can therefore with precision be allocated to policyholder, minor line of coverage, incurred month, state, or whatever classification of experience is under study.
2. The substantial time required to fully develop the incurred experience of a single month can be dramatically reduced under this approach, since the initial reporting of claims is quite prompt and in general nearly all the first payments on a company's Group Casualty claims will be made within three or four months of the incurred date.

(AUTHOR'S REVIEW OF DISCUSSION)

BERTRAM N. PIKE:

Mr. Holsten has given us a fine mathematical demonstration of the theory of claim reserves. His presentation is so clear and concise that there is little that can be added to it. It was especially interesting to see

how the generalized mathematical treatment automatically compensates for the fact that claims may not reach their ultimate rate of payment during the first policy year. In major medical and long-term weekly indemnity coverages this is a very likely situation, indicating that first year claim reserves are not at the ultimate dollar level or ultimate percentage of premium level.

Also of considerable interest is Mr. Holsten's demonstration that the ultimate level of the claim reserve is equal to the average lag in years (L) from date of incurral to date of payment. By the same token, a company changing from a paid draft accounting system to an issued draft accounting system would be able to make a reduction in ultimate claim reserve levels equal to the average difference in years (L) between dates of charging the claim as paid under the two accounting systems.

Many of us would like to second Mr. Wagenseller's comments with regard to an increasingly common misconception of claim reserves as "retention." Such an argument would be plausible only if a company held excessive claim reserves. In that situation there is a "retention" element to the extent that the policyholder suffers a loss of interest on that portion of the claim reserves which is excessive. The excess reserve itself would serve in the capacity of a contingency reserve. Under most circumstances the excess reserve would be refunded through the normal operation of the dividend formula if a case in this situation were to lapse. Thus, the "retention" element in claim reserves would be nil so long as reserves continue to be set at realistic levels.

Mr. Wagenseller has quite properly pointed out that there is at least one situation in which the assumption of a terminated policy status might produce a lower reserve than the assumption of a continuing policy status. It is well that this situation be noted, as ordinarily we would be inclined to think of the terminated policy status as always producing the maximum reserve. While the terminated policy status may well produce a proper reserve protection against lapse, it does not completely recognize the other reason for claim reserves, namely, a proper year-to-year allocation of experience, and may overpay early years' dividends.

It might be well to mention briefly a situation which arises occasionally, namely, the case of the policyholder who requests the use of paid claims for dividend purposes. In exchange for this, the policyholder agrees to a contract provision providing for a retroactive premium in the event of lapse of the policy, and recognizes that there will be an additional "retention" charge while the policy is in force, to reflect the loss of interest earnings on the claim reserve which normally would be held on other comparable cases. If the policyholder is a good credit risk, the right to collect

a retroactive premium may be a proper protection against lapse. While this approach does not properly allocate claims by year, it is questionable whether this omission is serious if the policyholder understands all aspects of the question. In many respects the decision to offer such an arrangement must be based on credit evaluation. There are cases which an insurance company is prepared to accept on a standard basis, but which it does not consider to be acceptable credit risks for reserve purposes.

Mr. Wagenseller points out some interesting problems arising on claim reserves for major medical coverage. This is a troublesome area, because this coverage embraces plans which on one end of the scale are close to basic types of hospital-surgical-medical plans and on the other end of the scale are indeed catastrophe coverage. One special feature of major medical reserves arises because the coverage is written with a $5,000 or $10,000 maximum and there can be a wide fluctuation in future payments on incurred claims and hence a wide difference between future claim payments and any reserve which is computed on a formula basis. This might point to a claim-by-claim evaluation of potential liability, at least for pending claims. Unfortunately, major medical coverage has not yet developed enough statistical data to allow many companies to make an intelligent analysis of future payments, even on a claim-by-claim basis. In view of this, it seems desirable to hold a reserve calculated on fairly broad assumptions, but at a relatively high level, until such time as we have built up enough statistical information to adopt a more refined approach.

It was not my intention to advocate use of the second or third method of determining incurred claims, as set forth in the paper, but rather to show that these methods, which develop incurred claims from the basic definition thereof, are equivalent to the practical calculation method in use by most insurance companies. I agree with Mr. Wagenseller's comment that even small adjustments would give rise to time-consuming proof of their size. Claim reserves basically are estimates, and should be recognized as such, with the understanding that the generally used method of calculating incurred claims will iron out any deviation of actual from expected figures of prior years.

I should also like to thank Mr. MacDonald for pointing out an area of difference between paid and issued draft accounting systems, which could have an effect upon the solvency test of Canadian companies.

As Mr. Ross has pointed out, there are alternatives to the "issued draft" and "paid draft" accounting systems. The method which he has described puts emphasis on one more step in the internal accounting system of the insurance company, namely, the audit function, by which some errors will be discovered before the claim payment is actually charged as

a payment on the company's books. Some people might question the necessity of introducing this step before charging the claim as paid, as a correcting entry on a relatively small number of claims could be put through if an error were found on a claim already charged as paid. As he pointed out, the method described by Mr. Ross for charging claims as paid requires a corresponding reserve adjustment. It is, perhaps, a matter of preference, but dealings with policyholders may be easier under an accounting system which charges paid claims as soon as possible and calls for the lowest reserve estimate. I believe that the breakdown of claims by state, incurred date, and minor coverage, and an exact reconciliation with the Trial Balance, are possible under any of the normal accounting systems so long as the method used to charge claims for individual cases is the same as the method for charging such claims in the company's Trial Balance.

Mr. Ross has observed that claim lag over a calendar year end is different from claim lag over other specific dates throughout the year. There is a significant difference in dollar levels of claim lag over different dates throughout the year, but there should be a somewhat smaller variation in such lag when it is expressed as a percentage of the last three months' paid claims. A large share of the claim lag on most coverages arises out of claims incurred in the preceding three or four months and recent claim payment levels may be a good measure of new incurrals. Of course, having reserve factors which vary during a year must also be considered in terms of administrative complexity, although in the era of EDPM equipment this may no longer be a serious deterrent to introducing a seasonal fluctuation factor.