

VALUATION WITH ELECTRONIC DATA  
PROCESSING MACHINES

- A. With electronic equipment (1) is it feasible or desirable to compute reserves for exact durations rather than on the traditional mean basis; (2) what are the relative advantages of the different traditional methods of valuation (group, attained age, retrospective, and seriatim); (3) what other methods are available?
- B. What changes, if any, are companies contemplating in the methods used to obtain policy reserves as a result of the introduction of electronic equipment? What problems are associated with these changes?
- C. What reserve verification procedures are appropriate for use with the new electronic equipment?
- D. To what extent is it feasible with electronic machinery to integrate valuation functions with other operations such as premium billing and accounting, dividend calculations, etc.? What are the factors that may limit the degree of such integration?
- E. If policy reserves are obtained by the use of electronic machines, how would supplementary information (such as mortality and lapse studies, plan and age analysis, etc.) now obtained as a by-product of the valuation procedure be obtained?

MR. R. E. SLATER, speaking with reference to a UNIVAC or IBM 705, stated that it is both feasible and desirable to compute reserves for exact durations if this merely means the elimination of the deferred premium asset item. If, however, it means the elimination of mean reserves altogether, and the use of the exact issue date for every policy, while possible, it is questionable whether it is desirable. It could have a serious effect on the surplus and even solvency of some companies if a large amount of business was written just before the year-end. Mr. Slater suggested a preferable move for increased valuation precision would be towards a gross premium valuation.

He pointed out that as the John Hancock intends to use UNIVAC primarily for premium billing and accounting the seriatim method is preferable for premium-paying policies, as the valuation is a by-product when the tapes are processed. For other policies a group method appears best for his company.

MR. M. V. DONOVAN pointed out that appreciable deviations from a uniform distribution of issue within a calendar year can be reflected more easily than by the expensive procedure of exact duration valuation. He stated that the best valuation method is the one that can best be integrated with the particular company's operating requirements.

The Metropolitan has been operating UNIVAC for the past year. They are at present following their normal preliminary valuation method and applying, at the year-end, valuation factors obtained by extrapolation from the preliminary valuations. A single detailed valuation near the year-end, adjusted by approximations for the balance of the year, was not considered practical for this year. A big problem of such a valuation would be the very short time available for its review.

The Metropolitan is exploring the possibility of integrating policy servicing and record keeping with valuation, using twelve monthly in-force files to be processed annually during the policy anniversary month. At the year-end, subsequent transactions would be processed and a net reserve adjustment calculated.

He pointed out that great care must be exercised in handling and storing consolidated records on tape. He also emphasized the need for a sufficient depth of trained electronics personnel to enable the computer to work an extra shift when necessary.

With reference to section E, he stated that he expected that the techniques adopted by his company for developing supplementary information under an integrated system using electronic equipment would be similar to those now used.

MR. W. A. KRAEGEL stated that the Northwestern Mutual contemplates obtaining policy reserves on magnetic tape using their present group method. They propose to up-date their groups monthly, using the output of the up-dating of the policy data tape record. The valuation tape will include the terminal reserves, which will be up-dated annually by accumulation and used at year-end to get the mean reserve.

If the group, attained age, or retrospective valuation methods are used, the verification procedures appropriate for punch card systems can be used. With the seriatim or exact duration methods verification must be on an individual policy basis by simultaneous calculation by different methods and by spot checking manually for systematic errors or errors in programming.

If the basic tape record is used for billing and dividend calculation, it may be in numerical order and thus a group valuation method could not be integrated with it. With an integrated seriatim method in which the accumulated terminal reserves form part of the basic tape record the valuation totals could be obtained but not the in-force totals used for mortality and other studies. This problem is an objection to such integration.

MR. M. R. CUETO indicated that he feels that for a large company the group method of valuation has very definite advantages, one main

reason being the resulting availability of supplementary information for mortality and lapse studies. Another advantage is that dividend calculation can be integrated with such a method. Dividend rates can be calculated for later application to the detail dividend file, and the estimate of liability for dividends in the subsequent year can be obtained. He feels that at present a great saving in machine time will result from this group method of dividend calculation as compared with calculation for individual policies in random order. Premium billing and accounting do not appear easily integrated with valuation for a large company. One limiting factor is the amount of activity in the particular file over the year, and another is the amount of sorting required. Data on tapes are not easily sorted.

MR. A. D. MURCH agreed that there is no "best" method of valuation for all companies. In the Prudential they expect to have tape files of individual policy valuation particulars in premium billing order. They considered seriatim valuation during regular billing runs of this file, but decided against it for various reasons. Among these were the increase in file length which would have been necessary and the limitations on the capacity of the computer. They decided to combine individual policy valuation files with the billing and accounting files, but to perform the actual valuation functions during separate valuation machine runs. The policy file will exclude reserve and other actuarial factors. The valuation runs will involve these factors, however, as well as summary valuation totals up-dated by transactions supplied from the billing and accounting runs. The basic group method of valuation will thus be retained. The group method permits economy of machine storage and hence allows consolidation of many allied functions as part of the valuation runs. They plan to produce exhibit totals, exposures and deaths in various mortality categories, items for the analysis of increase in reserves, and net deferred premium asset figures.

With regard to C, his company plans to use certain programmed systems checks, as well as built-in machine check devices. As part of each run, end of run reserves will be automatically compared with beginning of run reserves adjusted by independently calculated net premiums, required interest, cost of insurance, and net reserves released on transactions processed during the run.

He suggested that a change in the reserve verification procedures used by many insurance departments is clearly indicated where a company employs electronic data processing equipment for valuation, because (1) the operating accuracy possible with such machines should be very high,

and (2) improved methods of valuation may greatly increase the amount of arithmetic performed in getting the reserve figures.

MR. H. F. ROOD said that he felt the valuation procedure adopted would depend on the extent of integration. It is the Lincoln National's opinion that a tape machine can be justified for them only if they integrate accounting and actuarial procedures into one operation. The plan they are considering has one master tape file (plus a name and address file) which would replace twelve current files. It would carry the information necessary for billing, for reserves, for calculation of all policy values within a reasonable range of durations, and for turning out the usual asset and liability items including deferred premiums.

They are considering a daily processing of the entire file. This would permit obtaining from this file the policy status and necessary information for handling current policyholder service requests. Each policy would be up-dated on its anniversary. Individual reserves and CSO cash values would be on a seriatim basis and would be carried forward by accumulation, storing only the  $q_x$ 's.

Verification involves the individual policy reserves and the accuracy of the summation. As the individual reserves are to be used for cash values and dividends, any major discrepancy would soon come to light. They haven't finally decided on what checks to use, but they are considering such approaches as: (1) compare final values for consistency from year to year; (2) in the up-dating include reserve rate factors from time to time and compare the results; (3) use gain and loss methods on the anniversary cases being processed each day in total to see that the "cost of insurance" is a reasonable proportion of the business in force. Running totals of the reserve summations would be maintained for various breakdowns and at least once a year such totals would be checked by inventorying the file. They expect that print-outs of all transactions would have to be made in small enough groups to facilitate any reconciliations, at least for a time until more experience is gained with the machines.

In connection with section B he stated that the personnel and organizational requirements for the whole program are much larger problems than the technical ones associated with a change to a seriatim valuation method.

On section A he said that since many companies will not have computers, those that have should continue to produce figures similar to those produced in the past, including mean reserves and deferred premium assets.

On section E he said that supplementary information would be obtained much as by punch cards, only faster. Because of the sorting in-

volved, there may be no economy achieved here, but more information may be obtained, as for instance gross premium valuations for blocks of policies. These would be used to check the basis of valuation and to achieve more equity in dividend distribution.

MR. G. O. HEAD stated that the U.S. Life has an IBM 650 without tape. He commented that traditional valuation methods were influenced by verification considerations and that the various grouping methods had been devised to take advantage of the relative cheapness of sorting over multiplication. With the new machines the position is reversed.

They will continue to use the seriatim method as they would only average three policies per group under the group method. They will store  $q$ 's on the magnetic drum and carry net premiums on cards. The master cards for their integrated procedure would be by issue day and policy number. The file will consist of the premium master, one or more valuation cards, a dividend card for each participating policy, and, if applicable, one or more loan cards and one or more advance premium deposit cards. Thus consolidated, their records should be easy to keep in balance. Valuation output cards will be used for supplementary analyses.

MR. J. W. RITCHIE, discussing section A, said that the Sun Life of Canada favors the use of exact durations because: (a) the resulting reserve is more correct, (b) deferred premiums are eliminated, (c) valuation reserves can be made an integral part of the accounting system, (d) a major improvement results in the accuracy of financial statements prepared at intervals during the course of the year.

The minimizing of sorting under a consolidated functions approach requires that the record file be maintained in the order convenient for premium billing. In his company this means by branch office in policy number order. They would obtain seriatim reserves using Fackler's accumulation formula. The periodical increase in reserve will be calculated on the policy anniversary and applied according to the frequency of premium payment to obtain valuation reserves for exact durations.

With regard to section C, he suggested that the integrated seriatim method will facilitate verification of the change in reserves during the year. Spot checks will be easy to carry out and extensive computer programmed checks may also be made. His company has already used programmed checks involving a recalculation of the net premium by an alternative formula and a complete reaccumulation of the reserve from the date of issue to the date of check.

They are hoping that the insurance departments concerned will abandon the complete arithmetical check of valuation reserves and will substitute test checks covering inclusion and amount. Such a test check

might, in the case of his company, be on the basis of one or more sample branch offices for which the reserves on the year-end record tapes could be listed policy by policy.

Their approach involves a system under which changes enter at one point to up-date all records, and also, except for agency commissions, a fully integrated record. It brings together premium billing, and the calculation of dividends, dividend options, policy loan interest, loan balances, nonforfeiture information for branch use, and valuation reserves. Among the advantages which flow from the integration of valuation calculations are that (a) a minimum of record files and manipulation of records is required, (b) valuation reserves can be made a part of the accounting system, (c) the effect of default in premium under extended term or automatic premium loan may be predetermined at the due date, and (d) financial statements can be prepared for individual branch offices—a useful tool for management. The factors which may limit the degree of integration in any company are: (i) the existing organizational setup, (ii) the attitude of insurance departments, (iii) reluctance to rely on a single record (in his company a history card will be maintained in the branch office), and (iv) loss of supplementary information.

In speaking on section E he pointed out that in his company's approach new business is treated as a change and therefore new business analyses will be obtainable from the punched cards used to prepare the change tape. Moreover, it should be easy to take off special information for dividend change cost estimates, and lapse and simple mortality studies during the regular combined operations run. If a separate file is to be maintained, they feel it should be a mortality investigation file, not a valuation file, because there is little advantage gained by integrating a mortality investigation file. Such a file has a minimum of duplication with the main file and contains many dead records. Such a file could be up-dated by using the same change tape as is used for the main file and could be used for other purposes such as lapse studies.

MR. H. J. STOWE said that the Manufacturers Life plans to use a 650 with card input and output, and to integrate the valuation and dividend routines. The file will be in valuation basis order and because of the limited capacity of the machine and the complexity of their business it is doubtful whether any further operations could be combined.

With regard to section E, he stated that they need only particulars of sums assured for lapse studies and plan and age analyses and they will obtain these from the policy account movement file. He suggested that if information is not readily available there is less temptation to waste time and effort producing statistics that are of doubtful value.

MR. F. J. ONSTINE pointed out that with electronic equipment page 6 of the annual statement can be computed exactly instead of having one item such as the tabular cost of mortality as a balancing item. A surprising number of items normally get thrown into this balancing item that have to be tidied up if all items are computed exactly. Two examples which he mentioned are prior-dated new business and negative reserves. He thought that an exactly computed page 6 would be a very useful tool for actuaries in the future.

MR. L. F. SLEZAK suggested that the life insurance industry, being old, well-established, and very conservative, should be careful to look at electronic machines with the thought that new procedures may be desirable. He recommended exact duration reserves and estimated that the reserves for the Occidental might change as much as \$2,000,000 in a total of \$250,000,000 as a result. He also said that if reserves are to be calculated serially it might become highly desirable to revise completely the form of the statement exhibits and schedules.

MR. J. S. HILL brought out the point that studies of electronic application to life insurance have concentrated on savings in clerical costs, whereas in other industries the emphasis has been on the gains from improved management. For the "Management by Exception" technique various up-to-date and significant figures on underwriting, investments, and expenses would be available and not buried in a sea of other normal figures. Another technique, that of "linear programming," which is optimum planning for maximum earnings, could be developed.

MR. R. G. ESPIE also supported the idea that the annual statement may need redesigning in the light of the capabilities of electronic machines. He mentioned that the Aetna has had two 650's for a year, engaged only on accounting work, and is not even close to using them for valuation.