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SURPLUS: TWO HUNDRED YEARS OF ACTUARIAL ADVANCE

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On the occasion of the bicentenary of the foundation of scientific life assurance, it was thought fitting that a work should be prepared in which the development of some aspect of the subject might be discussed. The authors undertook some research on the origins and disposal of surplus and the results are set out in a book entitled *Surplus in British Life Assurance—Actuarial Control of its Emergence and Distribution during 200 Years*. The following pages convey some of the impressions formed in the course of its preparation. Much of the later part of the paper consists, in fact, of extracts from the text of the book. The introductory sections present a short outline of the book as a whole.

INFLUENCES ON DEVELOPMENT

The development of theory and practice in regard to the emergence and distribution of surplus has been subject to many influences. Amongst these may be counted:

(i) the manner in which scientific life assurance was first started, and other historical developments;

(ii) the influence of long-dated contracts in the direction of continuity and gradual change;

(iii) the expectations and demands of the assuring public; and

(iv) political and economic events to which actuaries have had to adapt their ideas.

The first office to transact life assurance on a scientific basis was a mutual society and had perforce to charge substantial premiums at the outset. Once the society had successfully established itself it was decided to increase the sums assured as compensation for excessive premiums, both past and future. The origin of the reversionary bonus system was as simple as that. The system worked well: it caught the imagination of the public not only, and perhaps not even primarily, because of the excellence of the idea of permanent life assurance, but also because of the attractive form of investment that the bonuses provided. The effect of this beginning upon the future course of bonus history was strengthened by the circumstance that it was more than fifty years before other offices began to operate on any important scale. Cash bonuses and bonuses in reduction of premiums were popular for a short time, but the battle for reversionary bonuses was really won at the outset.

Actuaries as individuals are no doubt as conservative as other professional men and are no less influenced by the work of their forefathers. They have, moreover, particular reasons for preserving the traditions of the past. As business men in competition they have to strive to meet the wishes of the public, which have certain unvarying qualities. Above all, however, the existence of assurance contracts of many years' duration is the most potent factor making for continuity of practice, for if any degree of equity is to be achieved there must be consistency in the long run, and sudden changes are to be avoided as far as possible.

One consequence of this link between consecutive periods is that certain illogicalities that entered into life assurance business in the early days, when the science was only partially developed, tended to persist for long spells. The idea of deliberately over-charging premiums in order to provide bonus may be considered unreasonable —it has even been held in some circles to be immoral. Yet with-profit premiums were still being based on the Northampton table a hundred years after that table had first come into use, and when mortality had fallen very far below such a level. Bonus loadings are still with us today.

THE EARLY DAYS

In the eighteenth century, illogicalities were heavily outweighed by a series of brilliant advances. First, the idea of life assurance itself was developed from its crude beginnings into a varied form of regular commercial activity. Secondly, mortality was re-measured and the need for further assessments was realised. Thirdly, and most striking of all, the notion of long-term funding was entertained and carried into practice; this in its turn led to the testing of the adequacy of a fund by means of actuarial valuations and to consideration of the proper treatment of any surplus. This third general form of development was more than fifty years ahead of its time, if it is fair to judge by progress in other countries.

Even in the first half of the nineteenth century, many societies and companies were unable to match the achievements of the most successful offices. There was frequently a lack, on the part of the management, of one or more of the qualities essential for lasting success, namely honesty and caution; there were many deliberate swindles and public pressure for the disbursement of surplus was so strong and difficult to resist that the need for adequate reserves was often neglected. Moreover, it was not until the later part of the century that it was realised how a reasonable measure of fairness between one policyholder and another might be regularly achieved.

Some new illogicalities found their way into British life assurance in the first half of the nineteenth century, and these often persisted for long periods. For instance certain forms of tontine bonus, based on a misunderstanding of the manner in which surplus emerges, were maintained for many decades, and were regarded as distinctive and even attractive features of the offices adopting them. The extent of inequity in these methods was gradually reduced, however, with the growth of an understanding of the basic requirements for fairness.

EVOLUTION OF A STANDARD OF EQUITY

A great step forward was the publication of the well-founded Carlisle table, in 1815, and its gradual adoption for the assessment of premiums and for valuations. Apart from this, progress in matters of valuation and surplus was slow until about 1850, when Jellicoe fulfilled the useful function of impressing upon the newly formed profession that the main source of surplus was loading profit which could properly be returned in proportion to the accumulated loadings paid since the last distribution. With the appearance of the *Assurance Magazine* and the beginning of regular discussions, the rate of advance was undoubtedly speeded. Disregarding much interesting material that fell outside the main avenues of advance, one may say that the principal steps in the development of the subject in the second half of the century were:

(*a*) The recognition of the major sources of surplus and the measurement of their financial effects; as is entirely reasonable, particular sources were not publicly discussed until they became of significance in practice; for instance interest profits by the eighteen-fifties; gains from reduced mortality (other than the results of initial selection) only later.

(*b*) The development of the idea that surplus should be distributed in proportion to the specific contributions from the various sources;

this idea was put into practice overseas where loading profit was less predominant, and other significant sources of gain more varied, than in Great Britain ; some simplified British contribution methods were devised but they did not come into widespread use ; they had a small following but did not receive public attention by the profession until towards the end of the century, by which time their usefulness was largely exhausted and criticisms were levelled at them.

(*c*) The increase in understanding of methods of valuation ; the need to make some more or less specific allowance for future expenses had been recognised at an early stage ; apart from this, confusion was created by the existence side by side of alternative methods the relative advantages and disadvantages of which were the subject of debate ; fairly general agreement on the use of the net premium method for presentation purposes was reached around 1870 but unanimity was never wholly achieved as to the propriety of this method ; the different purposes of valuations—for solvency, for transfer or amalgamation, and for distribution—and the best manner of fulfilling these purposes were also successfully distinguished by about this time ;

(*d*) The evolution of a standard of equity in surplus distribution whereby the premiums charged, the principles of valuation, the valuation bases and the bonuses granted could be shown by means of " model office " calculations to hold together reasonably for long periods if external conditions remained stable ; in these circumstances, for instance, a uniform simple or compound reversionary bonus could be justified if net premium valuations were made at artificially low rates of interest ; little thought was given to the effect of variations in experience until later, after certain types of variation had actually occurred ; perhaps not entirely surprisingly, the difficulties were often not foreseen until they actually arose.

THE FIRST HALF OF THE TWENTIETH CENTURY

Broadly speaking, the history of the twentieth century in regard to the emergence and distribution of surplus on ordinary life assurance business has been one of attempts to preserve the nineteenth-century image of equity through sharp and contrasting vicissitudes. In the fundamental task of earning surplus, considerable success was achieved, but in ensuring its uniform and equitable release the following handicaps were encountered :

(i) falls in mortality unequal as between the sexes and ages, and interrupted by wars ;

(ii) publication of new mortality tables at irregular intervals;

(iii) variations in the rate of interest, violent at times, as the result of political and economic action;

(iv) appreciation and depreciation in the market values of securities and, recently, sudden large increases in the prices of equities;

(v) side-effects of economic developments, such as varying lapse rates and increasing expenses of management;

(vi) emergence of new types of with-profit policy;

(vii) complications arising from overseas business.

In industrial business, the problem for the profession has been one of following the pattern of reversionary bonus traditional in ordinary business in spite of a totally disparate set of circumstances—for instance the existence concurrently of premium tables issued on different bases at different times and devoid of any specific loadings for bonus. Here, little has been published on the achievement of equity although some doubts have been expressed as to the degree of fairness achieved in practice. As there had previously been little expectation of surplus, it would evidently have been churlish for any policyholder to complain of gratuitous benefits when bonuses first began to be allotted; but as bonuses have grown in regularity and size, the characteristics of the business have tended to become similar to those of with-profit ordinary business, and premiums and valuations have no doubt been amended with this in mind.

The first reaction of the profession to changes in experience, after the "steady-state" approach to equity in bonus distribution had emerged, was simply to re-examine the whole question along the same lines as before but incorporating the main elements of the new circumstances and assuming that they would continue unchanged. So long as the pace of change was fairly gentle, this was probably quite a suitable procedure. One of the difficulties experienced, however, was that no single one of the models devised for this purpose ever achieved entirely uncritical acclaim. Criticism may, of course, have been inspired as much by the need to stimulate discussion as by the conviction that the model was inadequate. Nevertheless it is probable that there was sufficient incompleteness in the framework of each attempt to justify doubts regarding its entire validity.

After the first really big interruption experienced by the offices—the 1914-18 War—for a time papers on surplus vanished more completely than bonus itself; they reappeared only in the middle of the next decade. At this juncture a new set of problems was arising. The bonus-earning capacity of new business, with premiums loaded for bonuses on the pre-war scale, had become out of line with the high rates that could be granted on existing policies, as the result mainly of large profits from mortality and interest. The transaction of a large volume of new business led to difficulties with net premium valuations and to Elderton's famous remark that "if they could not do with as much good new business as they could obtain, which was wrong—the new business or the valuation?" In these circumstances, bonus reserve valuations became popular for internal use, although their publication presented the grave difficulty that if the bonus rate provided for were generally known the public might tend to regard a valuation assumption as a bonus promise.

Further complications were caused by the Great Depression, with its sudden upset of market values and interest rates, which caused the first references to "matching" to appear, a subject which has received much subsequent examination and which remains a very live issue.

THE PRESENT DAY

The aftermath of the Second World War brought with it some new and urgent problems which are still before the profession today. Although well known, they should perhaps be listed here. First among these is economic inflation, which has had far-reaching effects: it has created the demand every year for a vast amount of new business, much of which is necessary simply to maintain sums assured at a reasonable level in relation to earnings, and so has increased expense ratios; it has changed the attitude of investors towards various types of security and so has caused equity values to appreciate heavily; it has been associated in Britain with various economic crises and with the introduction of sudden Governmental measures and so has rendered difficult the maintenance of continuity; it has been associated also with high interest rates and low market values for Government securities.

Secondly, there has been a big demand for insured pension arrangements, and in this connection changes in the taxation laws have taken place. As a possible protection against expected economic developments, annuities (and assurances too) have sometimes been expressed in values other than fixed monetary amounts.

Thirdly, a business revolution has occurred with the development of electronic calculating and data-processing devices. It is appropriate to note here that the contents of the official forms of return under the Insurance Companies Act have at last come up for reconsideration after half a century without any change. These forms have had their effect on at least the public presentation of valuation results, and when there are new schedules there may also be developments in the methods of publication adopted by actuaries.

Finally, at the time of writing it seems likely that Great Britain will be admitted to the European Common Market. If this happens it may be expected that contrasts between the practice on the two sides of the Channel will become more evident. In regard to the distribution of surplus, British life assurance has followed a course very different from that pursued in Europe, and an increased awareness of the sharp distinctions between our methods and those of neighbouring countries may bring about some reconsideration of actuarial theory and practice both here and elsewhere.

It is in these circumstances that increased attention has been paid to:

(i) a general reconsideration of the concept of equity in the context of the emergence and distribution of surplus;

(ii) the development of theories of matching and immunisation—evidently one of the major advances of actuarial science in the twentieth century;

(iii) the issue of with-profit annuities and pension schemes;

(iv) the devising of numerous types of "variable" policy.

These subjects will be discussed in the following paragraphs.

EQUITY IN MODERN CONDITIONS

In the latter part of the nineteenth century, equity was considered to be achieved if whole-life and endowment assurance polices were issued with premiums loaded to provide a given rate of reversionary bonus and in stable general conditions enough surplus could be released at successive valuations to provide just this rate at all ages and durations of assurance and for both types of policy. This approach was still in evidence in the nineteen-twenties, in Coutts's paper; but soon afterwards Elderton introduced a more general version involving an equation of the capital values of premiums and expected benefits at the outset of a policy. After the Second World War, Suttie gave two alternative definitions; by the first, each group of life policies should receive the bonus it would have received if it had formed a separate and distinct fund—a concept having some affinities to that of Elderton. By the second, fairness would be achieved if profits were determined on the same principles at every valuation, and were distributed as expected, and the premiums charged to new entrants corresponded with this expectation; this is more akin to the traditional approach.

In the circumstances considered by Benz in 1959, namely the emergence of unprecedented (and perhaps temporary) profits, neither of these definitions proved particularly helpful. A special bonus lies outside the whole plan of the second, while the question of how such a bonus should be allotted is not answered with great clarity by the first, even when it is broadened (by Redington) into a concept of "graduated equity" in which successive generations of policyholders are to some extent pooled together. The first of Suttie's definitions seems, however, to have considerable relevance to the essentially modern problem of sharing surplus between (i) conventional with-profit whole-life and endowment assurances; (ii) individual with-profit deferred annuties (*a*) under the Finance Act, 1956, and (*b*) otherwise; (iii) pension scheme business, similarly subdivided, and (iv) variable business. In the case of (iii) there are even two competitors for shares in surplus—employers and employees. Equity between these general classes seems a likely subject for future discussion.

The question of capital appreciation on equity shares was discussed by Anderson and Binns in 1957. They suggested three ways in which it could be dealt with:

(i) by declaring a special vested bonus;

(ii) by allotting a special intermediate bonus that would never vest, the amount of bonus depending *inter alia* on the level of equity prices at the date of the claim; and

(iii) by leaving the capital appreciation untouched but paying special bonuses out of the increase in dividends.

Benz, after considering the case of a hypothetical office, discussed three courses, two of which differ from the foregoing:

(i) declaring a moderately increased normal bonus;

(ii) declaring a substantially increased normal bonus;

(iii) declaring a normal bonus together with a special bonus for the quinquennium.

In the discussion, the third course received general approval—with one notable exception that is discussed below. It was supported on the grounds that it allotted bonus to those who were entitled to it and gave them an immediate share in current prosperity. Furthermore it permitted the maintenance of the current scale of premiums. There was some discussion upon how the special bonus should be determined for each policy. Some speakers expressed the view that to the extent that surplus arose from capital appreciation it was a function of the reserve and should be distributed proportionately to the reserve or, as an approximation, to the fraction expired of the total duration of each policy. A final bonus on claims was also suggested. To go further than this it would be necessary to take into account the time at which the appreciation occurred ; the allocation of surplus would then be more complicated and would depend on the duration since the appreciation. This tends to a contribution method and to what Benz described as " overmuch ingenuity " which might cause difficulties with agents and policyholders.

The essentially practical nature of the debate was brought out by the number of references to the attitude of the policyholder. In particular, speakers underlined the difficulty in current conditions of publishing bonus estimates, since they are so often taken as being in the nature of promises. The special bonus, provided that it was clearly labelled, was considered less likely to lead to disappointment than a high rate of " normal " bonus which might not be maintained.

The fact that one member disagreed with the proposal to grant a special bonus has already been mentioned. Bayley pointed out (in a written contribution) that the freedom to depart from a matched position and invest in equities stemmed from the holding of free reserves together with the reserve from the bonus loadings received but not absorbed in declared bonuses. Any transfer from the free reserves was the property of the policyholders ; the unallocated bonus reserve was nil at the inception of a policy, rose to a maximum and returned to nil at maturity. Bayley therefore maintained that it was quite incorrect to distribute profit proportionately to the reserve. He then added that " the notional identification of equities with a substantial part of the policy reserve as it approaches maturity is consistent only with a type of policy which reflects the consequences in all circumstances, but that would not be the traditional form of participating endowment assurance ". Other speakers had insisted that before any capital appreciation was distributed ample reserves must be built up to meet any subsequent depreciation, but Bayley went further than this in rejecting the linking in any way of ordinary assurances with equity prices.

It may be argued that if this non-traditional form of assurance is pursued, it is not really possible to guarantee the amount of the sum assured, which must also fluctuate to some extent with equity prices. This leads to the subject of variable policies which will be discussed later.

MATCHING AND IMMUNISATION

Although some awareness that the term of the assets should be related to the period of the liabilities had been shown by the profession in discussions from 1914 onwards, it was not until 1952 that this important matter received detailed attention. In that year there were published two papers—one by Haynes and Kirton, the other by Redington. The two papers were complementary. Haynes and Kirton, by the use of model offices, showed that for a stationary fund exact matching could be obtained, that is to say, the " asset-proceeds ", consisting of the interest income plus maturing investments, could be arranged so as exactly to meet the " liability-outgo ", made up of claims less premiums. For an increasing fund some protection against a fall in the rate of interest could be obtained by investing longer and increasing the spread of the investments. Redington reached the same conclusions independently by means of a mathematical demonstration which produced the following two rules :

(i) the mean term of the value of the asset-proceeds must equal the mean term of the value of the liability-outgo ;

(ii) the spread about the mean of the value of the asset-proceeds should be greater than the spread of the value of the liability-outgo.

For this particular type of matching Redington adopted the word " immunisation ".

In both papers the authors stressed the fact that it would not be possible or even desirable to follow through this theory completely in practice, but they considered that it provided a norm to be departed from according to individual judgment. In particular it was remarked that immunisation was made against profits as well as against loss.

In a paper read in 1953, Bayley and Perks outlined " a consistent system of investment and bonus distribution for a life office ". Under this system only the paid-up part of the policy and the declared bonuses were immunised. The idea underlying this was that each premium should purchase a benefit immunised on the terms current at the time that it was paid ; all premiums, whether new or renewal, paid at one time were thus placed on the same footing. The mean term of the investments under this system is shorter and since there is not complete immunisation a substantial holding of free reserves must be postulated.

ACTUARIAL MANAGEMENT

The part played by bonus in ensuring the stability of a life office is a subject that has received considerable attention during the last twenty years. Indeed stability was one of the set topics for discussion at the Fourteenth International Congress in Madrid. Ogborn and Bayley read a paper there in which they argued that the fluctuations of the inter-war period had demonstrated that it was hardly possible to transact non-profit business alone; bonus was necessary as a cushion even where every account had been taken of the requirements of matching, immunisation and the theory of risk. It was important, therefore, that with-profit policies should be issued in the right proportions.

At the Faculty centenary, Dow made some pertinent remarks on "gearing". He showed how this can be measured, for new business and for existing business, and gave a number of criteria by which the actuary could arrive at an idea of a suitable proportion between the quantities of participating and non-participating business.

The actuarial management of a life office was also the subject of a paper by Anderson and Binns, in which they advocated following a definite new business policy including a moderate rate of expansion with a good proportion of long-term with-profit business. They considered that the proportions of non-profit and with-profit business should depend on the amount of bonus loading provided but that at the time (1957) it might be preferable to write 60% or even 75% of the new business on a with-profit basis.

WITH-PROFIT PENSION SCHEMES

So many varieties of guarantee and of premium rebate have been evolved that it seems necessary to define a with-profit pension scheme. Lauener, speaking in his capacity as Chairman of a meeting of the Students' Society in December 1961, described this (if we heard him correctly) as "a scheme in which at least part of the profits is payable at the discretion of the office".

Any plan for with-profit pension schemes must take into account the costing arrangements and the period for which premiums are guaranteed; pensions may be provided by annual premiums or single premiums or by a controlled funding method. Premiums may be guaranteed for the whole service of existing members, or for a limited period for all members, or there may be a combination of both ideas. The relationship of guaranteed premium scales to bonuses may be seen by taking the case of a one-year guarantee of premium rates. This is clearly similar to a system of annual cash bonuses, except that where the premiums are varied annually the " bonuses " might be negative.

Unlike an individual policyholder, an employer setting up an insured pension scheme is not looking to the policy as a profitable way of investing his savings—he would probably prefer to put back any profits into his own business. He expects to be relieved of the technical problem that a pension scheme presents and to obtain the security afforded by a life office. Moreover when a scheme is first instituted, the employer is likely to be providing pensions for two generations at once ; he will therefore accept a with-profits policy only if he can be satisfied that the costs for the benefits required will decrease at an early stage. An employee, on the other hand, will want to pay a contribution that is either fixed or can be determined with reference to his wage. These considerations indicate a system whereby profits are paid to the employer in the form of a reduction of premiums. A large number of schemes have been arranged on this plan.

A reversionary bonus system may be adopted because in times of inflation the amounts of pension originally provided may prove insufficient. The method has the drawback of creating an additional problem—that of equity between the different employees. Since it is perhaps impracticable to distribute mortality profit to pensioners, a method which has been adopted is to grant a final maturity bonus in the form of an additional pension when retirement age is reached. It is difficult, however, to decide at what rate surplus should be allowed to emerge ; there are many alternative possibilities, each having some advantages.

With both systems there is the delicate problem of deciding how much bonus may be discounted in determining the premiums to be paid by the employer at the outset. The question of equity between different employers, and between pension and ordinary business also arises. The former is a problem akin to that of equity amongst individual policyholders. It has been suggested that the latter problem would be solved by setting up for pensions business a separate fund with separate assets, but this does not seem satisfactory ; where there is a large number of employees the justification for going to a life office rather than setting up a private scheme is that the employer will share in the prosperity of the office as a whole. There is little doubt that the actuaries of the various offices concerned in this type of business are doing their best to ensure fairness, along lines and in accordance with principles now widely known and well appreciated. But the details of the problems arising have not been generally discussed in public.

In practice the number of different schemes evolved is almost equal to the number of offices conducting the business. In some, bonuses are based on the reserves and in others they are assessed on the premiums paid ; some bonuses are paid as cash discounts whilst others take the form of additions to the pensions. It is natural to compare this situation with that of ordinary life assurance more than a hundred years earlier and to wonder whether one type of scheme is destined to triumph and to be almost universally adopted. In favour of this idea it may be argued that the tendency towards the use of electronic computers and data-processing will encourage simplicity. But there is one important difference from the conditions of the early nineteenth century. Multiplicity of type of surplus distribution was then largely attributable to ignorance and disappeared in the face of progress ; this could not be said of today. One thing, however, is cértain ; it is that insured pension schemes now demand a large share of the energies of the life office—so much so that in many offices the traditional whole-life or endowment assurance policy is heavily outweighed in the total portfolio—and there is also a strong tendency for pension schemes to be with-profit in one form or another.

VARIABLE POLICIES

Although the idea of variable benefits has only recently come to the fore, it is not entirely new. De Morgan devised the concept of a variable sum assured and a century later Hagstroem suggested a scheme of " floating bonuses ".

The actuarial discussions that have been held during the last few years indicate a marked coolness towards variable policies. It is argued that it is not in the national interest to provide variable benefits. It is the function of the Government to combat inflation, but the life offices, who are custodians of a large part of the nation's savings, have a responsibility which transcends their duty to their own policyholders and they should do all they can to assist the Government. They should not encourage a distrust of the currency and they should not add impetus to inflation by creating yet another privileged class whose benefits would be automatically increased as the cost of living rose. From the viewpoint of the life offices themselves, it is felt that the issuing of such policies might be taken as a confession that the offices had lost faith in the value of their own contracts. There is also grave concern as to whether policyholders generally would understand the risks they were assuming.

The opposing argument is that offices should accept the fact of inflation and take whatever action is required to give protection against it. If there is a demand for these contracts it should be satisfied. Should this result in more publicity for the evils of inflation, so much the better, since it will give an added incentive to the responsible authorities to control it. Offices already invest substantially in equities and there is no reason why the logic of this course should not be extended further. It should be added that this appears to represent a minority view.

In fact, two schemes have been initiated in this country to provide variable annuities; both are restricted to those persons who are eligible for retirement annuities under the Finance Act, 1956. One scheme is run on familiar lines, certain benefits being provided by certain premiums; however, the contract is expressed throughout in terms of investment trust units instead of in currency. The policyholder therefore bears the risks of fluctuations in the price of the units but other bases are guaranteed. The other scheme operates on a different plan: there is a separate variable annuity fund and benefits are dependent not only on the value of the investments but also on the experience in regard to mortality, interest and expense. At retirement the policyholder may take a variable annuity, a fixed annuity or a combination of both.

At the time of writing there are five plans in force that provide variable endowment assurances. Three are sponsored by unit trusts with cover provided by life offices, one is operated by a life office which links the benefits to the price of shares in a trust and the fifth is run by a life office which operates its own unit trust. The plans may be divided into two groups. In the first group a minimum sum assured is provided at a given rate of premium and the amount payable at maturity is dependent on the price of units at the time when each premium is paid. No interest is allowed on the units purchased as this is taken into account in the premium basis. The sum assured at death is, subject to a stated minimum, equal to the value of the units purchased plus the proportion of the minimum sum assured represented by the unexpired portion of the policy. In the second type of plan, the sum payable at maturity is equal to the value of the units purchased with accumulated interest. The sum assured at death is, subject to a given minimum, equal to the value of the units purchased plus the amount of the outstanding premiums.

Under one plan the whole of the units are purchased at the outset, the policyholder being required to meet 25% of the cost immediately and the remainder over the term of the policy.

A start has therefore been made in the issue of variable contracts. It should perhaps be added that all the sponsors have taken precautions to protect policyholders from their own ignorance. The conditions are carefully explained and in the case of endowments there are minimum sums assured. Annuities are restricted to those prepared to pay a substantial premium who may be presumed to be aware of the risks involved.

THE SCOPE FOR DISCUSSIONS

There thus seems to be considerable scope for future discussions on a variety of topics connected with surplus in life assurance. Indeed it seems a little surprising that the profession has not, in the face of such tremendous modern developments, aired more of them in public already. A great deal of concentrated thought must have been devoted to such matters in the offices, but for more general discussion one has to wait, no doubt, until the time is ripe. There seems, however, to be a chance that delay may cause an opportunity to be missed. These considerations prompt a number of thoughts about actuaries, considering them as a body and taking their work in its widest possible sense, that seem appropriate on such an occasion as a bicentenary.

SOME CRITICAL QUESTIONS

In 1944, Bailey and Haycocks provocatively asked the question " Are we scientists ? " and addressed it, with suitable comments, to their fellow-members of the Students' Society. They looked at the terms of the Resolution carried at the formative meeting of the London Actuaries held in 1848, at the wording of the Royal Charter of 1884 and at the description of the profession in the current Year Book, and found assumptions of " science " in all of these. Even so, after ranging briefly over various fields of professional activity, they came to the conclusion that the evidence for the adoption in practice of a truly scientific approach to actuarial problems was rather thin, and declared that " the actuary must become a scientist " if he were to survive in the long run as a useful member of the community.

In such a short stimulating contribution one would hardly look for completeness, and in fact these authors did not include within their survey any specific reference to control over the emergence and distribution of surplus. They could well have done so and, if they had, critical queries on the performance of the profession in this respect would perhaps have occurred to them—as they do now to ourselves—somewhat along the following lines :

(*a*) Have actuaries been perpetually " behind the event " ?

(*b*) Has an effective, lasting definition of equity ever been found ?

(*c*) Has equity, in a broad sense, been achieved in practice ?

(*d*) Have methods of distribution been justified more by reference to tradition and public taste than by sound actuarial principles ?

(*e*) Has real progress in the theory of the subject been made in the last hundred years ? and in particular,

(*f*) Has modern statistical theory been adequately applied to the subject of life office finance ?

PROFESSIONAL FORESIGHT

To ask probing questions of this kind today is not necessarily to expect answers unfavourable to the profession but, in the light of actuarial history, there is at least some justification for posing them. For instance, in asking whether actuaries have often been " behind the event " one might find some supporting evidence in a variety of developments of which the following are among the principal :

(i) in the early days, apart from a few exceptions, surplus emerged before it was known how to control it and was distributed before concepts of equity had been developed sufficiently to disburse it properly ;

(ii) British contribution methods were not seriously discussed until the day of their usefulness was past ; much the same is true of the " reinsurance " method of valuation and other topics ;

(iii) the best nineteenth-century concept of equity did not envisage sufficiently the possibility of future variations in experience, and had to be reconsidered more than once in the light of new developments ;

(iv) the idea of " matching " was evolved only after economic circumstances had forced it upon the profession.

The main response to such critical observations might well be that it was not possible to provide in advance for all the developments that might have taken place. Actuaries are not soothsayers and in some respects must take things as they find them. It has to be remembered that for two hundred years the business of life assurance has been very successfully transacted and adapted to changing circumstances, with a standard of safety higher than in other forms of commercial activity, and that technical knowledge has steadily been developed—impressively so in certain periods. It can hardly be conceived, even with the benefit of hindsight, that it was possible in the conditions of 1880 to forecast the rapid social progress and wide economic swings of the twentieth century, or to provide in advance for those in any way. As for any lateness in discussing methods and concepts that quickly became outmoded, it can be argued that so long as these were working successfully they did not call for public comment; as soon as the time for critical appraisal was ripe, their deficiencies were pointed out and alternative and improved methods were then made available to bring into immediate use. If actuaries are not completely scientists, they may be said at least to be practical men who do not adhere blindly to a notion once its value is exhausted.

HAS EQUITY BEEN ACHIEVED?

Admittedly, the concept of equity generally agreed upon by the profession in the nineteenth century proved to be adequate only for a single generation, after which new and varied ideas had to be developed in the light of the prevailing circumstances. This can hardly be accounted a defect; rather is it a tribute to the awareness and vitality of actuaries in response to altered conditions which have wrought a profound revolution in the life of everyone. It is highly likely, indeed, that further changes in the surrounding circumstances will take place in the future and bring about the need for new concepts of equity. These will not be wanting when the time comes.

To inquire whether, in fact, equity has been achieved is merely to do what the profession itself has publicly done on many occasions throughout the period under review. Its members have frequently implied that performance has fallen short of perfection. Statistical evidence upon the degree of fairness secured is not generally available to the historian, although elaborate retrospective "model" calculations might perhaps be capable of supplying some indication of the answer. Such calculations have not been attempted by the authors, partly because the time has not been available but more especially because they are confident that it would be shown that, in spite of all adverse suggestions, a very reasonable standard of fairness has been achieved, indeed a much higher standard of justice than has been secured between individual persons and between classes of the population in other economic spheres.

It is not enough that distributions of surplus should be equitable in some mathematical sense. They should also broadly confirm what the public has been led to expect. This is an argument that has frequently been heard at the Faculty and Institute. It is the claim of the practical man of affairs rather than of the scientist. Research scientists do not, in general, have to do business with the public. The argument would constitute a criticism of the profession only if it had been used defensively, in order to attempt to justify some practice with weak theoretical foundations. We believe that it has not, in general, been used in this manner, but rather as an additional reflection that speakers in debates have felt it useful to mention in order to render the picture presented as comprehensive as possible for the benefit of colleagues and future students.

PROGRESS

What is progress ? This is a question that might reasonably be asked by way of reply to anyone who inquires whether the actuarial profession has " progressed " during the last hundred years. The critic may point to continued lack of success in reaching agreement upon the best method of valuation or of distribution of surplus. We believe, nevertheless, that considerable progress has been made, especially recently ; more could have been made, and more will be made. But in general the pace is slow ; there is undoubtedly room for much more research than is being carried on at present, and it is to be hoped that attempts to further it will be increasingly successful in the near future.

From time to time modern mathematical and statistical methods are applied to actuarial work, and doubtless there is scope for more activity of this kind. A possibly fruitful line of research would be to apply to life assurance operations some of the modern statistical methods to which relatively little attention has so far been paid in this connection in Great Britain. The economic uncertainties surrounding the business render it likely, however, that this approach, while valuable in theory, would have at most a limited practical usefulness. It would be better perhaps to make a comprehensive survey of possible variations in experience and their implications for the stability and equity of the business. Such inequities as have occurred over the years could perhaps have been mitigated if more consideration had been given to the prospects for, and probable effects of, future variations from the experience to which actuaries had become accustomed. Among such possible variations one can envisage at the present time, to take a few obvious examples, a decline in mortality, especially for men in middle life and at the older ages, a diminution in the rate of interest on new investments, and a fall in expenses resulting *inter alia* from the extensive use of data-processing. With the aid of electronic computers, it should be possible to estimate the financial effect of such contingencies on model offices of a much more complete kind than ever before.

CONCLUSION

The authors can thus end this paper (as they do their book) on a cheerful note as regards past achievements and can express great hope for the future. A very great deal has been accomplished, and much progress lies ahead. This could be the beginning of an important new era of development, and if anyone should be commissioned to write a corresponding tercentenary review in due course he should have much to add, in respect of the period 1963 to 2062, that cannot at present be foreseen.

REFERENCES

The full names of the authors quoted, and the titles and dates of their papers, are given in the book, *Surplus in British Life Assurance*, to which reference is made at the beginning of the paper.

SYNOPSIS

The paper is in the nature of a summary of the authors' book " Surplus in British Life Assurance—Actuarial Control over its Emergence and Distribution during 200 Years ". *Copies may be purchased direct from the Institute of Actuaries (price 17s. 6d.). Members and Students of the Faculty may obtain a copy for personal use at the reduced price of 11s. post free.* It begins with a survey of the principal factors that have influenced the development of theory and practice in regard to surplus throughout the years. It describes the manner in which surplus first arose in scientific life assurance, and traces how this and other historical developments have had an important effect both in the early days and later as a valid standard of equity was gradually evolved. At the same time the influence of long-dated contracts and of the expectations of the public has been a stabilising factor in spite of rapid changes in the economic and social scene.

The characteristics of the nineteenth-century image of equity are described, and the history of the twentieth century in regard to surplus is seen as one of attempts to preserve that image through sharp and contrasting vicissitudes. This idea is explored in some detail for both ordinary and industrial life business.

The problems of the present day are reviewed one by one and the paper touches on such matters as economic inflation, the public demand for pension schemes, the introduction of computers and data-processing devices and the prospect of Britain joining the Common Market. Against this background, various modern concepts of equity are contrasted and brief reference is made to matching, immunisation and gearing. Equity in with-profit pension schemes and systems of variable policies are also considered.

This general survey leads the authors in the end to ask some critical questions about the performance of the profession throughout its history. These questions relate to the success or otherwise of actuaries in foreseeing the future, in attaining equity and in progressing with the times. The authors attempt to answer them and are able to end on a cheerful note as regards past achievements and to express great hopes for the future, which may well bring a new era for the profession.

DISCUSSION

The President (Mr. A. T. Haynes).—We welcome this afternoon most warmly two Fellows of the Institute—P. R. Cox and R. H. Storr-Best—who are presenting to us their paper on " Surplus : Two Hundred Years of Actuarial Advance ". This paper is, as you know, in the nature of a summary of the most interesting book entitled, *Surplus in British Life Assurance* by the same authors, and our discussion may well range beyond the paper itself to the book on which it is based. Both the paper and the book owe their origin to the fact that this present year marks the two-hundredth anniversary of the founding of the first institution in the world designed to conduct the business of life assurance on a scientific basis. Mr. Storr-Best is an official of that institution, but I should hasten to add that his connections with it do not extend over the whole period of the survey ! Mr. Cox is known to us as an author of another well-known work, the official text-book on Demography published under the auspices of the Faculty and the Institute. This, perhaps, is a belated opportunity to thank him on behalf of the Faculty for all the work that he devoted to that task. The authors' book *Surplus in British Life Assurance*, to which I have referred, is an Institute publication and the present paper was first submitted to the Institute last Monday. We are grateful to our friends in the Institute for allowing us the privilege and pleasure of sharing this paper and we appreciate the courage of the authors in exposing themselves twice in an octave to the bar of professional opinion. In full confidence that their courage will be rewarded by the discussion this evening, I will now ask Mr. Storr-Best to introduce the paper to the Faculty.

Mr. R. H. Storr-Best, introducing the paper, said :—Thank you very much, Sir, for your very kindly welcome and for giving us the opportunity of bringing our paper here. It is really a very great privilege. The paper which we have prepared for the meeting has been based on the book which some of the members may have had the opportunity of reading. As you, Sir, have mentioned, the book was written to mark the completion of two hundred years of scientific life assurance, and its aim was to provide a study of the treatment of surplus throughout this period. This led us on to a summary of present-day problems and, finally, to pose a few questions about the profession itself and its part in the control of equity. In the book we were writing a history and most of our attention was devoted to the past, the present and the future playing lesser roles. For the paper we have altered the balance somewhat and, after a brief look backwards, we have focused attention on to-day and tomorrow as being more controversial subjects for discussion. For the present day we had a large amount of material on which to draw : much had to be left out when the book was written, and even more in the case of the paper. The task of selection was difficult and we omitted one or two papers which, perhaps, should have been included. We might have said more on the subject of assets and mentioned Whyte's paper to the Faculty and Pegler's to the Institute. We might also have referred to an interesting third form of matching discussed by Anderson and Binns in which the assets are arranged so that, on a change in the rate of interest, the rates of bonus earned by new and existing business are the same. Our survey of present problems has, in some ways, been overtaken by events already. There have been a number of new schemes for variable policies and we could have improved our account of them in the light of W. G. Bailey's paper to the Institute. We have put a number of possible subjects for discussion and I should like to refer briefly to just one of these. This is the problem of equity.

We made a reference on the last page of the paper to the possible use of computers to investigate the effect of changes in future experience. The prize-winning paper by Lane and Ward to the Actuarial Society of Australia and New Zealand has already done something in this direction. There is still, however, no firm agreement as to what should be one's aim in the pursuit of equity and in the absence of this agreement the very basis of any investigation may be questioned at the outset. The difficulty arises from the two-fold object of life assurance—firstly, as a provision for dependants and, secondly, as a means of investment. In the former, we do not deem it inequitable that one policy may become a claim in the first year while another may run, perhaps, for sixty years. We decide at the outset what is a reasonable premium and, thereafter, it is the luck of the draw. It is the investment aspect and insertion of bonus loadings that make life difficult. It is interesting to note that in the early days the leaders of the profession, notably de Morgan in England and Edward Sang in Scotland, opposed the system of bonus loadings, but it was carried by popular acclaim against their judgments. Once bonus loadings are accepted, it is clear that one must pay some regard to the sources of surplus and the insurance principle of averaging breaks down to some extent. The problems that have arisen result from the conflict of these two ideas—on the one hand, the averaging of experience and on the other the return to each policyholder of what is his due. The interpretation of equity depends on the emphasis placed on each idea. Somewhere between these two must be a happy medium. The problem has been further complicated by the introduction of profit-sharing pension schemes and new candidates for a share in surplus. We are confident that the balance between the various claims is fairly held, but it would be interesting to know of any further signpost which might guide us to this happy medium.

Mr. D. W. A. Donald, opening the discussion, said :—In the course of a recent essay on the subject of whether Homer had ever existed, and if so how many people he had been, the author expressed a point of view which on the evidence of the title they have given their paper is directly contrary to that of Messrs. Cox and Storr-Best. He was discussing whether it was possible to treat as a reliable witness a man who regularly caused his heroes to perform impossible feats—for example, when they hurled at each other rocks described, in his own words, " even to lift which was a feat beyond the strength of any two men bred to-day ". This was explained as being " merely a conventional tribute to the ancient belief that regression rather than progress is the rule in human affairs ". The paper we are discussing to-night is boldly sub-titled " Two Hundred Years of Actuarial Advance ".

Was it, I wonder, by design, that a degree of emphasis has thus been given to the paper which was not there in the title of the book on which the paper is based ? That claimed merely to record the history of actuarial control over surplus, without any suggestion whether actuaries were getting better or worse at coping with the related problems. Possibly the opportunity for second thoughts afforded by the paper has led the authors to the conclusion that the answers to the searching questions repeated on page 34, but originally posed in the book, were more favourable to our profession than they had first thought and that progress and not regression is indeed the normal rule of actuarial life. The authors are, of course, historians, and it is no mean feat to have compressed into a book of little over one hundred pages (much less a paper only a fifth as long) the record of what actuaries have done in this sphere for two centuries. Quite rightly the authors have not, except by implication, sought to pass judgment on these actions ; they let the record speak for itself. If therefore one ventures the suggestion that actuaries too are human, that all advance is not necessarily progress, it is not to criticise the authors. It is merely putting a different gloss on the same facts and, of course, in what follows I must emphasise that the opinions expressed are strictly personal. There is, I feel, at least a case to be made out for the contrary view that even if we may congratulate ourselves on the successful solution of the difficulties inherent in our traditional reversionary bonus system, we may regret that of our own free will we devised a system which has led to such difficulties, when with more forethought on our part, some, at least, need never have arisen so acutely. To say this is not to blame those who laid the foundations of our system a century or more ago. At that stage, with what they knew then, it was natural that the security of their companies should have bulked largely in their thoughts. To-day, and in the light of what we know, I confess that I find faintly distasteful the emphasis in many of our writings and discussions on how fortunate we are to have inherited a bonus system which conveys upon us a high degree of freedom to reach wrong decisions without imperilling our solvency. We can hardly ignore that life assurance has flourished in other countries, sometimes under the most trying conditions, without the benefit of the very large margins inherent in our with-profit rates. The peace of mind of the actuary, purchased at the expense of those of his clients who fail to attain a ripe old age, and who *prima facie* are most in need of the protection of life assurance, may be bought at too high a price.

The problem in ordinary life business may be summarised as the attempt to hold a fair balance between policyholders of different generations. This covers both the pursuit of equity to policies already on our books, and the problems inherent in writing new business at a time when the rates of bonus supported by our premiums are markedly below current bonus levels. Part of our difficulties, as compared with those of a Continental or American actuary, stem from the fact that so large a proportion of our bonuses comes, not from profits, but from a return of the policyholder's own money. In normal conditions if our " bonuses " were smaller, if we knew that policyholders were getting a share of the true profits earned by their business plus a share of miscellaneous surplus arising from other business, then we could feel that they were getting a good bargain, and we should not be unduly worried at the thought that at another period of time they might have done even better. It is, for example, almost inevitable that, in times of rising profits, distributions will tend to be made on a conservative basis, just as in the era which may lie before us competition may compel the attempt to maintain the present historically high level of bonus rates, despite a fall in the rate of profits which can be earned. This may not be strictly fair, but if the policyholder is getting more than he pays for it is hardly inequitable. Our difficulty is to define what he has paid for. Under our system bonuses form so large a part of the benefits, and the effect of a change in bonus rate is apparently so much greater than if participation were on a smaller scale, that we have more cause for concern. For example, the choice an average British office offers a man aged 30 who wishes to assure his life is, for the same premium, a with-profit sum assured of £1,000 or a without-profit policy for about £1,750. At current rates of bonus the difference might be made good in about 23 to 25 years. If bonus rates fell by as little as 10% the period would be extended by about 4 to 5 years, which would affect the death benefits payable to about 5% of the original entrants. An average American company offers a choice of a with-profit policy for £1,000 or a without-profit policy for about £1,250 and at this level the effect of a fall of 10% in the rate of bonus would be felt by a smaller number of claims. I do not press this argument where endowment assurances are concerned—there the main object is presumably saving and not the provision of life cover. Even so, when I see bonus illustrations (in however guarded terms) for 25-year endowment assurances when the estimated bonuses almost equal the basic sum assured, I cannot help wondering if we are not encouraging undue expectations and if a contract with a higher guaranteed element might not be better from the public's point of view, if not from ours. It is now probably too late to hope for such an approach—such certainly has been the experience of one office in this country which has tried the experiment of lower premiums and lower bonuses—but at least let us not defend ourselves on the grounds hinted at on page 36 of the paper, that we are giving the public what it wants. It is we who have encouraged the public and created the taste for what, in relation to the true function of a life assurance company, I cannot but regard as a somewhat unwholesome diet.

My preceding remarks have been confined to surplus arising from normal sources. If the source is abnormal then, in my opinion, there is no possibility of agreement on who are the equitable owners of the surplus, which belongs to the " estate " of the office. If it were possible to identify the policyholders who " ought " to benefit by a rise in the value of equity shares, then equally when falls occur, as this year, of up to 25% in value among even the soundest stocks there would be an identifiable body who " ought " to receive a smaller normal bonus. We may trust the actuary not to act capriciously in disposing of any such surplus but we need not be surprised or feel that there is any cause for apology if two actuaries reach widely different conclusions about how it should be distributed.

So much for ordinary business. When we turn to the modern developments which have occurred and still are occuring in the field of pension business we may again feel at least a doubt whether progress is the most apt description. It is a matter of surprise that when the vagaries of an income tax system made it impossible to fix a basis for deferred annuity rates which could really be equitable to the office and to the policyholder, and when therefore the logical solution would have been a with-profit contract, there was no great demand for it, but possibly it was because at that time there seemed no great hope of profits. A rise in interest rates coincided with the sweeping away of the taxation uncertainty, with the introduction of the pension annuity fund, and interest in the idea of with-profit pension schemes increased. I see no reason for feeling that the long term outlook for profits to-day is much different from, say in 1949, yet large volumes of with-profit business are now being transacted. The mere transaction of the business need not cause concern, but I confess to a degree of worry as to how, within the same fund, the interests of this new class of participating policyholder can be reconciled with those of the existing members which may lie in other directions. If equity is to be our watchword (and it would be a pity if we abandoned it entirely) then we are in danger of creating a whole host of new and difficult problems.

Apart from the obviously different light in which improvements in mortality rates will be viewed there are, at least in certain types of with-profit schemes, fundamental differences in outlook. In our assurance business we charge a level bonus loading for an increasing benefit, and therefore, in general, we do not distribute any true profit before it has been earned. In the annuity business there is a tendency on the part of the purchaser to say " unless this is going to be cheaper now there will be no sale " which means that profits may have to be anticipated. If things move against the office there will still be a tendency for bonus loadings on assurance policies to be received even if bonus rates are reduced—there is in the scale of values quoted a disincentive to surrender the policy or alter it to paid-up and most people are not so adequately insured that they can readily contemplate a reduction in their life cover. In the annuity business no such considerations apply, and if ever it would pay the employer to switch to a non-profit basis he can do so without loss. He is also likely to be in receipt of a good deal of advice which, even if not completely disinterested, may rest on securer technical foundations than anything that is likely to be available to the average policyholder in a life fund and, especially if he is contributing a relatively large share of the premium income, he may be able, in this highly competitive business, to make his voice heard with a force that cannot readily be ignored. We may, in ordinary business, be satisfied that we are being fair to the " average " policyholder. There is no " average " pension scheme, and the larger the scheme the more likely is the employer to expect to find his experience and not the average reflected in the cost of providing pensions. I fear that the actuary who tries to drive in tandem a with-profit annuity fund embracing a comparatively small number of powerful interests with a traditional with-profit assurance fund sharing the same assets is risking a conflict, in the solution of which equity may not play a major part. I do not think the mixture is anything but explosive, innocuous as either component may beif kept strictly separate on its own.

I have already congratulated the authors on their feat of compression, a feat achieved by sheer brevity and clarity and not by omission of essentials. The danger may indeed be that they have dangled almost too many tempting baits before us, but if others have had the same pleasure as myself in considering them, and deciding which fly to rise to, then we should have a fascinating discussion and the authors the reward they deserve.

Mr. J. M. Macharg.—We must all be grateful, Sir, to the authors for a most interesting paper and for the review of current problems which they have given to us. Few actuaries will have read the last part of the paper without a certain pricking of the conscience as the authors ask some rather pertinent questions and draw attention to problems which still remain unsolved.

On the subject of with-profit pension plans, the authors' remark at the top of page 31 that the details of the problems arising have not been generally discussed in public reads, albeit unintentionally, a little unfairly perhaps to the authors of four papers between 1954 and 1956. Since that time actuaries concerned with pension schemes have been very busy cultivating their gardens, wherein some pretty nasty weeds have been sown. Nevertheless, there have been two papers on the subject since then —one to the Institute Students' Society and one to the Faculty Students' Society.

We have moved quite a long way since those discussions seven to nine years ago. At that time the authors were much concerned to argue the case for a with-profit pension plan, mainly from the point of view of the office. However, there is no doubt that the idea has caught the imagination of the public, so that even the doubters among the offices have come into line, and now we only have voices, or maybe a voice, crying in what is perhaps not exactly a wilderness. This is surely a tribute to the reputation for making profits and declaring bonuses which the life offices have built up in the past.

As the authors say, the number of with-profit plans on offer more or less equals the number of offices underwriting the business, but I would suggest that there are recognisable family groups, three in number, which might briefly be described as "rebate plus cash bonus", "cash bonus", and "reversionary bonus". Here one might take issue with the authors on some statements they make on page 30. In the middle of the page they say, "These considerations indicate a system whereby profits are paid to the employer in the form of a reduction of premiums", and later on they say, "The method" (that is the reversionary bonus method) "has the drawback of creating an additional problem—that of equity between the different employees". It is quite possible to devise a plan declaring bonuses in the form of additions to pension probably, but not necessarily, using controlled funding, wherein the benefits to employees are fixed, and profits are not paid in the form of rebate of premiums. The third family group I have mentioned does consist of such plans, and how they may be formulated is described in Mr. Edey's paper to the Institute in January 1956.

The authors wonder if one type of with-profit pension plan will triumph over the others and they make the comparison with the early days of ordinary life assurance. This comparison is interesting in many ways but, as the authors remark themselves, the situation is now different. Then there was ignorance; now there is knowledge. Each type of plan mentioned is put forward by life offices of impeccable reputation. There is another difference. Our predecessors looked forward to an era of almost limitless expansion, and something of the same note lingered on in the discussions round about 1955. Now, it would be a bold man who would forecast the state of the pensions market twenty, or even ten, years ahead, but it does seem unlikely that with-profit plans will have opportunities similar to those enjoyed by life assurance in the past. Already the market shows signs of saturation, and surely this will become worse if the area of State participation increases, encouraged, no doubt, by European influences. The future would seem to hold more competition, more attacks on existing schemes, more scheme amalgamation and discontinuance, lower mortality, higher expenses, more pressure, in fact, to do all the things that we said we never would do.

What of equity when these times come? Will we come clean and say that there is nothing or that there is less in the pensions' profit kitty than they thought there might be, or will the money be found somewhere? Whatever the answer may be to that, what type of plan will have proved soundest from the life office's point of view? Surely it will be that plan which did not anticipate profits and which held on to the bonus reserves until the last possible moment. The symbol of security here would seem to be the triangle in the form of Mr. Redington's triangular bonus.

Mr. I. Isles.—I have risen, in Mr. Donald's metaphor, to a different fly from that of the previous speaker. In fact, the fly deals with the equity of distributions in the light of the new problems which have arisen in recent years with the increase in life office holdings in ordinary shares and the rise in the price of ordinary shares. There is a parallel, I think, between this situation and that which confronted actuaries in the early nineteenth century in that we have surplus funds in our hands which have arisen in a way, and with a suddenness, that was unlikely to have been foreseen. The methods of achieving equity, where a rise in interest rates is linked with a fall in capital values and *vice versa*, have frequently been discussed over the years, but the new problem that is with us is the movement in the same direction, predominantly up but sometimes down, of income rates and capital values. There are two questions. How much is to be distributed as bonus and how is it to be shared out? The rise in the market value of ordinary shares in the last five years has arisen not only because of increased dividends arising from inflation, but also from the anticipation by the investing public of future increases in dividends. Taking the long-term view, therefore, I think that some reduction in present-day values should be made for the second of these features and perhaps if we job backwards some graduation of the curve covering the years 1950-1960 should be made. If this view is taken, it seems to me that book values of ordinary shares should be written up gradually and steadily, ironing out minor ups and downs and releasing gradually the benefit of increased capital values, perhaps even including capital appreciation as a regular item in the analysis of surplus. This slow release of capital appreciation may not at first sight appear to show up well in competition with other forms of investment—it cannot hope to do so if we make comparisons with the investor who sells out when the market is at the top—but over the duration of a medium or long-term policy, this plan offers a favourable comparison and it guards against any possibility of a major setback in the advance of ordinary shares such as might arise in the event of deflation, depression, or even a period of dividend limitation. Like William Morgan, we must resist any public clamour to give away too much too quickly. Ought we not, therefore, to look on the gradual release of capital appreciation as an addition to the interest yield arising from successful investment policy, and share it out in the same way as we share out any extra interest earned by declaring a higher normal rate of bonus and charging new entrants more for the privilege of joining a fund which enjoys this feature?

This particular course was suggested in the paper given by Mr. Benz to the Institute in October 1959 but it did not receive a great deal of favour in the discussion. I wonder, in fact, whether it does not provide the correct answer and that the special bonuses declared in recent years may be regarded more as in the nature of corrections or delayed payments arising from the delay in market values reflecting the underlying value of shares and whether we shall see in future smaller special bonuses which, because they are smaller, will be included with the normal bonus.

Mr. Donald has drawn attention to the wide disparity between the sum assured secured by a with-profit policy as against a non-profit policy but offices have in recent years encouraged to a considerable extent the effecting of decreasing temporary assurances in one form or another in conjunction with with-profit policies. These decreasing assurances have closed the initial gap very considerably and as many of them run for something of the order of twenty years that is much the same term as the term to run to Mr. Donald's cross over point.

Mr. F. M. Redington.—There is much in tonight's discussion on which I would like to comment, but the job I set myself in closing the discussion in London last week was to try to draw some conclusions from our 200 years' history. Our generation has been through quite exceptional changes of fortune. Our old systems have been tested and we have been forced into the basement to look at our foundations. There are many chapters in our history which are still open, but perhaps some can be concluded.

While I find the first 100 years of our history fascinating, my great admiration and respect for the last 100 years is tempered with some impatience. Too often the fundamentals are hidden beneath a complex practical superstructure. For 200 years we have been searching for a valuation basis which both demonstrates solvency and produces equitable surplus in a convenient manner. One of the big advances of the last 20 or 30 years has been to appreciate that there are three questions here and that they cannot all be answered by the same valuation system. These three are: Is the company solvent? What is a fair surplus? And how should that surplus be distributed? Now, I think, we know the answer to the first two questions and I think we know the third to be insoluble.

As far as solvency is concerned I do not think there is any dispute among any of us—or ever has been—that we must use a prospective gross premium valuation; it is active in that it is responsive to changing events and it is satisfactory if cautious but realistic estimates of the future are used. As to the rate of interest, we can use the rate on the current assets as long as they last and a cautious rate thereafter.

When we turn to the question of what is a fair surplus for the year, I must stress that *any* system of valuation is prefectly fair, in theory, if the resulting surplus is distributed where it arises. It is not a question of right or wrong, but of a practical, sensible answer. In North America they are more logical. They choose to use a net premium valuation and then they distribute the resulting surplus as fairly as they can by the contribution system. Now, while any valuation basis can be fair, in practice we cannot have erratic or negative bonuses, so our reserves must start at nought and finish at a hundred per cent. In these circumstances the net premium basis —the old-fashioned, passive unchanging net premium method—zillmerised for preference, is eminently sensible, satisfactory, and objective. There is an overwhelming consensus of world opinion to support the net premium valuation even when the philosophy of distribution thereafter is entirely different—simple bonus, compound bonus, uniform bonuses, variable bonuses, contributory systems and so on.

There are some reservations however. A bonus reserve basis on the original premium basis is theoretically even better than a net premium basis, but it is impracticable. In any event, it gives much the same answer as a net premium valuation. Second, it is legitimate, in choosing *which* net premium basis to use, to consider the form of the subsequent distribution, e.g. simple or compound bonus with a margin for level emergence. I think we could write *finis* to that chapter, too; that the sensible way of producing a fair emergence of surplus is the net premium valuation.

In Britain there is still some doubt about this and there are many people who feel that the net premium valuation is artificial and misleading. In some ways the net premium valuation is worse than artificial. In the ordinary sense of the word it is not a " valuation " at all, and much of the confusion arises from this. " Valuation " is inherently a prospective word. It implies an assessment of the future. Now a passive net premium valuation is basically a statement of the expected reserves throughout the duration of a contract. It is comparable with a navigator's "expected time of arrival" and the surplus is, colloquially, where you are compared with where you expected to be. If we dropped the word "valuation" much of the confusion would disappear.

In case I seem too critical of the bonus reserve valuation, I would add that it is an excellent language for expressing our results. If we really get into difficulties through a collapse in the stock market, a bonus reserve valuation is a very good way of demonstrating solvency while maintaining bonus declarations. But it is no way of finding the truth. I may say that in my own office we continually use both net premium and bonus reserve valuations, but I get no information from the bonus reserve valuation about a fair surplus for the year.

I think that we can prove that the third question—how should surplus be distributed—is insoluble. The identity of money is lost in the anonymity of large funds and the whole problem defies analysis. There always was a dimension in this problem which was above science. The expectations of the policyholders are a real factor, not purely psychological. Matching theory has added its algebraic voice to the theme that generations are indebted to each other and that there is a general uplift from belonging to a life office community:—an uplift which belongs specifically to no particular group. I said in the discussion at the Institute that it is now a scientific theorem that science is not enough. Now, in an intangible area such as this, the simple commonsense of our British uniform system fits our pragmatic character and if it can withstand the last thirty years it can withstand anything. I think there is a great deal to be said for a uniform system with one proviso. It is the proviso that most of the speakers have been talking about to-night and it concerns the assets and the revenue account. Its essence is "What is income and when does it arise?" There is no general consensus of opinion on the subject, but there are one or two points I would make. This is another question which is more than merely scientific. Again, the expectations of policyholders are important and I would say to the last speaker that the rivalries between our forms of investment and other forms of investment are a thing we cannot ignore. If we were in our own world, there is a lot to be said for our old system, but we are now having to compete with other forms of saving.

The past has a sharp lesson for us on this subject. The problem of not giving the surplus to the right policyholders, though it is severe, is far less insidious than the problem of subsequently giving the surplus to the wrong policyholders. The history of the "Old Equitable" is fascinating. Its strength crept on it unawares, but the subsequent distribution of it nearly wrecked the Society. Again, in the 1930's the confusion in the profession about valuation methods very largely arose from the problem of the overspill of profits from the 1920's into the 1930's and the consequence that the new business was not supporting the very high rates of bonus that were being declared.

Having been quite dogmatic on some things, on this issue of what is income and how it should be distributed, I have an open and curious mind. New consensuses of opinion have to be formed and I hope our young men will do it for us.

Mr. R. W. Spittal.—I do not rise to any particular bait but merely to make one or two very general points on this most interesting paper. I found it very thought-provoking and it is a paper which deserves to have far-reaching results.

Like Mr. Donald, I wondered very much about the word " advance " in the title, and I am looking forward to hearing why the authors thought of including it when it did not appear in the title of the book. One is inclined to wonder if, in fact, any advance is possible in this field because, in spite of the impressive technical improvements which have taken place and the availability of powerful means of statistical analysis, we remain as much in the dark as to future variations in practical and economic experience as at any time in the past. Of the seven handicaps to ensuring uniform and equitable release of surplus, listed on pages 22 and 23 of the paper, five are practical and economic. That the authors are well aware of this is shown by their comments under the heading of " Progress " on page 36, where they suggest that a survey of future variations in experience would be a useful guide. The usefulness of such a survey would depend very much on the judgment of those directing it. It is questionable if a survey inaugurated, say, twenty-five years ago would have been of any assistance to management in dealing with the problems which these years have brought. The formation of such judgment is, in the present day, a very difficult matter and it seems to me that this point is related to the authors' general remarks on the profession. With the increasing size of offices and the consequent increase in specialisation, the number of actuaries in a position to take a broad view of the whole problem is diminishing. Not only is the *actuary*, as distinct from the investment, valuation, pensions and so on expert, becoming rare, but the time he has available for original thought and research has been largely consumed by the demands of day-to-day problems. The younger actuary, to whom Mr. Redington referred, who is expected to undertake these tasks, is, in my opinion, as mythical as " the student who has time " of our earlier days. This is such an important question that it merits serious consideration by the Councils of the Faculty and the Institute. Is there not a case for taking joint action to further this research ? Offices would surely agree to co-operate fully in releasing suitable Fellows from their duties to advance their knowledge and would, in any event, benefit greatly in the long run by the post-graduate studies such investigations would entail. It is in my view that, only as a result of such action, will any real progress in this field be made.

Mr. J. Elder.—On page 34 of to-night's paper the authors pose six questions and then proceed to give their own answers. Young men are known to be, at times, critical of the ideas and performances of previous generations. It may be of interest if one young actuary gives his own answers to some of the questions—admittedly from a position of some inexperience.

As regards equity between different groups of policyholders, I would consider that broad justice has been done. However, I am left with the suspicion that successive generations of policyholders have received less than their due share of surplus. Methods of valuation, particularly with regard to assets, seem to me such that the release of surplus is held back to an extent where, by the time it is released, those who are entitled to it in equity are no longer entitled to it in law. We must, of course, seek the maximum security for the policyholders, but I do feel that actuaries have at times been over-cautious, in part from that best of motives, security, but also in part because valuation methods are such that the true position is never revealed and the actuary does not know how large a safety margin he is making.

Despite fairly severe attacks, uniform reversionary bonus systems have emerged virtually unscathed if one goes by the figures in the authors' book where, out of 82 offices examined, 77 granted reversionary bonuses. I cannot believe that if this method of distribution were actuarially unsound, actuaries would have allowed it to survive in such strength. That being so, I would feel that so long as its disadvantages as compared with other methods are relatively minor, one should take account of tradition and public taste. And here I would go much farther than the authors and claim this not as an additional reflection, but as a point of major importance. So long as we run our business soundly and efficiently I would much rather we were practical businessmen than scientists.

One cannot but agree with the authors that progress is difficult to define, let alone assess, and it would be invidious for a young actuary of my experience to comment on the rate of advance in the past. However, it is noticeably difficult to obtain answers to questions about certain aspects of actuarial theory and one must agree with the authors that a great deal of research remains to be done and to be published. There must be a certain amount of research carried out within offices which never sees the light of day as far as the profession as a whole is concerned and there is probably scope here for an immediate increase in the total knowledge of the profession. To my mind, future research must be organised in more detail by the Faculty and the Institute and must be carefully directed at all stages. A start seemed to have been made a few years ago with the formation of study groups on electronics, but no more appears to have come of this method of research. Personally, I would have felt that these groups were too large to be fully effective, but I would have hoped that sufficient would have been learned from their operation to enable us to proceed on not totally dissimilar lines.

On the authors' last question, I can offer no answer, but I would like instead to comment on one of the future variations in experience suggested by the authors for future research—a fall in expenses resulting from the extensive use of data processing. Personally, I doubt whether data processing will ever reduce our expenses significantly. At best, I can only see it holding down the ever-increasing costs of running a life office. At worst, I see it saving us nothing but enabling us to provide a better service to policyholders. More important, whatever its effect on expenses, it should provide us with a great opportunity to increase our knowledge by producing far more statistics than are at present available and, for example, by enabling us to value on several different bases each year.

Mr. N. Benz.—I contributed to the Institute discussion and I do not want to go over the same points as I made then apart from the frequency with which papers come before our professional bodies. I do not think there would be this plea for joint research—which I am bound to say I found a little impracticable—if papers could come forward more frequently and one of the previous speakers really laid his finger on the difficulty which is the question of finding time. I am sorry if I am speaking perhaps a little definitely but I feel that as I wrote a paper only three years ago at the Institute I may say a word on that subject.

I was particularly interested that both the opening speakers referred to with-profit pension schemes, a matter which was scarcely mentioned in the Institute discussion. I think that they exemplified clearly the dangers which exist in giving very different contracts (I have in mind the ordinary individual with-profit contract and the with-profit pension scheme) with the same sort of name and thinking they are the same " beasts ", because they are very different indeed. I would like to support the Opener in his references to the dangers of proceeding on the assumption that they are basically identical.

Mr. Isles referred to my own paper and mentioned the possibility of small special bonuses. Probably a number of offices have thought in the last few years of special bonuses but, perhaps on grounds of their smallness, nothing more has ever been heard of them. Special bonuses should be of reasonable size before they emerge. After all, they cause quite a lot of bother and trouble. I do not think that I have ever seen special bonuses as an attempt to pick up past errors. I have always regarded special bonuses as an attempt to do then and there what should be done then and there, because it cannot be done later.

When I wrote my paper three years ago I spent some time reading through the papers of the nineteen-twenties and nineteen-thirties, and it seemed that one of the things which was worrying our predecessors thirty and forty years ago was the trend of assured lives' mortality. This I found very puzzling because it did not seem to me that, whatever problems they might then have had, they had anything worse in the assured lives' mortality than the absence of a suitable standard table. I have since spoken to a senior member of the Institute who told me that it was lack of confidence which had caused the trouble. Obviously the annuitants, then very unimportant or relatively unimportant, were a matter for some thought, but the main problem was the question of the outlook for new investments. We still cannot purport to see clearly what the future holds for investment matters, and we can only do our best. This is what the authors are telling us in this book, and I would like to say again, as I did at the Institute, that, if anybody says that much more could have been done, I would like to turn the question and say, " What more could have been expected ? ".

Mr. R. Anderson.—I would also like to take up a fly which has been raised earlier by Mr. Macharg—the with-profit pension scheme. With-profit ordinary business arose as a natural consequence of the way ordinary business was set up. On the other hand, with-profit pension schemes arose not as a natural thing at all but chiefly, it seems, from the desire of offices to cut down on the guarantees which had previously been given to non-profit schemes and which were threatening to swamp the original business. It is therefore, of interest, to look at the various types of scheme which have been arranged and see how well these fit into the picture of with-profit business as such and how far they are simply methods of cutting down on guarantees. Mr. Macharg mentioned the various families of with-profit business and the first family I would like to choose is the family where there is a one-year guarantee of premium rates and a cash bonus. It seems to me that if premiums are independent of the amount which has been contributed to the office's funds in the past, then this is, in fact, a variation on a non-profit theme and not a with-profit contract at all. If there is no variation with the office's experience on sums already paid, it is simply a one-year single premium non-profit contract. The office makes up its mind each year what particular rate of premium is applicable in that year. Of course, if the premium depends on some criterion which may be a measure of the office's prosperity, as I believe is the fact in one case where the premium depends on the yield on the office's funds, then this might be regarded as a with-profit scheme. There is a further extension of this one-year guarantee of premium rates which is that on occasions a further premium reduction is given depending on office prosperity. I think this is far more of a with-profit idea than anything else.

We come now to the reversionary bonus system. The more I think about reversionary bonus systems in relation to pension schemes, the more I think that this is an extension of the ordinary reversionary bonus system which the market knows but which may perhaps not fully fit in with the type of business which pension business is. In the first place, it is not desirable for an annuity to be increased by reversionary bonus additions. This simply distributes mortality profit to the least deserving. Consequently, we find that reversionary bonus additions must cease at pension age. Now, in the one-year guarantee system in particular, the part of the contract which can be least foretold at the time the contract is issued, is the mortality experience. Consequently, the office will naturally wish to increase reserves at pension age as a contingency against adverse future mortality experience. It seems to me that there can be little prospect of equity when the type of the business is such that extra reserves are required at the very point when participation, in fact, ceases. I cannot see how equity can be arrived at by distributing surplus—mortality surplus in particular—in proportion to pre-pension age reserve. The maturity bonus has been suggested as the method by which this drawback can be alleviated but I fail to see how a maturity bonus can do anything other than distribute expected profit. It cannot possibly distribute actual profit. A maturity bonus to my mind is much more akin, in effect, to what is obtained by applying the maturing policy monies from an endowment assurance to secure an annuity at a higher rate than the guaranteed rate. In fact, in the with-profit pension scheme there is generally no cash option but, nevertheless, that is the effect of the maturity bonus. In with-profit pensions business, and, indeed, in all pensions business, 90% of the contracts are in some way or other altered before the contracts reach their end—with withdrawals, early retirements, late retirements and all these other things. In a true with-profit pension scheme we should take account of these variants in determining surplus to be distributed to an individual scheme but there is certainly no publicised method which takes account of the surplus arising from these sources. It seems to me that if, in the first place, we had chosen a different line of approach, if we, instead of relying on a variation of the previous deferred annuity contract, had decided that pensions business could best be looked upon as an accumulation of a given share of the assets of a separate pension company, then we could have set up a system which, perhaps, would not have endangered the offices, which might not have had the advantage of the security which the original office at present gives so many of its pension plans, but which would, in the long run, have led to far more equitable treatment of both pensions policyholders and the ordinary policyholders of the office.

Mr. A. T. Grant.—I think I would join issue slightly with the last speaker and with the authors in rising for this tempting and succulent fly of with-profit pension schemes.

On page 30 the authors suggest that we have rather a large number of with-profit pension contracts on the market, and they are undoubtedly correct in saying this. They did not suggest explicitly that this was a bad thing; they simply stated this as a fact and left it for us to jump at this large and tempting fly. I wonder if they had their tongues in their cheeks at this point. It seems to me that there are a lot of reasons why there should be a multiplicity of with-profit pension schemes. First of all, if you are dealing with ordinary life assurance contracts, to be practical you must decide on a standard contract and then sell it in sufficient volume to make it worth while putting out the contract at all. When you come to a pension scheme, you find yourself in the position of selling one scheme to one employer who may himself represent perhaps 10,000 or 20,000 lives in a large works scheme and this fact in itself makes it possible, and with a broker nudging your elbow even desirable and necessary, to add a few frills here and there, which you certainly would not envisage for the individual policyholder on ordinary business.

As regards the types of assured scheme, I can see that the needs and preferences of employers vary considerably. For example, some employers might like the deposit administration type of scheme, but even for pension schemes insured through deferred annuities the two major methods seem to me, in many ways, very similar. Mr. Anderson has referred to the rebate type of scheme where there is virtually no guarantee at all, or a one-year guarantee with perhaps a small cash bonus later. The second type might be the reversionary bonus system, a system which has attractions in as much as it is perhaps easier to sell. You can point at your ordinary business bonus record and say "We have done well in the past and we have declared a 60/-% bonus on ordinary business, and now we propose a 60/-% bonus on group pensions". There may be no connection at all between the two bonuses but it helps to sell the group pension scheme. I do not defend this as a sound reason from the point of view of actuarial science, but rather from the point of view of a practical business man as advocated by Mr. Elder.

If you consider these two methods together, I think you find that there are a lot of parallels. Take a male entrant at age 35 due to retire at age 65. If we assume an average term after age 65 as short as five years, there would be 35 years to run from the payment of the single premium at age 35 to the average pay-out date of the annuity. Now, some offices guarantee maximum premium rates and then cost on cheaper chargeable rates, which, in effect, have virtually no guarantee in them at all; the maximum rates are extremely high and the chargeable rates have considerable latitude. I have seen such quotations, where, for a scheme with young lives, the maximum rate quotation in the first year was something like double the actual quotation based on chargeable rates, or if you like to put it another way, the maximum rate cost is x and there is then a rebate of $\frac{1}{2}x$.

In the compound reversionary bonus system there is a fairly common practice adopted of discounting bonus, one way or another in the costing plan, to bring out a first year cost which is competitive with other with-profit plans and, indeed, with non-profit plans. It is a pity we have to sell pension schemes on the basis of first year costs, but we do, and by my arithmetic, discounting say £2% per annum bonus for a term of 35 years would, in fact, halve the initial cost so that in my carefully chosen example the two types of scheme show a rough equivalence in the relationship between what one may consider as maximum cost and actual chargeable cost.

What happens when you actually pay your premium? In another place a week ago, surprise was expressed that for a single premium with-profit deferred annuity contract where you are actually going to receive bonuses in future you could pay less than for a non-profit contract, even although the same pension was guaranteed under both cases. This might be the case for a youngish entrant with the rebate scheme combined with a small cash bonus. A later speaker at that meeting pointed out correctly that, of course, the guarantee of premium rates was the balancing factor and you could not look at one year's premium application by itself. You must consider the whole conspectus of years covered by the guarantee.

There is a difference between the two with-profit systems I have mentioned when the premium has actually been paid. If you employ a rebate system incorporating a small cash bonus, then as soon as you have accepted a premium you have guaranteed the pension which is to be bought. There may be a little bit of cash going back to the employer by way of bonus but, basically, you have a non-profit contract. If, on the other hand, you employ the reversionary bonus method and the employer has said, " I want £100 per annum pension for this employee, but I will actually pay in a premium sufficient to buy £50 per annum pension and hope the bonus makes up the balance ", you have a different set-up on acceptance of the premium, because now the office has only guaranteed £50 out of the £100 per annum pension to be paid eventually. The office, therefore, is in a rather better position with this contract in as much as it still has a large amount of leeway to make up and a large amount of manoeuvrability to correspond with this.

As regards this cash bonus, I always feel that people sound a bit apologetic about any small cash bonuses paid later in conjunction with a rebate scheme. I do not think this should be so at all. Under a with-profit scheme, the actuary, who is not infallible, must fix some sort of rate which is reasonably close to his expected experience, but just a little bit on the safe side. This is, after all, a with-profit contract, and as the experience differs from what he has anticipated, as it almost certainly will, then it is proper to take care of this by instituting a procedure to sweep up the odd crumbs and put them back into the mouth of the employer.

As far as the maturity bonus is concerned, surely all that one is doing is reducing the area of error. You wait until you get up to age 65 for a man retiring at that age before you estimate and pay out a final bonus for the last few years. This is much easier than making estimates at age 35 under a non-profit contract as you must do when you are trying to fix your rates.

Finally may I endorse enthusiastically a comment made by Mr. Donald, which was that, historically high interest rates were needed before with-profit pensions could be introduced as they have developed. The authors have given us a notable historical story of surplus. and in this context it seems to me right to acknowledge the importance of high interest rates which were essential before we could sell with-profit group schemes as we have.

Mr. G. G. Bannerman.—I must admit that when I came along to-night I had met Mr. Cox before, and therefore knew what he looked like. I had not met Mr. Storr-Best. From the paper I had rather wondered whether he would appear here in a toga because the paper was rather reminiscent of what it is alleged that Pontius Pilate said—" What is truth ? " Pilate, we are told, did not stay for an answer. The authors, I am glad to say, have come along both here and to our sister body in London, and I have no doubt they have got a great many answers, although whether they are wholly satisfied with them, I do not know. They have asked us, in so many words, " What is progress ? ", and also, in rather more words, " What is equity ? " I think that for the question of " What is equity ? ", we might almost go down South again. In England, the concept of " equity " arose because the legal system there is not quite as good as that up here. As a result, bad cases made bad law, and "equity" arose being, I think defined as the conscience of successive Chancellors. I think that equity in bonus distribution must base itself on the consciences of the successive actuaries in our life offices. We have there almost an exact parallel. I feel, though, that in this business of equity we hear a great deal of talk around it and about. I think that equity to a large extent is realised if someone, when he makes a contract, gets what he contracted for. If a person comes in to a life office he is given an idea of the history and of the bonus philosophy of that office and he pays his premiums accordingly. He has reasonable grounds for complaint if there is a change in philosophy, but if the general principles are the same he has got no great complaint. He comes in on a uniform bonus system, he gets a uniform bonus and he should be happy. The one thing, though, which we must watch is equity between the successive generations of policyholders. If the actuary's conscience says that he must hold up surplus, or something which he thinks is surplus, to ensure the stability of the office, he is enhancing the bonus prospects for the future and to preserve equity he must, I submit, charge the premiums for new entrants in accordance with the bonus prospects of the office.

There has been a lot of advocacy to-night of research into the future. I feel that, to carry out adequate research into the future, what the actuary needs, instead of a diploma, is a crystal ball and this is rather difficult. We are not able to make just those estimates of future experience that we would like and such estimates as we can make involve much uncertainty. In fact, "Nothing is certain but uncertainty"; and I wonder whether we ought to use that as a basis for a valuation theory. The authors have referred to actuarial science as having progressed. Progress has meant that we have gone from individual calculation of the values of policies through grouping, short-cut methods and back to computers where we do everything individually again. Introduction of computers has, however, meant that we can try out our valuations on a number of different bases. If we are going to carry out the valuation of our liabilities on different bases (we must remember that a valuation of liabilities on its own does not mean much) it must be coupled with an appropriate valuation of the assets—but if we try both out on various assumptions, comparing the two on bases that are linked, we will get an idea of what we have in hand. We do not know exactly what will come in the future, but we can try out the different bases and see how things may happen. We hand out the surplus so calculated and I think, if we do that, we have achieved equity.

Mr. A. N. Calder.—My first reaction upon reading this paper was one of disappointment. Disappointment that I did not have it available during my studies. I am sure that this paper will be invaluable to students in stimulating original and enquiring thought into the basis for and the background to the methods of distributing surplus.

With regard to the possibility of the greater use of electronic computers and data processing leading to simplicity in the type of with-profit group pension scheme, I feel that while this is greatly to be desired—not least by the programmers—it is rather doubtful if it will ever come to pass. My own feeling is that, while in certain circumstances the fact that an office's group schemes are being processed on a computer might well lead to a certain amount of standardisation within the office, it is unlikely to generate simplicity of types of scheme between offices. In fact, the fundamental problem remains with each life office of deciding upon the method by which it should distribute surplus under a group pension scheme.

Towards the end of the paper, attention is drawn to the possibilities of estimating the effects of future trends by using computers. I agree, as the last speaker said, that there is a great deal of useful work to be done here. Indeed, it is not looking too far ahead to suggest that programmes will be written which will enable the actuary to see what the results will be from various basic assumptions. Not only will the effect of future trends in mortality and interest be examined with respect to model offices, but, starting also with an associated portfolio of investments, it will be possible to estimate the effects of various assumptions regarding the course of future events. The basic programme would be written in such a form that it consulted various parameters to determine the basic assumptions regarding the trends of interest, mortality, etc. By varying these parameters the results of different assumptions may be ascertained. Included amongst these variable parameters would be the possible trends in the markets, variations in the valuation bases and also in the bases for valuing assets. This, in turn, would obviously affect the amount of free reserves at any given time. By this method the actuary may not be able to see exactly where he is going, but he should be able to see to a very much greater extent than previously where not to go.

Mr. W. Lundie, closing the discussion, said:—When I first saw the paper which has been discussed to-night I anticipated a wide-ranging discussion. If I may somewhat broaden the angling analogy, I think that our authors, coming from the South where the anglers are coarse and not fly as they are here, have not delicately flicked in the odd fly—they have thrown in a sack of ground bait—and that makes life very difficult for the poor man who has to close the discussion. Before the discussion started, one of our visitors asked me if it was the custom for the Closer to synthetise the discussion. To that my reply, suitably expurgated, was, " Heaven forbid ! ", and I think in the light of what we have heard I have been fully justified.

Being scientifically minded and computer minded, I programmed my contribution. I had branches, sub-routines which I was going to use if the discussion went this way or that way, but it soon became evident that the programme was badly in need of de-bugging. At least one gremlin from the South got into the works and we found ourselves in a multiway branch. I must confess at one stage I got rather lost. So I have had to abandon my prepared remarks, most of which have been said in a different manner and perhaps with different emphasis, and I come to, first of all, the Opener, Mr. Donald. Very much to my surprise—this was completely against the programme—I found myself agreeing with practically everything he said. In particular, I found myself in complete agreement with him on the question of abnormal surplus belonging to the " estate ". Abnormal surplus, it seems to me, almost inevitably arises from a decision having been taken which involves a certain element of risk and that decision just could not have been taken unless there were free reserves. Also, where the abnormal surplus has arisen from such a course of action, one must consider the other side of the coin. What if the decision had resulted in an abnormal deficit. Would there have been a special negative bonus ? I do not think so. It would have been met possibly out of inner reserves and a lowering of the normal bonus. This seems to me to be a very strong argument against the use of the special bonus.

The actuary's attitude to equity has always bothered me. In fact, I can get lyrical about the subject. I started my professional training as an accountant. During that training I learned two things—to try to ascertain the facts and, having ascertained the facts, to try to ascertain what the contract was. When I became a senior actuarial student, I must confess I was puzzled by the constant references to equity. It seems to me that there never has been such a well-meaning profession. We are always seeking after equity, sometimes, I think, seeking far too hard after equity, when there is a plain answer in sanctity of contract. If we will only try to find out what the policyholder is reasonably entitled to think his contractual rights are, then a good deal of our worry over equity would be eliminated. The time for equity, it seems to me, is when we determine our with-profit rates. At that stage we say, " Here is your chance to get a share in the future prosperity of this particular institution ". We try to fix these terms so that in the light of conditions at that time they represent a fair balance between the existing policyholders and the new entrants. Having done that, there is a clear contractual right, it seems to me, to the new entrant to share *pari passu* with the old entrant on the bonus distribution system as used in that particular office. Sanctity of contract, it seems to me, is even more important than equity and it is only when conditions are so abnormal that the contractual right is not immediately evident that we should have recourse to equity.

Mr. Redington, whom I have referred to in disguise earlier, produced what I found a very useful attitude towards the net premium valuation—the charting of a course with a correct estimated time of arrival. But, it seems to me that does not answer the whole question. Why net premium valuation ? Why not just an arbitrary course which looks nice and which will get you there in time ? Why bother to go to the trouble of calculating ? Why not just take an arbitrary set of figures ? The other point which worries me—and this is in connection particularly with group pension schemes, whether with-profit or non-profit—is that where you have a large volume of group schemes with perhaps short premium guarantees so that the business is effectively single premium business, I do not see how you can value that type of business consistently with what is becoming a smaller part of the fund valued on a net premium basis. You cannot value single-premium business adequately on a net premium basis. So we are going to have, perhaps 40% or even less of the fund valued by what I still regard as the artificial net premium method and the remaining part valued on some sort of gross premium method. This, I think, is one of the major problems that the profession has got to solve on the scientific side. Mr. Redington, quite rightly, said that the test for solvency would normally be a formality in current conditions. The question was to find a basis which revealed a fair surplus. Now, really, that is rather begging the question because if we knew what a fair surplus was we would not be worrying about equity. It seems to me that some of the younger speakers who spoke late in the discussion have perhaps given us the clue to the line of research which will prove most useful to us. Uncertainty regarding the future, particularly the future terms of investment, has always been the actuary's nightmare. It is his big problem. Mr. Donald compared the long-term prospects in 1949 and the long-term prospects now. This, I think, is the clue. I was just as ignorant in 1949 as to the rate of interest in 1970 as I am to-day. Beyond a certain term our uncertainty is constant and this very constancy of uncertainty could well be the foundation of a new approach to valuation and emergence of surplus, whereby instead of having a single valuation basis we have a set of valuation strategies which define what the liability will be in various circumstances where you are completely ignorant of the future. If you have such a concept, then you can work on the principle that in the next five years you will move from a known position to various possibilities of positions where you will have complete uncertainty. Successive five years do not matter because you will still be going into complete uncertainty. Therefore, you have only short-term uncertainty to worry about. I strongly support the authors in their section of the paper labelled " Progress " and I support most strongly those who, in the discussion, have called for more research. I think our profession may well be proud of what it has done for life assurance in the past. I am not so sure that we can be proud of what we have been doing recently in the way of fundamental research in our own science. I agree with Mr. Benz that organised research groups inside the Faculty and the Institute have grave practical difficulties. I think the best research in this field would be done by small groups either working within their particular office or working independently, provided they are willing to publish their results reasonably speedily and are not afraid of criticism. I would most strongly appeal to the younger members of the profession to consider whether they want to be scientists or whether they want just to be business men. We must be deeply grateful to the authors for their liberal use of ground bait which has stimulated such a good discussion. I am sure they must be gratified that they have started a fair amount of controversy and we are all very grateful to them.

The President.—We have had a most interesting discussion and, as I said at the start of this meeting, we are most grateful to Mr. Cox and Mr. Storr-Best for bringing their paper to the Faculty for our consideration this afternoon.

The actuary in his training—and this has been implied in much that has been said this afternoon—learns to relate the past to the present and to the future, and it is significant that the authors conclude their historical survey on a forward-looking note and in a spirit of cautious optimism to which, again, several references have occurred. May I confess that more than quarter of a century ago—and centuries seem to be the measure of time in our discussion to-day—I presented a paper to the Insurance Institute of Aberdeen on " The Development of Life Assurance ". In that paper I explored the history of far more than two hundred years ago. By some means, now long forgotten, I had discovered that in ancient Greece they had a scheme for the granting of pensions to widows and orphans and that the lives of slaves were insured in a common fund by their owners. And, in Rome also, there were *collegia tenuiorum* which provided for their members fixed sums payable as burial money in the event of death. To these benefits the members contributed an entrance fee and monthly premium payments—whether by banker's order or not, I have no knowledge. There was also a Roman Prefect, Ulpianus, who, in the year A.D. 364 prepared tables to measure the length of human life—but Rome was sacked and darkness fell upon European civilisation and our actuarial history was resumed many years later. That history, which we have been reviewing at this meeting of the Faculty, started in those days when the " Old Equitable " was founded and I know that I may be excused this afternoon for mentioning the name of that office which first introduced scientific life assurance to the world at large. In those days, the Gambling Act, 1774, had not yet been passed. Life assurance was a mode of speculation and, as John Francis said in his *Annals, Anecdotes and Legends of Life Assurance,* published in 1853, " there was absolutely nothing on which a policy could be opened but what was employed as a mode of gambling. Scarcely a nobleman went to his long account without an assurance being opened during his illness by those who had no interest in his life ". Out of all this unhealthy background to the world of Life Assurance, there emerged the " Old Equitable ", which, in the year 1800, was transacting an annual new business approaching £1 million in sums assured—truly a remarkable achievement. From that day to this, the " Old Equitable " has not only represented the best traditions of life assurance and actuarial science but has also produced several of the most worthy and most widely respected members of the actuarial profession. To them to-day we pay tribute and we are glad of this occasion to do so.

To Mr. Cox and to Mr. Storr-Best, we are most grateful for their paper which has stimulated such an excellent discussion. We thank them most sincerely for presenting their paper to the Faculty and for the opportunity it has given us to review the past, present, and future of life assurance. Members of the Faculty, before I ask Mr. Cox to reply to the discussion, I know that you would like to show your appreciation to our joint authors for presenting us this afternoon with such an interesting and stimulating paper.

Mr. P. R. Cox, replying to the discussion, said :—I thank you very much for your kind words. May I join with Mr. Storr-Best in saying how delightful it has been to come to Edinburgh and hear this most interesting and stimulating discussion ? Sitting here on the river bank with various lines out dangling various kinds of bait, I was interested to hear people not only rising to the bait but also saying they would rise to it. What they did not say was whether they reckoned they had been fairly hooked. I may, perhaps, be allowed to consider in some cases that they were ; but standing here with a gaff in my hand, I am a little reluctant to apply it because, really, there are two hands upon it and, while Mr. Storr-Best told me what he was going to say in advance, he has no idea whatever what I am going to say in reply. So perhaps I should be a little cautious and leave some of the points to answer in writing later on.

I do not think we quite realised when we started our work how relevant this reconsideration of the actuarial position to-day might be. What I have learned in the last two years about the state of affairs in other countries whom we may be joining in a Common Market makes me feel that a re-appraisement of our position is certainly called for at the present time.

To the speaker who suggested that a historical approach would be helpful to the student, I am glad to say that Mr. Young, the joint author of the new text-book on life assurance now in preparation, tells me that it does in fact adopt that form of approach and that he does not disagree greatly with ourselves in the manner of presentation of the history.

The question has been raised whether the profession has advanced and this may be linked with what was said at the Institute last week about whether we are scientists or artists. I think Mr. Storr-Best would join with me in saying that we should like to see science applied as far as it possibly can be but we also believe that there must be a residual part which can only be art. The question was raised also of what science meant, as much modern science is, in fact, artistic in quality. I think we would take for this purpose a rather old-fashioned view and describe it as, " A series of logical steps on which we can all be fairly generally agreed ". It may be that Mr. Redington is right in saying that the first hundred years were a period of advance and the second hundred years have been comparatively unimpressive. That may be because we got as far as we could a hundred years ago with the scientific logical steps which everyone can agree upon and since then we have had to improvise. I must confess to a predilection for attempting to be a scientist rather than a business man but then, of course, I am not a business man.

Mr. Redington suggested that world opinion is in favour of the net premium valuation. I wonder, in fact, if he is not mistaking a haphazard pile of stones for a carefully constructed edifice ? The reasons why net premium valuations are used in various countries differ a great deal. It may be because they fit in well with the contribution method, or because they allow very close control by the supervising authorities, or because they release surplus in an equitable manner. But I am not sure that these add up to a universal acceptance.

I was interested to hear the remarks in the discussion about anticipating future variations. It is easy when looking backwards into the past to ask, " Why was that prospect not foreseen ? " I accept, of course, that it was not so obvious before the event occurred but must confess to a feeling that we should try more than we have done to envisage the prospects for the future.

The question of how research should be stimulated has been raised and one speaker mentioned the use of study groups. These are indeed useful but I am not sure that they are the most effective way of conducting research in this case ; it may well be, as Mr. Lundie said, that groups within the offices may do better, providing that the necessary publicity can be ensured.

One difference from the Institute discussion which I have noticed tonight is less readiness here to criticise the quotation we put at the beginning. If I may, I will give you another quotation which seems apt although we did not put it in the book. It is by Lytton Strachey and he says :—" Ignorance is the first requisite of the historian—ignorance which simplifies and clarifies, which selects and omits ".

Mr. Cox and **Mr. Storr-Best** subsequently wrote as follows :—To reply adequately to the wide-ranging discussion would require another paper and we must content ourselves with a few remarks. Our defence of the use of the word " advance " in the title of the paper is not perhaps a strong one ; but we felt that a little euphemism might be justified, on the grounds that the successful completion of two hundred years of professional existence is an occasion as much for congratulation as for criticism.

We have great sympathy for much that Mr. Donald said in opening the debate and we agree with him that it is the size of present-day bonuses that makes the question of equity important. The system of bonus loadings may, as Mr. Donald implies, be anti-insurance in spirit but if we press this argument we may be accused of biting the hand that feeds us : the prosperity of British life offices today is in no small measure due to the investment element inherent in with-profit policies. It would be generally agreed, we think, that broad equity can be achieved among the members of the same generation. Equity between different generations is harder to attain and, as Mr. Elder pointed out, excessive caution must lead to inequity. Certainly we should not advocate any distribution resulting from price movements which anticipated higher dividends in the future ; there should therefore be sufficient margin to cover such falls as the 25% to which Mr. Donald referred. To the extent that capital appreciation has merely followed the fall in the purchasing power of the pound it seems improbable that share prices will ever revert to their pre-war level and not to take account of this would be unrealistic. From this point of view the gradual distribution of capital appreciation proposed by Mr. Isles may not go far enough. We feel that Mr. Benz hit the nail on the head when he said that special bonuses attempt to do at once what cannot be done later.

Speakers on the subject of progress were unanimous in their opinion that this was necessarily retarded by the impossibility of seeing into the future. We agree with Mr. Lundie's remarks as to the constancy of uncertainty beyond a certain term—this is akin to the expanding funnel of doubt described by Mr. Redington in his paper to the Institute. The references of Mr. Lundie and other speakers to a set of valuation strategies supports what we had in mind with regard to computers. Whilst one cannot foretell the future, one can now prepare onself for a number of contingencies. Actuaries can at least console themselves with the thought that, if Benjamin Franklin was right that nothing in this world is certain except death and taxes, they have a better chance of forecasting accurately than most men do.

The need for more research was mentioned by a number of speakers. Mr. Spittal referred to the shortage of time and suggested that actuaries might be released from their duties to undertake research. We doubt if this would be practicable in present times. There must, however, be many investigations conducted by individual offices which are not publicly presented. The sporadic nature of papers on certain subjects may be due not only to the difficulty of finding a suitable author able to spare the time but also to the fact that the moment may be felt inopportune or the programme of papers may already be full.

In the very interesting discussion of with-profit pension schemes Mr. Macharg took us to task for our reference to the problem of equity between different employees in reversionary bonus schemes. He did not refer to our preceding sentence which suggested that the system may be adopted because in times of inflation the amounts of pension originally provided may prove inadequate. We had in mind a scheme—perhaps unusual nowadays—in which reversionary bonuses were used to increase pensions rather than reduce the costs of the employer. Where employers' contributions are kept low at the outset on certain bonus assumptions the difference between reversionary and cash bonuses seems only a technical one. Pressure of competition has encouraged the quotation of very low initial premiums and we would support those speakers who referred to the dangers of this and, in particular, to the fallacy that with-profit ordinary and pension policies are similar.

We certainly had not intended to do less than justice to the recent papers on with-profit pension schemes to which Mr. Macharg drew attention, and he will find most of them listed in our Bibliography. We did feel, however, that the problems had not been adequately discussed; this is no doubt due to the fact that most of the papers were written some years ago, largely before the problems had had a chance to emerge.

Finally, we must apologize to Mr. Bannerman for appearing in *pallia* when such a memorable occasion clearly demanded the *toga*!