

DEFERRED ANNUITIES WITH PARTICIPATION IN PROFITS

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SOME combinations of ideas seem strange and unfamiliar. Life assurances with participation in profits—what could be more natural? But annuities with participation in profits?—the association of such discrepant ideas gives rise to all manner of objections in our minds.

HISTORICAL

2. At the start of scientific life assurance in 1762 it was customary to grant assurances either for capital sums or for annuities. A survivorship assurance might assure a capital sum to the surviving life or it might assure an annuity. Similarly, a pure endowment contract might assure a capital sum on the survival of an assigned time or it might assure an annuity, i.e. a deferred annuity without return of premiums. The right to participation in profits was granted to all contracts which were for the whole continuance of life, that is to say, whole-life assurances, survivorship assurances and survivorship annuities. The right to participation in profits does not seem to have been granted to contracts which were for an assigned time only, for example, temporary assurances, pure endowments and deferred annuities. There seems to have been no differentiation between the assurances for capital sums and those for annuities.

3. Pension and widows' funds of various kinds were developed in many countries before the advent of scientific life assurance. Such funds would have been mutual in character, though it is doubtful whether many of them had the resources needed to develop participation in profits by means of a bonus system comparable with the bonus systems of life-assurance offices. Some of the funds developed into mutual life offices serving a limited class of life. An interesting fund (still in existence) was founded in 1816 to transact life assurance amongst customs officials, the benefit being either a capital sum or an annuity. The contracts are whole-life assurances and reversionary annuities; both types of contract share in profits by way of periodical increases in the benefits. Endowment assurances and deferred annuities are not granted.

4. Sporadic attempts were made by a few British offices to introduce systems of participation in profits for life-office pension schemes. But in the last few years several offices have introduced such systems and there seems the beginning of a general movement in that direction. The present time may,

therefore, be suitable for a general discussion of participation in profits in relation to deferred-annuity business. It is not proposed to review the features of individual systems.

5. These brief historical notes lend support to the ideas

(a) that there is no essential difference between a contract for a lump sum and a contract for an annuity such that the one should and the other should not participate in profits, and

(b) that the system of participation may reasonably link like contracts, e.g. whole-life assurances and reversionary annuities, endowment assurances and deferred annuities.

6. American practice is in direct contrast to British practice with this type of business. Jenkins states that deferred annuities in America usually participate in profits (*Proc. Cent. Assembly*, 2, 258).

REVIEW OF RECENT EXPERIENCE

7. When deferred annuities became so markedly popular, rather more than thirty years ago, the actuary was handicapped by poor tools. The tables of mortality of annuitants based on the experience of British offices in 1863-93 were still being used, though they were known to understate the actual experience of the vitality of annuitants. However, the comparatively high rates of interest which could then be earned on new investments yielded an interest surplus which it was hoped would compensate the offices for losses on mortality.

8. The publication in 1924 of the $a(f)$ and $a(m)$ tables based on the experience of the years 1900-20, extrapolated to show the assumed mortality in respect of annuities purchased in 1925, led to more realistic bases of calculation. After this lapse of time it would be difficult to give a complete picture of the market, but common bases were the $a(f)$ and $a(m)$ tables with interest at 4% p.a. and a small loading for expenses.

9. The rate of interest of 4% assumed that a gross rate of interest would be earned on the investments of the annuity fund. Finance Act, 1923, had provided for the taxation, indirectly, of the profits on annuity business (by set-off against the claim for rebate of income tax in respect of management expenses) and of the excess, if any, of the investment income of the annuity fund over the sum of annuity payments and the profits. It is probably true to say that all the implications of this dual basis were not foreseen at the time, though it is believed that the responsible actuaries received the basis of taxation with some misgivings.

10. Though the rate of interest of 4% may seem to be a comparatively high one, it should be remembered that the gross yield on new investments was substantially higher. Probably, too, it was felt that the use of annuitants' mortality was rather stringent for deferred-annuity business which consisted largely of pensions. A profit on mortality could reasonably have been expected.

11. After the conversion of War Loan in 1932 from a rate of interest of 5 to 3½% p.a. the fall in market rates of interest led to adjustments in the terms for deferred-annuity business. Between 1932 and 1939 the rate of interest assumed for new deferred-annuity business was reduced from 4% to a level of about 3½-3¾%. These should also be regarded as being gross rates of interest.

12. The passage of time, by itself, would have required some adjustment to the $a(f)$ and $a(m)$ tables if the vitality of annuitants continued to improve in the manner assumed in the construction of those tables. The statistical evidence showed some improvement and for individual contracts it became customary to make some adjustment to the age (a deduction of, say, $\frac{1}{2}$ year) in the rate of annuity for deferred-annuity calculations.

13. The outbreak of war in 1939 had remarkable effects on the terms for deferred-annuity business. The increase in the standard rate of income tax from 5s. 6d. in £ in 1938/39 progressively to 10s. in £ in 1941/42 was mitigated by the introduction of a maximum rate of 7s. 6d. in £ for life-assurance business. The maximum rate also applied to deferred-annuity business, but the increase of 2s. in £ was sufficiently severe to lead to a reconsideration of the effects of taxation. Offices which transacted a substantial amount of deferred-annuity business had by this time an excess of investment income over annuity payments on which they would be taxed even though no profits were made. Moreover, the high rate of personal taxation, which was levied on the full amount of the annuity, made an annuity look an unattractive contract to the individual pensioner. Hence, the offices' difficulties were enhanced by deferments of retirement, by the selection of cash options, where available, and by the popularity of 'split contracts'.

14. For new deferred-annuity business it seemed more appropriate to assume a net rate of interest during the deferred period. It is pessimistic to assume that the investment income will be taxed throughout the deferred period and, as was later demonstrated by G. V. Bayley (*J.I.A.* 76, 237), the true rate lies somewhere between a net and a gross rate of interest for deferred annuities whose deferred periods extend beyond what he defined as the 'taxed period' of the fund.

15. During the war new investments were concentrated in British Government securities—mostly at a rate of interest of 3% p.a. for long-term investments. This comparatively low rate of interest laid a heavy burden on those offices which were expanding rapidly because they had accepted large amounts of business in the years before the war. Also, for new business it had to be assumed that the premiums would be invested in British Government securities, at least for the duration of the war.

16. In the years 1940-45 the terms for new deferred annuities were commonly based upon a rate of interest of 3% p.a. combined with the $a(f)$ and $a(m)$ tables with, for individual contracts, a rather larger adjustment in age (a deduction of, say, 1 year). The basis might be regarded as setting the known liability for income tax on the investment income against the possible improvement in the rate of interest which might be obtainable after the war. This rather generous attitude was accompanied by a much more cautious approach to problems of single premiums, cash options and surrender values for which a net rate of interest, say 2% p.a., might be assumed.

17. So far from an improvement in investment conditions in the years following the war, there was the attempt by the authorities to establish $2\frac{1}{2}$ % p.a. as the market rate of interest on long-term British Government securities. In these circumstances a further reduction in the rate of interest assumed for new deferred annuities seemed to be desirable. At the lowest level the assumed rates of interest ranged from 2 to $2\frac{1}{2}$ % p.a. during the deferred period and

3% p.a. after pension age, with surrender values and cash options based on rates of interest ranging from 1 to 1½% p.a.

18. It is somewhat too early to deal with the impact, on the terms for new deferred annuities, of the $a(55)$ tables of mortality of annuitants, published in 1953. The rates of annuity at the usual pension ages by the $a(f)$ and $a(m)$ tables with interest at 3% p.a. are about equal to those by the $a(55)$ tables with interest at 3½% p.a., as may be seen from Table 1.

Table 1. Comparison of values of a_x

x	Males		Females	
	$a(m)$ 3%	$a(55)$ 3½%	$a(f)$ 3%	$a(55)$ 3½%
60	11.952	11.958	13.883	13.683
65	10.057	10.077	11.845	11.821
70	8.199	8.222	9.731	9.891

19. Evidence is accumulating that the mortality of male pensioners is distinctly heavier than the mortality of male annuitants. However, the interpretation of the evidence needs some care. No doubt there will be differences—in the nature of class selection—between the mortality experiences of different kinds of pensioner and annuitant. Also, there may be differences between the mortality experiences of pensioners from different kinds of employment. Since the cost of a deferred annuity at pension age has usually been estimated by reference to the experience of immediate annuities, there should be a mortality surplus after pension age which would partly offset the effects of the fall in the rate of interest that has been described.

20. Little has been said about the mortality assumed during the deferred period for deferred annuities without return of premiums at death. No suitable table of mortality has been available for this purpose. When the $a(f)$ and $a(m)$ tables were published they were probably used for the mortality of the deferred period as well as for the mortality after pension age, though they were based upon the experience of immediate annuities, not deferred annuities. It was soon realized that mortality tables derived from the experience of assured lives would be more appropriate and the A 1924-29 table was commonly used for the deferred period, where required. This is a difficult problem because the contracts are mainly required for pension schemes and, theoretically, the mortality assumed during the deferred period should be a table of mortality during active service, as was suggested by G. W. Pingstone (*J.I.A.* 77, 358).

21. It will be readily agreed that the wide variations in the contractual terms that have been assumed for deferred-annuity business within the span of a single generation are indeed remarkable. Since the business has consisted of non-participating contracts, the premiums have included no charge for the right to participation in profits which could have provided a buffer against adverse experience. It is difficult to maintain that the premiums charged from time to time have been suitable and equitable in the light of subsequent experience, though they appeared to be so at the time. Such wide variations in experience can be accommodated only by a system of participation in profits, under which a substantial margin against possible adverse experience

is included in the premium scale and, by way of compensation, the right is granted to participation in profits. The actual experience can then be given effect to by allocations of bonus from time to time.

EFFECTS OF VARYING ASSUMPTIONS

22. It is instructive to compare the effects on premiums of varying assumptions about interest and mortality both for deferred annuities and for different kinds of assurance. This may be done by comparing the differential coefficients of the pure premiums for the various types of contract.

23. Let \bar{P} be the annual premium payable continuously for a particular kind of benefit (not being a return of premiums) on the assumption of a force of interest δ . Then the differential coefficient of \bar{P} with respect to δ is given by

$$\frac{1}{\bar{P}} \frac{d\bar{P}}{d\delta} = -(t_1 - t_2),$$

where t_1 is (in the sense defined by Redington, *J.I.A.* 78, 289) the mean term of the outgo represented by the benefit payments and t_2 is the mean term of the premiums receivable. Here, of course, it is the variation in the premium that is being studied, whereas Redington was studying the variation in the valuation liability, the premium being assumed to be invariant.

24. Table 2 shows the values of t_1 and t_2 , by the A 1924-29 table with $2\frac{1}{2}\%$ interest, for deferred annuities and for whole-life, limited payment and endowment assurances. The basis is not a realistic one but is sufficient for purposes of comparison, which ought to be made on a uniform basis.

Table 2. Comparison of mean terms and proportionate differential coefficients

Class of contract	Age at entry $x=30$		
	t_1	t_2	$t_1 - t_2$
Whole-life assurance	36.2	17.8	18.4
Whole-life, premiums limited to age 65	36.2	14.3	21.9
Endowment assurance at age 65	30.6	14.3	16.3
Deferred annuity at age 65, with return of premiums with interest	42.3	15.0	27.3
Deferred annuity at age 65, without return of premiums	42.3	14.3	28.0

25. The values of t_1 show that the liabilities under deferred annuities are longer in duration than the liabilities under assurance contracts; also the effect is intensified by the limitation of the premiums to the deferred period. Thus the premiums for deferred-annuity contracts are more sensitive to variations in the assumed rate of interest than are the premiums for whole-life and endowment assurances.

26. The differential equation in para. 23 does not hold if the benefits are a function of the premiums. For deferred annuities with return it is usual, in calculating the premiums, to ignore mortality before pension age. This has also been done in calculating the relevant t 's in Table 2. That is to say, for

deferred annuities with return t_1 and t_2 are based only on those who survive to the deferred date; the return of premiums with interest on previous death is not included as a benefit and the value of such premiums is similarly excluded. This explains the value of 15.0 for t_2 , since it is based on an annuity-certain, whereas the other t_2 's are based on life annuities. Hence also the values of t_1 are equal for the two types of deferred annuity. The procedure is correct for the purpose of finding the differential $-(t_1 - t_2)$. If the actual mean term of an existing deferred-annuity fund were under consideration, account would have to be taken of the return of premiums.

27. In order to compare the effects of variations in mortality some assumption must be made about the incidence of the variations with age. The pure premium can then be differentiated with respect to the variable mortality. Two simple, and extreme, assumptions are:

- (a) a uniform variation, positive or negative, in the force of mortality, independent of the attained age, and
- (b) a shift in the age, either positive or negative.

The results of these assumptions are shown in Table 3, in which the coefficients for (b) have been multiplied by 1000 to give comparable figures.

Table 3. The ratios, to the pure premiums, of the differential coefficients of the premiums with respect to variable mortality, by A 1924-29 ult.
2½%

$$\text{Assumption (a): } e = 0 \quad \frac{1}{\bar{P}} \frac{d\bar{P}}{de} \quad \text{for } \mu_x + e$$

$$(b): \quad r = 0 \quad \frac{1}{\bar{P}} \frac{d\bar{P}}{dr} \quad \text{for } \mu_{x+r}$$

Class of contract	Age at entry $x = 30$	
	(a)	(b) mult. by 1000
Whole-life assurance	46.1	34.0
Whole-life, premiums limited to age 65	42.6	25.6
Endowment assurance at age 65	31.0	10.4
Deferred annuity at age 65, with return of premiums with interest	-7.3	-43.9
Deferred annuity at age 65, without return of premiums	-28.0	-67.5

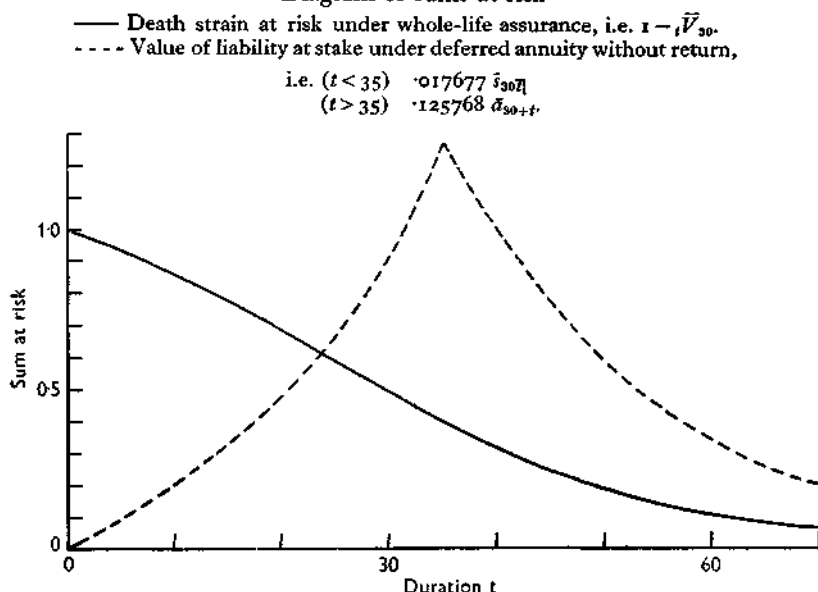
28. The differential coefficients are, of course, positive for assurances and negative for annuities, since an increase in the assumed mortality tends to increase the premiums for the one and to reduce the premiums for the other class, and conversely for a decrease in the assumed mortality.

29. The figures under (a) show that a uniform variation in the assumed mortality, independent of age, affects the premiums for assurances proportionately more than the premiums for deferred annuities, though the comparatively large size of the differential coefficient for the deferred annuity without return of premiums is interesting. It is little less in magnitude, though of opposite sign, than the endowment-assurance coefficient. The figures

under (a) may be compared with the values of $(t_1 - t_2)$ from Table 2, but it should be remembered that a change of a given magnitude, say $\cdot 0025$, is much more likely in the rate of interest than in the rate of mortality.

30. The figures under (b) show that a variation which is of the nature of a shift in the age affects the premiums for deferred annuities proportionately more than the premiums for assurances. Indeed, the differential coefficient for the deferred annuity without return of premiums is numerically about double the coefficient for whole-life assurance. The figures under (a) and (b) are not directly comparable in magnitude; it would be necessary to divide the differential coefficients for assumption (b) by an average value of $d\mu_x/dx$. For convenience a value of $\cdot 001$ has been used, which produces the multiplier of 1000 mentioned in para. 27.

Diagram of sums at risk



31. Assumptions (a) and (b) may be regarded as being extreme limits to reasonable variations in the assumed mortality. But even so it is apparent that at least as much care should be exercised in the choice of the basis for deferred annuities as would be exercised for assurances. Also, prudence suggests that the assumed mortality should contain a margin which is of the opposite sign to the margin for assurances.

32. The effects of variations in mortality have to be viewed against the background of the improvements in vitality that have taken place and that may be expected to continue in the future. In calculating premiums for new business what is wanted is an estimate of the future mortality experience. The assumed rates of mortality are, in effect, applied to the sums at risk in each year of age (i.e. the death strain at risk for assurances, the value of the liability at stake for annuities). The sums at risk show the effective monetary weights

attached to the rates of mortality. On the preceding page is a diagram of the death strain at risk under a whole-life assurance for unit sum assured and of the value of the liability at stake under a deferred annuity without return of premiums which has the same capital value as the whole-life assurance at the inception of the contract. Both contracts are assumed to be effected at age 30, the pension age is 65, and the basis of calculation is A 1924-29 ult. $2\frac{1}{2}\%$.

33. It will be apparent from the diagram that the sums at risk for a given batch of new business have a much later incidence in time for deferred annuities than for whole-life assurances at the same age at entry. This is an important consideration in a discussion of the reliability of estimates of future mortality. The probable error of an estimate of future mortality, other things being equal, tends to increase with the distance ahead for which the estimate is required. For this reason, premium calculations which relate to sums at risk that are, on the average, further ahead in time should contain rather larger margins than premium calculations for sums at risk nearer at hand.

FISCAL AND OTHER CONSIDERATIONS

34. Calculations of premiums for deferred annuities are bedevilled by the complications of the United Kingdom income-tax system. There is no need to give a full description of the method of taxation of annuity funds because this has been done by others. The complications of the system lie in the possibility that the investment income of the annuity fund may be temporarily taxed, and in the uncertainty whether the tax so paid will be ultimately recouped by the set-off of the taxed income against taxable profits.

35. So long as the annuities paid exceed the investment income of the annuity fund, and may be expected to continue to do so, calculations may be made upon the basis of gross interest because the annuity fund will be taxed upon profits, not upon investment income as such. When the investment income of the annuity fund exceeds the annuities paid, or when the transaction of new deferred-annuity business may lead to such an excess, consideration has to be given to the income tax that will be attracted by the excess investment income.

36. In principle, the premiums for new deferred annuities should allow for the expected experience of the new business as an integral part of the annuity fund. If part of the investment income is taxable, the net interest only can be accumulated—though credit could be given for the recoupment of the tax expected at a later date. The recoupment of the tax, however, is dependent upon there being a sufficient quantum of taxable profits, and it will probably be agreed that it is undesirable to anticipate profits. The deferred annuities may prove to be unprofitable when they come into possession or the annuities may never come into possession because some kind of surrender option is exercised. The latter possibility can be guarded against by the assumption of net rates of interest in the calculation of surrender options. But the only means of guarding against the former possibility is the calculation of the deferred-annuity premiums upon such a conservative basis that profits are virtually certain to emerge. If such a conservative basis were to be adopted, it seems equitable that the policyholder should be granted the right to participation in the profits.

37. Deferred-annuity contracts commonly include various options, e.g. a cash option at pension age or the option of a joint-life and survivor annuity on the lives of the annuitant and his wife or other dependant. The options are no doubt calculated to be equivalent at the time when the deferred annuity is effected, but alterations in circumstances with the passage of time destroy the equivalence. Such options have the effect of increasing the uncertainty, and it seems difficult to accommodate the options in deferred-annuity contracts unless a large margin for fluctuations is incorporated in the actuarial basis.

38. In the United Kingdom a considerable part of assurance business has traditionally been with participation in profits. But the investment period for deferred-annuity business is longer than for assurance business; the premiums are at least as sensitive to variations in mortality, which also has to be estimated for a longer period ahead on the average; the options in deferred-annuity contracts seem to demand a large margin for fluctuations; and the method of taxation of annuity funds makes it difficult to be equitable unless the policyholder pays for and is granted a share of profits.

GUARANTEED PENSIONS

39. It is all the more surprising that deferred-annuity business has hitherto been transacted without participation in profits. The spectacular growth in pensions business has consequently upset the balance between participating and non-participating contracts. Some idea of the effects may be gained from the figures in Table 4, taken from the *Annual Abstract of Statistics*, no. 91, 1954. The figures relate to the previous valuation.

Table 4. Life assurances in force, ordinary business (companies established within the United Kingdom)

£ million

Year	Sums assured with profits (including bonus)	Sums assured without profits	Annuities	
			Immediate	Deferred
1937	1443.0	696.8	8.2	12.6
1948	1940.6	1241.6	10.8	51.3
1949	2058.0	1379.7	11.1	72.1
1950	2220.5	1617.4	11.4	80.5
1951	2352.0	1990.7	12.9	130.8
1952	2512.7	2143.5	13.8	150.8

In the space of 15 years the participating business in force has increased by barely three-quarters. In the same period the non-participating assurances have increased three-fold and the deferred annuities twelve-fold. If the deferred annuities are treated as being equivalent to a capital sum of ten times the amount of the annuity, the deferred annuities represent a quarter of the total life-assurance business in force; the proportion of participating business has dropped from over 60% to about 40%. On up-to-date figures it would undoubtedly be less.

40. These facts are not new. They have been in the thoughts of many actuaries for some years. But it does seem a suitable time to discuss deferred annuities in relation to the traditional place taken by participating business in

the field of life assurance. In a recent paper to the Madrid Congress by one of us and G. V. Bayley, F.I.A., *Participation in profits as a means of securing stability in life assurance funds* (*Trans. Fourteenth Int. Congr.* 2, 112), it was stated

British actuaries will have to give close attention to the nature of the guarantee that can be afforded in practice, having regard to the wide variations in conditions that are experienced.

It is not proposed to repeat the discussion of participation in profits which is contained in that paper, though it forms the background to the present one. The purpose is to take up the suggestion in the sentence quoted above.

41. There is no doubt about the strong demand for guaranteed pensions. The figures quoted in para. 39 are sufficient evidence of the demand which will be within the experience of every actuary concerned with pension schemes. This demand ought to be met if it is at all practicable. But is it practicable?

42. Any kind of life assurance could be transacted by a proprietary life office whose contracts were wholly guaranteed, the backing of the contracts being the proprietors' capital. Many life offices opened for business on these lines, but nearly all British life offices have introduced some system of participation in profits. Long-term contracts such as life assurances require the backing of a substantial capital to cover the wide variations in experience, and the amount of the capital should grow proportionately with the size of the business. It does not seem possible to fix any rule for the amount of capital that would be required, but it will be apparent from a brief examination of the problem that the amounts must be very large indeed. It seems much more practical that the policyholders themselves should bear part of the burden of fluctuations in experience—and should share in the profits if conditions are sufficiently favourable.

43. A system of participation in profits also seems to be in the long-term interests of policyholders themselves. The worth of a long-term contract such as life assurance depends primarily on the stability of the life office which makes the contract. The interests of the policyholder are bound up with that stability. Though the policyholder obtains an immediate advantage by effecting a contract at the lower scale of premiums appropriate to non-participating contracts the advantage may be dearly bought. And in the long run a system of participation in profits is likely to be more equitable as well as more stable because it is possible to adjust the benefits to the experience by means of allocations of bonus from time to time.

44. The conclusion seems to be that some system of participation in profits is at least as necessary to the healthy development of deferred-annuity business as it has been to life-assurance business. The paramount need is stability. With this in mind it may be as well to examine more closely the demand for guaranteed pensions. Is the guarantee of the amount of the pension as essential as it has been thought to be?

45. The arguments for a guaranteed annuity are strongest where the deferred annuity is effected in connexion with a pension scheme, and attention may be confined to that problem. When a pension scheme is arranged it is convenient if the employer can offer his employees a definite pension at a fixed normal age of retirement. The employee becomes a member of the

scheme, and agrees to pay such contributions as are required by the terms of the scheme, on the understanding that the employer will arrange the appropriate pension contract with the insurance company. The whole arrangement appears to be more clear-cut and definite if the pension is a fixed, known amount of annuity.

46. Yet the impression of a clear-cut, definite arrangement is illusory. In the practical operation of a pension scheme the pension contracts are continually being adjusted to suit the changing circumstances. The amount of the pension usually depends, partly at least, upon pay, and pensions have to be adjusted for increments in pay. Some members may have to retire early and others may delay retirement until a later age than the normal one, the pensions being adjusted to the actual age of retirement. Hence the pension originally contemplated rarely becomes payable without modification.

47. The national pension is nominally a fixed amount for each pensioner according to status. But the intention of the authorities is to adjust the amount of the pension from time to time in accordance with changes in the cost of living so that the fixity is more apparent than real. Since many pension schemes have some regard to the amount of the national pension, the changes in the national pension may be relevant to the consideration of changes in private schemes.

48. Having regard to this state of flux, it may be suggested that participation in profits is merely another source of variation to be taken into account in adapting pensions to changing circumstances. So many changes are to be expected in the course of a long period of service that it is far more important for the amount of a pension to be equitable than for it to be fixed.

49. Since there are three parties to a pension scheme there is the alternative that the member's pension may be fixed in amount, the employer retaining the benefit of participation in profits so as to cushion the employee's pension against variations with allocations of bonus. The employer thus endeavours to undertake the guarantee of the amount of the pension—but with an important difference. If the employer finds that the scheme is becoming too costly to maintain he can give notice to modify or terminate his contributions.

50. In the light of this discussion it seems that the demand for pensions of fixed, guaranteed amounts has less reason behind it than would appear at first sight. There seems to be no reason why deferred annuities should not participate in profits. Perhaps there is a field here for insurance men to educate the public in what is desirable and equitable for long-term contracts.

PRINCIPLES OF PARTICIPATION IN PROFITS

51. Whole-life and endowment assurances 'with profits' share in profits throughout the whole duration of the contract. If the same arrangement were to apply to deferred annuities the right to participation in profits would continue after the annuity has commenced to be payable. But the annuitant would probably prefer a fixed to a fluctuating income. It would be inconvenient to have an income which fluctuated with profits, yet if it were arranged that the annuity would be increased by allocations of bonus annuities, the persons who would benefit most would be those annuitants who survived longest, an arrangement which would be unattractive and inequitable. Pensioners would

no doubt prefer to receive the largest possible annuity in the years immediately following retirement, rather than at later ages when they would have adjusted themselves to living in retirement.

52. Profits might be allocated as reversionary bonuses instead of bonus annuities. Such a system of reversionary bonus would appear to be equitable at least to the extent that the surpluses came from capital falling in by the deaths of annuitants. But the annuitant would probably prefer a larger income to a payment at death, and it seems that the bonus system ought to be so framed as to give the annuitant the largest possible regular income.

53. The investment problem is not so difficult for immediate annuities as for deferred annuities. The average period for investment is shorter; the whole investment is made when the contract is effected and there is no accumulation of money as there is with deferred annuities. Thus the office has not the same need for margins against possible fluctuations in markets. The limitation of profit-sharing to the deferred period could be justified on grounds of expediency.

54. Theoretically, too, it is desirable to be more conservative in the valuation of immediate annuities than in the valuation of life-assurance contracts because the maximum liability under an annuity is indeterminate, whereas the sum assured is a fixed known amount. To take an extreme case, if a fund consisting of immediate annuities were closed to new business it is difficult to see how a system of participation in profits could continue to operate. It would be necessary to cover the liabilities by purchase of annuities from the Government or an insurance company. Though this contingency is not likely to eventuate it does suggest that a system of participation in profits designed for immediate annuities would have to deal with the heaping up of surplus required by such considerations.

55. In all the circumstances it seems best to arrange that the right to participation in profits should be limited to the deferred period so that when the annuity becomes payable it will be a fixed, known amount and the contract will not share in profits thereafter.

56. Allocations of surplus during the deferred period would have to allow for variations in the value of the annuity liability in the light of the expected experience of annuitants. The cost of the annuity will probably have been estimated upon a conservative basis, and the allocation of surplus during the deferred period should allow for such margin as there may be in the estimated cost, having regard to the trend of experience of mortality among annuitants. The problem will be easier to solve if it is left until the end of the deferred period when a special final allocation of surplus can be made. If this is not done it would be necessary to adjust the allocations in the later years of the deferred period so that by the end of it an equitable allowance would have been made for the whole period including the estimated surplus expected to enure from the annuity.

57. When considering the distribution of surplus on deferred annuities it would be helpful to compare the sources of surplus during the deferred period with those of endowment assurances. These are the same sources, interest, loading, mortality and miscellaneous surplus, but they probably contribute to the total surplus in different proportions than would be found with endowment

assurances. Deferred annuities will contribute little to mortality surplus during the deferred period since there is virtually no life risk. The loading surplus may be a little different because the loadings and the assessed expenses will be lighter than for endowment assurances. The miscellaneous surplus would be considerably affected by the scale of surrender values; if the surplus is to be comparable with the miscellaneous surplus on endowment assurances the surrender values would have to be on roughly the same scale. Taken together it would appear that these sources might yield somewhat less surplus on deferred annuities than on endowment assurances.

58. As has been mentioned, deferred annuities should be able to earn gross interest after a preliminary taxed period so that they should contribute more to interest surplus than endowment assurances. The main source of surplus is the bonus loading in the premium scale, and if a fairly similar scale of bonus loadings is adopted for both deferred annuities and endowment assurances it may be suggested that both classes might share in profits on similar principles, for a while at least. This would require the calculation of the premiums on comparable bases, subject to an adjustment for the different benefits payable at death.

59. The surplus may be allocated in various ways, e.g. a bonus annuity, a reversionary bonus, a reduction in premiums and so on. Where deferred annuities are granted in connexion with pension schemes it may be felt that the surplus ought to be used to reduce the premiums. This assumes that the employer would wish the employee to have a fixed pension, not dependent on profits. Deferred annuities are, however, effected in such varying circumstances that it seems desirable to adopt a method which is as elastic as possible. It would be ideal, if practicable, to permit the employer to choose between granting the benefit of participation in profits to the employee and reserving the benefit for himself.

60. The methods of allocation of surplus are interchangeable to some extent. If the premiums are reduced, some part of the contributions will be released and can be used for augmenting the benefits. If the annuity is increased by a bonus annuity, the amount of any incremental annuity that may be required can be correspondingly reduced, so reducing the cost of increments. Since the ultimate effects are similar, there seems something to be said for allocating surplus to deferred annuities by a method which is similar to the one used for endowment assurances, probably a reversionary bonus system. This should facilitate the equitable distribution of surplus between the various classes of assurance. If the reversionary bonus is payable at death or on survival to pension age (as for an endowment assurance) the bonuses can be used to augment the pension, just as if a bonus annuity had been declared.

61. There is one considerable advantage to the member if the allocations of surplus are used to augment the pension. It is a common practice for pensions under pension schemes to be effectively based on average salary (e.g. group pensions purchased year by year according to salary range passed through). If the pensions are increased by bonus from time to time the earlier pensions, based on the lower ranges of pay, will be increased most by bonuses. Consequently, the total pension including bonus will compare more favourably with final salary than usually happens under this kind of arrangement. There will not be a close relationship between the total pension, including bonus, and the

final salary, but at least the comparative position will be improved. It may also happen that the allocations of bonus may be some counter to the effects of mild inflation.

CONTRACTUAL TERMS

62. It has been suggested that the premium scale should allow for about the same bonus loadings as the scale for endowment assurances, and that the premiums should therefore be calculated on fairly similar principles. The premiums would be computed for a 'maturity value' as a pure endowment at pension age, the maturity value being the equivalent at that age of the annuity. Bonuses would be added to this maturity value in much the same way that reversionary bonus is added to the sum assured under an endowment assurance. When the annuity becomes payable an additional annuity would be granted which would be proportionate to the amount of bonus added to the maturity value.

63. Under the usual type of deferred-annuity contract, it has been customary to return the premiums paid, accumulated with compound interest at a stated rate, if the life dies during the deferred period. Some such arrangement could be continued under the participating contract so that the bonus would be payable only on survival, not at death. An argument in favour of this practice is that the contracts contribute little to mortality surplus during the deferred period so that it seems appropriate not to pay the bonus at death.

64. There is, however, little relationship between the mortality surplus and the cost of paying the bonus at death. It seems preferable that the payment at death should share in profits in much the same way as the benefit on survival. A simple arrangement would be to return the premiums paid without interest but with such reversionary bonus as had been declared on the maturity value. This return would correspond to the sum payable at death under an endowment assurance but with the premiums paid substituted for the sum assured. Since the premiums paid include bonus loadings it is somewhat generous to return the whole of the premiums paid *and* the reversionary bonus, though the premiums can be computed so as to provide this benefit. It may be preferred to return a part of the premiums and the whole of the bonus, or the whole of the premiums and a proportion only of the bonus.

65. The return at death of the whole of the premiums paid and the reversionary bonus would mean that the contract would grant a small amount of life-assurance cover, effectively the amount of the bonus. The contract can be regarded as an increasing assurance under which the increase each year is one premium and one bonus. The premiums for an assurance of one unit in the first year, two units in the second year, three in the third year and so on, are little affected by mortality provided that the period of the assurance is not too long. The level annual premium for the increasing assurance effectively represents the average single-premium cost of each year's increment so that the level premiums provide more than is required for the early increments—there is a buffer against an increased mortality. It seems unnecessary, therefore, to call for evidence of health.

66. The premium formula will depend upon the bonus system that is adopted as well as the office's practice on the other subjects which have been discussed. It is not practicable therefore to submit a premium formula for

discussion, but it may be mentioned that one office, which has adopted the suggested 'endowment assurance' approach, has found it appropriate to calculate the 'with-profit' deferred-annuity premiums from the endowment-assurance premium scale by deducting the cost of the life assurance during the deferred period and replacing it with the cost of the refund of premiums without interest.

SURRENDER VALUES

67. With deferred-annuity business the customary practice has been to guarantee a surrender value equal to the premiums paid, or a proportion of them, accumulated with compound interest at a stated rate. The practice has all the disadvantages which are associated with guaranteed surrender values under life-assurance contracts and the further disadvantage that the contract tends to be regarded as being effectively a deposit at call, since there is no life cover to absorb part of the premiums. If the guarantee be given under a pension scheme, the employer may be able to surrender all the contracts *en masse*, with a view to making other arrangements, at a time when the mass surrender is inconvenient to the assurance office.

68. Life assurances and deferred annuities are long-term contracts. The sums which have to be invested to fulfil the contracts are intended to be placed in long-term investments. By a suitable arrangement of its investments a life office can ensure that the money will be available to meet its liabilities when they mature and can take steps if it wishes to minimize the effects of market fluctuations. The life office cannot, however, at one and the same time match its long-term liabilities and have available for return at call the premiums that have been paid.

69. If a long-term contract is determined at an earlier date than was expected the long-term investments which back the contract effectively have to be realized. Though the surrender values may in fact be met out of other funds coming forward for investment, these other funds ought to be invested at current market rates and not used to take over old investments at prices in excess of market value. Thus the position is the same as if the investments needed to meet the surrender values were actually sold. This is but one facet of the general problem discussed by Redington. It cannot be too strongly stressed that a life assurance or deferred annuity is a long-term contract and ought not to be regarded as a deposit at call.

70. However logical it may be that there should be no guaranteed surrender value there is undoubtedly a strong demand in connexion with pension schemes for the return of a member's contributions with interest if he leaves the service of the employer and so withdraws from the pension scheme. Theoretically, the probabilities could be calculated and a payment could be guaranteed on withdrawal in the same way as the return of premiums is guaranteed at death. However, there does not seem to be any clear definition of 'withdrawal from service', should the employer be minded to take advantage of the guarantee for purposes of mass surrender. It may be suggested that the problem could be suitably dealt with by the return of premiums with interest, on withdrawal from service, as a customary practice which is not guaranteed.

71. The member who withdraws from service seems to expect a cash payment out of the pension scheme. The expectation is illogical and not neces-

sarily in the member's best interests. Would it not be preferable for the pension purchased to date to be reserved for the member's benefit when he retires, i.e. for the member to be granted a paid-up annuity? Such an arrangement is customary in some other countries. There seems to be scope for assurance offices to educate public opinion in the United Kingdom on this subject.

72. The arguments of the preceding paragraphs have all the more force if the contracts participate in profits. With such contracts it would be natural to grant a paid-up policy which might continue to share in profits. It does not seem practicable to guarantee surrender values under 'with-profit' contracts. It is difficult to justify any value which is based upon the return of the premiums paid with or without interest. Surrender values ought to be calculated by the methods traditionally regarded as being appropriate for with-profit endowment assurances.

VALUATION

73. Some years' experience of the participating deferred-annuity contracts may be required before the best method by which to value them becomes apparent. A simple approach is to treat the contracts as being endowment assurances from which the life risk has been removed; this leads to the following analysis which is equally applicable to net premium and bonus reserve valuations.

74. During the deferred period, a participating deferred annuity is effectively a pure endowment payable on survival to the stated pension age. It is assumed that if the life should die before attaining pension age the premiums paid would be returned without interest but with bonuses or a part of them. This contract can be valued in the same way as an endowment assurance but with a suitable modification of the factors.

75. Let the age at entry be x and the original term n years, the age at valuation be y and the unexpired term r years. Also let the maturity value be M , the office premium P'' and the premium valued P . The ages and terms are assumed to be integral but suitable adjustments can be made for fractions. The duration is $(n-r)$ years and the value of the net liability, excluding bonus, may be written

$$M \cdot A_{y:n}^1 + (n-r)P'' \cdot A_{y:n}^1 + P'' \cdot (IA)_{y:n}^1 - P \cdot \ddot{a}_{y:n} \\ = M \cdot A_{y:n}^1 - (M - nP'') \cdot A_{y:n}^1 - P'' \cdot \{rA_{y:n}^1 - (IA)_{y:n}^1\} - P \cdot \ddot{a}_{y:n}.$$

The value of declared bonus must be added and also the value of future bonus if a bonus reserve valuation is made.

76. It has been suggested that the premiums for participating deferred annuities should contain bonus loadings of about the same magnitude as do the corresponding premiums for endowment assurances. If this is so, it is probable that M will exceed nP'' by a comparatively small amount. In the second term of the formula $(M - nP'')$ is multiplied by the factor $A_{y:n}^1$, which is itself relatively small so that the product would be negligible compared with the other items. If the second term be made zero the net liability would be slightly overstated.

77. The factor in the third item of the formula is a decreasing temporary assurance assuring $(r-1)$ in the first year, $(r-2)$ in the second year and so on.

This factor does not differ much from $(a_{\overline{r-1}} - a_{\overline{r-1}})$; taking continuous functions it can be shown that

$$r\overline{A}_{\overline{r-1}}^1 - (\overline{IA})_{\overline{r-1}}^1 \approx (1+i)^{r/2}(\overline{a}_{\overline{r-1}} - \overline{a}_{\overline{r-1}}).$$

A similar approximation would simplify the third item of the valuation formula.

78. Making the suggested adjustments the valuation formula, excluding bonus, becomes

$$M \cdot A_{\overline{r-1}} - P^*(a_{\overline{r-1}} - a_{\overline{r-1}})(1+i)^{r/2} - P \cdot \overline{a}_{\overline{r-1}}.$$

In this formula the maturity value is valued by the same factor as is the sum assured under an endowment assurance. This overstates the payment at death by an amount which is approximately equivalent to a decreasing temporary assurance for the amount of the premiums remaining to be paid. The second term of the formula is the correction for this overstatement.

79. The valuation formula implicitly assumes that the maturity value M remains a suitable estimate of the liability for the annuity at pension age. It may well be that some further addition would have to be made to M , the excess being valued by the pure endowment factor. The valuation formula would have to take account of the bonus system adopted for deferred annuity contracts and if it is decided to allot a special and final bonus on attainment of pension age this fact would have to be borne in mind when deciding upon suitable values of M for the valuation.

SUMMARY

80. The paper falls into three fairly distinct parts. The first glances at the history of the subject; a consideration of experience since the First World War brings out the widely varying bases that have been adopted for fully guaranteed deferred annuities, and shows that, in the light of subsequent experience, it is difficult to maintain that the premiums charged from time to time have been suitable and equitable, though they appeared to be so at the time.

81. The second, and most important, part sets forth the arguments in favour of deferred annuities with participation in profits. These arguments may be summed up in one word: uncertainty.

82. It is argued that the considerations which apply to life-assurance business apply with greater force to deferred-annuity business. The premiums are more sensitive to changes in the rate of interest assumed. The contracts are in practice for a longer term, and the absence of large death benefits at the early durations entails a greater building-up of reserves and a more formidable investment problem, especially for the growing funds which are so prevalent. The decreasing trend of mortality is in favour of assurances but against deferred annuities; also the latter are more vulnerable to mortality changes at the longer durations. The questionable basis of taxation and the almost irresistible public pressure for 'short' options both increase the uncertainties of deferred annuity business. 'Guaranteed' pensions are likely to prove an expensive mirage to the assured in practice, and the demand for an absolute guarantee should be countered by education of the public in their true interests. The

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cumulative uncertainty of the future calls for ample margins in the premium scale; by way of compensation the right should be given to participation in profits.

83. The final part is more tentative. It is suggested that participation in profits should be confined to the deferred period and that a simple method of tackling the problems of a system of participation for deferred annuities is through a comparison with endowment assurances, making allowance for the difference in death benefit before the deferred date. Questions of premium and surrender value bases, and of valuation and surplus, are considered in the light of this analogy.

ABSTRACT OF THE DISCUSSION

The President (Mr J. F. Bunford) said that before the paper was presented he had one observation to make. There was no doubt that there had been some disappointment that the Chancellor, in his recent Budget speech, had made no reference to the second Millard Tucker report. There would be personal concern among professional men, who, as partners in firms, were from the point of view of the taxation treatment of retirement benefits an under-privileged class.

There would be more general disappointment that no steps had been taken in either the recent Budget or that of 1954 to remedy the various anomalies between the different types of pension schemes.

One effect might perhaps be that employers who had waited in the hope of legislation might decide to wait no longer before negotiating a scheme for the benefit of their employees. That prompted him to repeat something that had been said by his predecessor in the Chair, namely, that there were two broad bases upon which pension schemes might be arranged—those administered by life offices and those which were run as privately administered schemes. It was important that every employer who might be considering the setting up of a scheme should be informed of the relative advantages and disadvantages of the two types of scheme, so that he might consider them in the light of the circumstances in his own company and of the nature of the benefits which he was anxious to set up, and that he should do so under actuarial guidance.

The subject of the paper was highly topical. Actuaries were all most concerned with the proper balance of with-profit and without-profit elements in the funds which they administered.

Mr M. E. Ogborn, in introducing the paper, said that he and Mr Wallas had examined the subject more deeply than might be assumed from the paper itself. A number of lines of thought they had pursued had been excluded merely to keep the paper to a reasonable length and above all to concentrate on what they felt to be the main question: why, in fact, contracts should be 'with profits' at all.

In the previous year the speaker had completed thirty years' service in one office, and most of that time he had been in contact with deferred-annuity business. Some of those present who were students in his Part IV class somewhere about 1937 might remember that he set them a question on deferred annuities with profits and the manner in which they might share in profits. The students' answers ranged over all the arguments for the different systems of participation, and had it been possible it would have been interesting to submit those answers to the meeting as a kind of Appendix. The authors could not range so widely as those students.

War-time experience convinced him personally that some system of participation in profits was essential to the healthy development of deferred-annuity business, but war time did not seem to be the right time to talk about profits.

From that it could be seen that though the paper had been put together in a hurry, the thought behind it had not been so hurried.

He would emphasize that the paper was presented jointly by Mr Wallas and himself. Mr Wallas's collaboration had been both real and helpful.

Walter de la Mare was a poet who recalled his readers to the imaginative world of which they tended to lose sight. For Walter de la Mare's seventy-fifth

birthday Cecil Day Lewis wrote a poem which finished with the lines (they were also apposite in a sense to the paper under discussion)

Pass, friend, and fare you well, and may all such travellers be speeded
Who bring us news we had almost forgot we needed.

The purpose of the paper was to recall ideas which were common in the early days of the Institute but which, it seemed, they 'had almost forgot they needed'.

Mr T. H. M. Oppé, in opening the discussion, said that on reading the paper he had sought an analogy by means of which to conjure up a picture of its scope; it was the somewhat gruesome one of a skeleton. He did not mean the kind of skeleton that was kept in a cupboard for as long as possible, but the type of skeleton that was used by medical students as a means of instruction. Such a skeleton had, he thought, two main advantages. It hid nothing and it enabled the student—using that word in the wide sense—to get down to the bare bones of the matter.

He did not think the authors intended to do more than argue the case for with-profit deferred annuities and to resolve certain principles of participation in profits.

If the fundamental principle were accepted, detailed methods of application had to be defined and added, just as—to continue the analogy—flesh and blood had to be added to the skeleton before it came to life.

The authors' main contention was that there was at least as strong a case, or perhaps even a stronger case, for with-profit deferred annuities as there was for the traditional practice of transacting with-profit life assurance. Historically, deferred annuities had not been transacted in Great Britain to any appreciable extent until recent years. The reason, he thought, was not hard to seek. Individual deferred-annuity business, outside pension schemes, had always been small, a fact probably not unconnected with the withdrawal of income tax relief from deferred-annuity premiums by the Finance Act of 1916. The recent growth of pension schemes, however, had made it necessary to reconsider the position.

It was difficult, he thought, to disagree, from general considerations alone, that wider variations from the expected or assumed rates of mortality and interest underlying the premiums were likely to be experienced in respect of deferred-annuity business than for life assurance. The term of the contract, from the first payment of premium to the last payment of pension, might be very long indeed. The rate of interest would be affected not only by the general economic position but also by the taxation position of the annuity fund.

The President had already referred to the Budget, and he need hardly repeat what had been said about the disappointment from which they were suffering through there being nothing about annuity taxation. However, he congratulated the authors on not being misled by the rumours that were going round before the Budget.

Mortality was of comparatively little account in the deferred period, but it assumed great importance afterwards. That was because, unlike life-assurance business where the sum at risk was at its maximum in the early years of the policy, the sum at risk or liability at stake under a deferred annuity was greatest on the vesting date of the annuity. That might be years ahead of the time when the contract was taken out and the premium fixed.

Expenses, he supposed, were just as likely to go wrong under any form of contract, but the one with the longest term was bound to introduce the most uncertainty.

That general reasoning was strengthened by the mathematical demonstration in §§ 22-33 of the paper, where tables 2 and 3 showed the effect of variations in interest and mortality rates in respect of the premiums for the various types of contract.

It was on that question of future uncertainty that the authors based their case for with-profit deferred annuities. Uncertainty, of course, worked both ways. An office might profit unduly and the policyholder be left with a poor contract from his point of view; or the policyholder might do well at the expense of the office. Either way the position was unsatisfactory and open to criticism. It therefore seemed sound sense that an office should want an additional buffer by way of bonus loadings and that the policyholder in return should have a share in the surplus. That was particularly so where the existing buffers consisted of reserves, shareholders' capital and the bonus loadings of other participating policies, which were small compared with the weight of non-profit business.

Table 4 showed the great growth in non-profit business in force since 1937. Although it was easy enough to criticize a statistical table without being constructive, he ventured to suggest that comparing the proportion of with-profit to without-profit business on the basis of the sums assured, as the authors had done at the foot of § 39, was somewhat misleading.

In his view, since the difficulties lay mainly in investment policy and its effect on the rate of interest if the insurer was too highly geared to non-profit business, a better comparison might be on the basis of net liabilities. Unfortunately, those figures were not summarized by the Board of Trade which was, he suspected, why the authors did not use them. But a fairly large sample of offices showing sums assured in force at the end of 1952 (or the last preceding valuation date) of £1,106 m. with-profit and £1,067 m. without-profit produced corresponding net liabilities of £336 m. and £164 m. respectively. In other words, non-profit assurance liabilities were less than half the with-profit liabilities for roughly the same sum assured. The chief reason for that was that some 40 % of the without-profit sums assured in the sample was temporarily assured.

However, despite that digression the authors' conclusions regarding the growth of non-profit business remained valid, although perhaps the current position was not as bad as it appeared from the table.

While he was still on the subject of the table, he would like to complete his statistical excursions by throwing some additional light, which might be helpful later on in the discussion, on the composition of the figures for deferred annuities in force. Figures issued by the life offices' associations in respect of 1952 showed group deferred annuities in force of £176 m. per annum and individual deferred annuities of only £30 m. per annum, the proportion of group to individual being, therefore, six to one. Of the £30 m. individual deferred annuities at least £20 m. were in connexion with retirement benefit schemes. He agreed, therefore, with the authors that they need only consider pension-scheme business. But he would go further and say that in any practical approach to with-profit deferred annuities group business was the primary consideration.

While he did not disagree with the authors' preference for bonus additions to benefits rather than bonus reduction of costs for individual contracts, he did not think the method was so practicable for group schemes. The authors argued in support of their preference that the contrary idea of a guaranteed pension was illusory, because there were many adjustments, for example in respect of salary increases, late retirements and general alterations of schemes consequent upon a change in the value of money which might affect the employee's

ultimate pension. The bonus would be simply another variable which would be accepted because a with-profit policyholder, as in ordinary life assurance, got the better bargain, or might get the better bargain, in the long run.

If it were accepted that in a group or any large scheme the idea of bonus additions had to be put over not only to the employer but to the employees, was it right to say that the employee's real interest was in the equitable funding of the scheme or was it more likely to be in its secure funding and perhaps in knowing how much his pension would be on a reasonable forecast of salary increments? Variations in pension due to bonus additions as between different age groups of pensioners who themselves might have worked in the same wage and service categories would not necessarily be equitable or acceptable to the employees. For that reason, he had been much drawn to the argument put forward in two papers on with-profit pension schemes.* The first was by Mr G. Mills, F.F.A., and was submitted to the Student Societies of both the Faculty and the Institute in 1954. The second was by Messrs M. D. W. Elphinstone and M. W. Melton and was more recently submitted to the Faculty.

He did not propose to say much about those papers, because no doubt many others would want to cover some of the ground who were better qualified than he to do so. He would just say that those papers advocated bonuses to reduce the cost of the scheme rather than to increase the benefits. If that were done, there was not so much trouble with surrender values, the subject of a special section of the authors' paper. He believed that under existing group schemes employees' contributions were applied on a returnable basis while the balance of the cost was borne by the employer, usually on a non-returnable basis on death. A member leaving the scheme would get a return of contributions, but it was not necessarily certain that the employer would get a surrender value, although in practice a proportion of the premiums was returned to him, subject to the good health of the withdrawing member. Any surrender value paid to the employer would go back into the scheme, and he did not think there need be any argument as to the precise method by which a reserve released on the withdrawal of a member was applied to the continuing cost of the scheme. Personally, he did not think it desirable from the office's point of view that surrender payments in cash to the employee or to the employer should be excessive. The authors, indeed, had mentioned the possibilities of surrenders *en masse* as one factor to be considered.

The authors, too, provided another answer to the problem of surrender values by the suggestion in § 71 that the assurance offices should educate public opinion so that members of pension schemes would take paid-up pensions instead of surrender values in cash. If that meant that both the employees' and the employer's shares were to be applied to paid-up pensions, the problem became very wide indeed, much wider than with-profit pension schemes. However, he would do no more than suggest that that was yet another thought that would provoke discussion.

Mr M. W. Melton remarked that the authors had themselves pointed out that the growth of pensions had produced the enormous volume of deferred-annuity business then in force, and it was perhaps as well to recall that the methods commonly used in dealing with insured pension schemes envisaged each premium as an aggregate of small amounts applied to purchase benefits for a multitude of members. The costing methods employed made use of single premiums rather than annual premiums, and the normal custom was for the

* See *A.S.M.* 3, no. 1, 86, and *T.F.A.* 23, 85.

employer's share to be dealt with on the basis of premiums non-returnable on the death of the member. Those differences did perhaps tend to make the problems of with-profit deferred annuities, when associated with pension schemes, fall into a class of their own.

Where with-profit contracts were in question, an office had to be largely concerned for its own protection with the amount of bonus loadings included in its premium rates. But in pension business, where each premium was separated into small pieces to buy a part of the benefit for many different individuals and in the same contract provision was made for new benefits automatically to be included each year, the buffer for the office was not only determined by the size of the bonus loadings but also by the guarantee of rates and the costing plan adopted for the purchase of benefits. All three played a prominent part in deciding how much protection the office could maintain for itself at different points of time in the existence of a scheme, and only manipulation of all three together could produce the most satisfactory solution. Even non-profit contracts could, through the medium of the rate guarantee and costing plan, be made to reflect in the year-to-year cost favourable and unfavourable changes in experience. He did not consider that approach to be as equitable or complete as true with-profit methods, but some at least of the objections raised in §21 to non-profit systems could in that way be minimized.

As to whether pensions should be guaranteed or bonuses used to increase them, it would seem that the most important factor in that connexion was the place of a pension scheme in management planning and general employment conditions in the country. Since inevitably the cost the employer was prepared to pay in setting up a private scheme for his employees would determine the level of pensions to be provided, the difference between applying bonuses to increase pensions or to reduce cost left the realms of actuarial mathematics and became rather a question of appeal to the employer. If bonuses were added to pensions the basic scale of benefits would normally be on a much lower level, and that would result in those employees whose needs were greatest, i.e. those nearest to retirement, being treated more harshly.

It had been suggested that bonus additions to pensions would help in inflationary conditions and also lessen the impact of final salary schemes on the employer's outlay. Assistance in that way was by no means fairly distributed between members, and a far better solution would be a flexible scheme in which changes could be made properly and equitably to meet altered circumstances.

In §§67-72 the authors discussed the question of surrender values, but seemed to be relating them more closely to individual policies or a group of individual policies under which a guaranteed return of premiums with compound interest was allowed at any time. Many of the schemes responsible for the increased deferred-annuity business referred to provided the benefits under one policy, and although guaranteed surrender values were granted for individual portions, discontinuance carried no such guarantee of surrender value for the whole policy. Paid-up pensions were granted in those circumstances and an over-generous guarantee of those terms was the danger to the office. The introduction of participation in profits would therefore provide an additional margin for the office, in that on discontinuance the policy could cease to share in profits or share in them to a reduced extent.

The long-term nature of pension business and the uncertainties associated with mortality, taxation and the inclusion of many options would, as the authors pointed out, call for great care in determining the most suitable basis for

premiums; but, by including participation in profits in deferred-annuity contracts and providing at the same time the protection available from proper rate guarantees and discontinuance penalties, the danger to the stability of an office of the inclusion in its funds of an increasing volume of pension business could be more apparent than real.

Mr J. Edey drew attention to the reference in § 14 to Bayley's paper where the authors said 'the true rate lies somewhere between a net and a gross rate of interest . . .'. He thought they should look again at Bayley's paper and see his own words, for he questioned the ethics of his theoretical results. He challenged them with the submission that the actuary was bound to forecast a standard which accommodated the facts.

It was perhaps time that a further analysis should be made to see whether it was not possible to find a more satisfying synthesis of the facts, but it was not appropriate that evening to do more than state the problem. Indeed, they might find a different set of facts was with them before long.

An annuity fund could not, in the long run, earn less than a net rate of interest or more than a gross rate of interest. The fund could earn both a gross rate of interest and untaxed profits for a time, i.e. effectively more than a gross rate of interest, while it was recovering tax previously paid on or deducted from interest.

In designing any system for distribution of profits to participating annuities, whether individual contracts or group contracts, he would regard it as unwise to assume that legislation would remain stable and unchanged. He would regard it as unwise to take credit for future tax recoveries and above all unwise to distribute profits before they had been earned. The authors had given a warning in that sense in § 36.

In § 33 it was stated

premium calculations which relate to sums at risk that are, on the average, further ahead in time should contain rather larger margins than premium calculations for sums at risk nearer at hand.

A margin for contingencies was not always the same as a bonus loading. Deferred-annuity premiums had to have contingency margins, but they did not necessarily need further loadings, the object of which was to provide bonuses of a customary form and of satisfying amplitude; it was not necessary to press industry to pay such loadings under pension schemes. As to margins, however, adverse contingencies were no less likely to occur in the more distant future than in the near future. If the margins were to be kept small so that the system of bonus distribution was economical, they should not be distributed too rapidly. It would, in the long run, be economical to devise a system of bonus distribution under which the cost of the bonus was very small in the early years.

Bearing in mind that it was unwise to distribute profits before they were earned and economical to defer until the later years of a contract's term the distribution of contingency margins, they should beware of the selling organization competing on the basis of first year's costs. They had a duty to the public which required not only that they offered equity in participation and the economy of slow distribution, but also that they did all they could to avoid misunderstanding by employers of the forms of contract, which could scarcely fail to be complex.

The authors drew an analogy between deferred annuities and endowment assurances. It was natural that the analogy of bonuses on individual endowment assurance policies should have led to a consideration of the possibility of granting bonuses on deferred-annuity contracts in the form of proportional additions to

the benefits. The idea of an addition to the amount of the benefit in each year of continuance of the contract, implying as it did that the longer an annuitant lived the greater the bonus which would be given to him, was paradoxical. It seemed at first sight that the longer a pensioner lived and therefore the greater the strain imposed on the office, the more generous the office would be to him in giving a bonus of that form. But the resolution of the paradox was in retrospect simple, though perhaps it seemed important at the time. Those who were in that business were familiar with the recurrent single-premium method of finance. If it was considered that the premium paid, whatever the method of calculating the premium (whether single or annual), was applied to purchase of pension on the single-premium plan, then, if there was a suitable valuation basis, it would give an interest margin on the valuation reserve. The surplus would emerge as a proportion of the reserve and support a bonus of a proportion of the amount of the pension. If the premiums and the reserves could contain an interest margin, there would be a consistency between the valuation and the bonus system.

There were four elements of surplus which he wished to mention. The first two were more tractable than the second two. The first pair were mortality and expense: both were likely to move against them. Mortality had been moving steadily against them for many years and would probably move against them in the future. Expense might move against them but in that particular business there was a remarkable reflex to inflation. So, the premium basis should contain margins for both mortality and expense: both were likely to move steadily. When it came to interest, however, they had something which did not move so smoothly, and there were two elements to consider. First, there was the variation from time to time in the gross rate of interest on investments. It was perhaps trite to say that it was extremely difficult to conjugate the assets with such very long-term liabilities as deferred annuities. But it was important to remember that in some territories and in some currencies it was quite impossible to do that. In regard to home business, there was the further element in regard to interest: the taxation basis was all-important. It was most important not to design a system of bonus distribution which depended upon the stability of legislation.

He felt that the method of valuation should be planned at the same time as the method of distribution of surplus was planned. He did not agree with the authors' suggestion of waiting for some years for the best method of valuation to become apparent. The valuation technique might be varied from time to time, but the broad pattern should be such that the margin of surplus would be suitable to the method of bonus distribution which was chosen.

Mr A. M. Pearson referred to the authors' conclusion, from the history of deferred-annuity contracts during the past thirty years, that the wide variation of experience required such a substantial margin in rates that it would be only equitable to grant, as compensation, the right to participation in profits. In fact, they said, the calculation of deferred-annuity premiums should be on such a conservative basis that profits were virtually certain to emerge and therefore the public had to be educated to demand a with-profit deferred annuity.

To him that seemed a confession of defeat. It was argued that because past experience showed that the rates charged had not always been equitable the policyholder had to become a co-insurer with the company and be educated to demand a share of a risk of which he knew even less than did the actuary. He thought that was wrong because, in his opinion, with-profit deferred annuities

were not in the policyholders' best interests, and he felt sure the public did not really require them. It seemed however that assurance companies wanted the public to relieve them of a great part of their proper duty of spreading risks. A company was often asked to quote deferred-annuity single premiums without return on death in order to assure the pensions already acquired by members of an internal fund that was being wound up; the whole argument for placing that business with an assurance company was the elimination of risk and the certainty of the provision of the pensions as required.

Once the idea of with-profit deferred annuity business was firmly established, it would not be long before companies would boast of the high bonuses secured, with the effect that those high rates would inevitably be taken into account in quoting for such business and the members of the wound-up internal fund would themselves be assuming the risk of perhaps 30 % or 50 % of their pensions that had previously been guaranteed by their employer. That was one of the many cases that required a non-profit deferred annuity.

It might be that deferred-annuity premiums should be increased. Even so, in his view they should remain on a non-profit basis with the entire risk assumed by the assurance company.

If premiums could be calculated on such a conservative basis that profits were bound to emerge they could also be calculated on a lower basis giving only a sufficient margin to the assurance company; free competition between the offices would soon reduce the rates if they were too high, unless it was also proposed that there should be some agreement between the offices regarding non-profit rates. If that should come and the logical consequence of it follow, offices would soon be reduced to a universal standard when they would be ripe and ready for nationalization.

Finally he did not agree with §46. The definite arrangement was not illusory because it did depend on pay if a man was assured that his pension would be 50 % of his retiring salary, nor did adjustments for early or late retirement make it so.

Mr K. M. McKelvey said that sums assured were not the best measurement of what had happened in the past fifteen years to the participating element in the offices' liabilities. He would agree with the opener that reserves were probably a better, even if not a wholly satisfactory, measure. He would also suggest that averages, as was so often the case, were misleading in that matter. It seemed likely that an office making a speciality of group business might have found the non-profit proportion of total reserves as much as two-thirds at the time of speaking as compared with one-fifth fifteen years earlier.

There was no life contract with a longer term than a deferred annuity. From time to time since the war, in the light of investment conditions, deferred annuity rates for pension business had seemed almost harsh. But nothing could properly be done. The offices were committed to invest premiums on fixed terms for anything up to forty years ahead. They were guaranteeing surrender values and perhaps theoretical paid-up values and they were guaranteeing various options at pension age. They knew mortality was going against them. The only possible basis in fairness to their participating policyholders and their shareholders was one including fairly generous margins. The results had at times been unattractive as against the self-invested fund and if the more gloomy expectations remained unfulfilled large surpluses might emerge.

Therefore in the interests of existing participating policyholders and of

employers who wished to instal a pension scheme, with-profit deferred annuities had become an imperative and essential part of the business. They could give the employer a real element of equity in his scheme. But he fully agreed with the authors' remark in §50, that they had to be 'sold' in a self-invested fund atmosphere. A with-profit pension scheme was far more akin to a self-invested fund than to a non-profit insurance. Under a self-invested fund nothing was guaranteed except value for money; the same applied to with-profit deferred annuities.

In §37 mention was made of options. In his view, although options had to be given in connexion with participating deferred-annuity contracts, particularly when they formed part of a pension scheme, the basis should not be guaranteed.

On the question of distributing profits, he believed that they should emerge either as extra pension or as a reduction in cost. There were already sufficient subsidiary benefits in pension schemes, whose primary object was to provide pensions. Therefore, he did not favour the emergence of bonuses in the form of additional subsidiary benefits.

On the question of a premium basis the idea of linking the formula closely to that for endowment assurances was neat and ensured consistency, but it might not give the most desirable results. Under an endowment assurance the whole sum assured participated in profits from the outset. A large proportion of the premium consisted of bonus loading and as a result the contract was, to use jargon, very highly geared. For example in the case of a representative with-profit endowment assurance premium basis the minimum gross rate of interest which the office would need to earn in order to fulfil the basic contract was as low as between $1\frac{1}{2}\%$ and 2% . Moreover, for a new class of business, such as was suggested, he believed they should, while gaining experience, load for a greater proportion of the rate of bonus they expected to declare than under the familiar classes and that would aggravate the gearing position. He believed an employer would not take such a highly geared contract for his pension scheme. Its initial cost would not be competitive compared with a non-profit scheme and it would take too long to show its advantages, although once it started to do so it would continue to do so. The employer wanted a more attractive net cost in the early years. He was not prepared to wait for what might well be a perpetual advantage if it was a deferred perpetual advantage, even though he was quite wrong in so ignoring the very long-term nature of a pension scheme. For the level annual premium deferred annuity, therefore, the speaker was not happy with the exact endowment-assurance analogy.

The single premium or rising cost deferred annuity, on the other hand, could be loaded for the same rate of bonus as an endowment assurance, or preferably a little more while they were learning, and still bring out a saleable initial cost. A bonus would be granted on each year's pension purchased in respect of the period between then and pension age. That contrasted with the annual premium with-profit deferred annuity, where bonuses would be given from the outset upon the whole pension to pension age. The element of gearing was reduced. Emerging profits could be used to offset the natural increase with age of the basic single-premium rates, and a more saleable article would result. But it was rather different in concept from an orthodox endowment assurance.

Although he did not agree with the wholesale adoption of endowment-assurance practice as regards bonus loadings, it was important that if possible a system should be devised which would preserve a close and published relationship between the rates of bonus on ordinary with-profit assurances and the

rates on with-profit deferred annuities. Such a relationship was most important for the prospective policyholder, the employer, as an index as to the degree of optimism or conservatism underlying any assumptions upon which the office might base its estimates of future results.

With regard to §§ 67-72, although for practical reasons under pension schemes a minimum return of the employee's contributions had to be guaranteed, he felt with the authors that the office could not and should not give any guarantee in such cases in respect of the total, that was to say the employer's plus the employee's surrender value.

Under with-profit deferred-annuity pension schemes, in the case of routine withdrawals, he would prefer to consolidate prospective future profits on very conservative assumptions into the paid-up value, which would then cease to participate. That avoided odd small amounts of with-profit deferred annuities remaining on the books. Such treatment could not be extended to cases of mass withdrawal, due for example to a slump, and in those cases paid-up policy values smaller than those just mentioned, but continuing to participate, would be appropriate.

Mr G. W. Pingstone thought that in § 6 the authors could have added that the distribution of profits in America was done by the contribution method, as that would have been useful in connexion with what they had to say later.

In § 19 there was a reference to the mortality of annuitants, and it might be useful to mention again the difference in mortality of pensioners as measured by lives and amounts to which he himself had referred in a paper given to the Institute in 1951 (*J.I.A.* 77, 335). Subsequent experience had shown no change in that position. It did seem to be a material factor, mortality by amounts being lighter than mortality by lives to the extent of some 9% over the years 1950-54 inclusive.

In § 20 the authors mentioned mortality during active service, and in that connexion he would have thought that, for ages above 45, the C.M.I. 1947-48 experience for assured lives* was a fair measure of the mortality experienced during active service. For younger ages it would be too heavy. However no actual experience had been published in the United Kingdom.

In § 26 the point emerged which had been mentioned already—that the authors appeared to think primarily in terms of individual policies. They said that it was usual in calculating the premiums to ignore mortality before pension age. That was, in fact, the case neither in respect of the employer nor the employee entirely where group life and pension schemes were concerned.

He agreed with some earlier speakers in reference to § 46. He could not find that the fact that a pension was increased because a man deferred retirement constituted a reason for 'with-profits'. It seemed to be stretching the argument too far. A definite pension at some point of time had surely to be determined. He thought the pension age was the natural one.

In § 51 would be found an argument that pensions should not participate in profits. He certainly agreed with all the arguments for making a final settlement in respect of profit distribution at pension age when a reasonable view could be taken of what the future prospects of mortality were. But the economy seemed to be geared to inflation. There seemed to be no sign of its being eradicated, and he was not so sure there might not be an argument on that ground for having

* See *J.I.A.* 77, 117.

annuities participating in profits. He did not say that that was what he wanted to do but that there might be a reason for doing it.

In § 57 the authors said that there was virtually no life risk. But there again they were considering individual deferred annuities and that statement was not true of an ordinary pension scheme on a group basis.

In § 67 there was a point previously mentioned: namely that in general under a pension scheme it would not be practicable for the employer to get his money back in the circumstances envisaged. It would be in the form of fully-secured pensions. Even if the employees got their money back in cash, it would still be paid-up pensions only which would be available for the employer's share.

In § 70 it was stated to be usual to return a member's contributions with interest. He queried the words 'with interest', so far as insured pension schemes generally were concerned.

In § 72 there was a point upon which Mr Melton had already made some comments. He himself was not at all sure whether it would be natural to grant a paid-up policy which continued to share in profits. There might be good reasons for doing otherwise.

Mr A. T. Haynes said he would like to comment on the second part of the paper, because he felt that it was by far the most important part of what he regarded as a very timely paper. He felt bound to join issue with a previous speaker who had expressed the view that deferred annuities, especially under pension schemes, ought to be issued only on a non-profit basis. To his own mind, the authors' arguments were quite unanswerable. As they put it, their arguments amounted to one word—'uncertainty'.

There was uncertainty so far as interest was concerned—uncertainty which might lead to a wide range of possible financial results under a long-term contract. If, for example, premium rates for non-profit deferred annuities were calculated on a 4 % interest basis and if, over the years, the premiums could be invested at only 3 % instead of 4 %, there might well be a 25 % shortfall in the fund available at the vesting date to provide those annuities. That possible deficit might arise purely from the one factor of interest.

There was uncertainty also so far as mortality was concerned. It would be seen from the diagram (see § 32), showing the shape of the sums at risk under deferred annuities, that the maximum financial effect of mortality might be expected to arise between the ages of 60 and 70. At those ages, of course, the curve of deaths was also at its peak. The impact of the one factor on the other created a double order of financial effect within that ten-year age-range. If the anticipated deaths were shifted back a few years through improvement in vitality, the anticipated benefit by way of release of reserve from the deaths under a non-returnable deferred-annuity contract might be missed entirely. That was one instance of the way in which quite considerable adverse financial results could arise through the estimates being proved wrong.

The real point at issue was that the actuary was no prophet. The actuary could not predict mortality, and he could not predict interest. The actuary's function was not to predict, but to cope with, changes in levels of interest and mortality. He should ensure, to the best of his ability, that in all circumstances he would be able to cope with any changes in those levels that seemed to him to be within the bounds of possibility. The actuary's responsibility was to be as sure as possible that the benefits offered would in fact be there at the required time.

There were two broad ways in which that could be done. The first way was to grant guaranteed benefits under non-profit contracts and to hold ample reserves to back those guarantees in any circumstances that might arise. Valuation reserves in a wholly non-profit fund should, in his view, be on an extremely stringent basis—the degree of stringency depending, for example, upon the rapidity of the increase of the fund. He thought that the authors would agree with that statement because, when they pointed out that a partial alternative to very stringent valuation reserves might be shareholders' capital, they expressed the view that the amount of capital required to provide security for any substantial volume of non-profit business might be very large indeed.

The alternative was, of course, the authors' way—to restrict the proportion of non-profit business and to grant deferred annuities in with-profit form. It might be held that that was not in the interests of the present with-profit policyholders, but he did not agree. It seemed to him that in a predominantly non-profit fund, if the actuary was to fulfil his responsibility of setting up fully adequate reserves to cover all contingencies, surplus might have to be held back from the existing policyholders, and that it might well be in their interests for the number of with-profit policyholders to be extended in such a way that the surplus could be released in good time.

Mr M. D. W. Elphinstone recalled that in 1931 he had dealt with his first with-profit pension scheme. In 1937 or 1938 he had himself begun to consider the problems of what might be called a modern with-profit pension scheme. In the discussion on Mr Pingstone's paper, Mr Ogborn had said that he felt that offices ought to get away from the transaction of large amounts of non-participating pension scheme business and should put it on a participating basis. He himself spoke immediately after Mr Ogborn and said he had never heard anything in an Institute discussion with which he was in more wholehearted agreement. In 1955, with Mr Melton, he had given a paper to the Faculty. That had been referred to already or he would not have mentioned it. The subject was with-profit pension schemes. Shortly after had come the paper they were discussing that evening.

Apparently, he and Mr Ogborn took about the same length of time to hatch an egg with the assistance of their colleagues, but he was afraid the resemblance ended there.

First of all, as other speakers, particularly Mr Pingstone, had pointed out, most deferred-annuity business was group business. If they were going to sell individual deferred annuities he saw little practical chance of getting away from the reversionary bonus. He thought it was the wrong answer in a pension scheme.

To the man who would be drawing the pension thirty or perhaps forty years later, it was not much use agreeing now to give a pension of say £100 a year. He would like his pension to be linked to the cost of living. He might like his pension to be linked with his employer's profits, though the general opinion was against that. But the last thing he considered it ought to be linked with was the profit of a remote life office. With individual policies that could hardly be avoided. With a group policy there could be a cash bonus. That was not necessarily allotted in respect of individual employees. It could be applied in many ways—used to reduce the employer's contribution or the employees' contributions, or thrown into reversion so as to increase pensions according to any scheme chosen, allocating it to different employees in a hundred different ways.

Mr Pingstone raised the point that whereas a pensioner would not like a

fluctuating annuity, he would not mind if it fluctuated upwards though never downwards. The bonus could be used if the pensioners were getting into a bad way. That was an important point.

If he might make one criticism, the paper was written too much against the background of individual deferred-annuity policies. The greater part of pension business was written under group policies, and the problems of administration and even some of the actuarial problems seemed to be quite different.

Referring to the suggestion made twice that the public should be educated, he would say that when actuaries were agreed upon a matter of undoubted actuarial fact, let them unite and educate the public. If, however, an actuary wanted to sell a policy and there was some public resistance, and if some of his colleagues were not agreed with him, he was likely to find himself in competition with an office whose actuary had been educated by the public. On neither point had the authors educated him, nor did he think he was likely to be educated. He would be delighted to meet the authors' office in competition if they persisted in educating the public!

Mr H. E. Raynes wished to support one of Mr Elphinstone's criticisms—that the paper was written too much from the point of view of the individual policy or the group of individual policies effected with annual premiums, such as the Federated Superannuation System for Universities. To his mind, there was no reason why under such a scheme deferred annuities should not be with profits. A deferred annuity based on a cash option was very similar to an endowment assurance with profits, as the authors had pointed out. It was simply that the portion of the life assurance during the deferred period was abstracted.

He wanted to put the point of view of a typical pension scheme. It was a continuing contract; it was not a separate bundle of individual contracts. It was a continuing contract in which the office reserved to itself the right of amending the rates of premium from time to time. If the premium changed, it was brought into accord with current conditions required by changes in mortality or changes in the rate of interest or changes in expenses and in that sense it was always participating in profits.

Under the group schemes which had been so popular during the past twenty-five years the employee paid a fixed percentage of his salary and he got as a benefit an annuity of a fixed percentage of his average salary. The two things were fixed and definite. The difference in the cost from year to year was paid by the employer. Therefore, if there was any change in the rates of premium, the benefit or disadvantage fell upon the employer.

He could see no objection to some system of reduction of rates of actual contributions from time to time in virtue of the actual experience instead of a change in the basic rates of premium. But he did not see that there was a great deal of difference. If the office could alter the contract by charging new basic premiums to bring it into accord with current practice, a large measure of safety was secured for the office.

Mr K. G. Tew thought the authors had put up a good case for participating deferred annuities but he would like to comment on their choice of bonus system.

The endowment-assurance approach which ran through the paper seemed to present a number of difficulties arising chiefly from the introduction of a

'maturity value'. That value would need adjustment from time to time, as the authors admitted.

Moreover, a periodical bonus declaration had to be made to the policyholders and the 'maturity value' to which the bonus declaration would refer had also to be known to the policyholders. Was there not a danger that the 'maturity value' might sometimes be regarded as a cash option and prove embarrassing to the office? Since the contracts were expressed in pension form, the bonus should also be expressed in pension form, thereby eliminating any reference to a 'maturity value' at all.

The analogy of a deferred-annuity contract with an endowment-assurance contract was rather unreal, he thought. They attracted different taxation and separate funds had to be considered.

It was also possible that the endowment-assurance principle would lead to the surplus emerging too rapidly. It was more appropriate to retard the bonus with deferred-annuity contracts since the sums at risk had a much later incidence than in the case of endowment assurances, as the authors had illustrated.

Those considerations pointed to declaring bonuses in the form of a reversionary annuity based not on the total value at the retiring date but on the deferred annuity already secured, whether purchased on the annual premium or the single premium plan.

If the bonuses were compound, rather than simple, so that they were calculated on pension bought to date together with bonus additions thereto, greater equity for the policyholders and simplicity for the insurers might be achieved.

The authors referred to a special final allocation of bonus on the date of retirement. That accentuated the retardation of the bonus emergence and he therefore thought that that feature of their system was quite appropriate.

Mr W. G. Bailey proposed to assume that the benefit arising from any participation in profits would accrue to the employer in some shape and so reduce his costs. There had been considerable discussion on the comparison between endowment assurances and deferred annuities. He found himself in complete agreement with the remarks made by Mr Edey on that subject. The authors remarked in § 58 that both classes might share in profits on similar principles, 'for a while at least'—a phrase which pointed to perhaps the most important objection to the suggestion. There were however several objections.

It was necessary to distinguish between the outlook of the individual policyholder and the employer under the contracts. The individual policyholder would tend to look at his contract as an investment. The employer regarded his premium as an overhead and if he were charged more than was absolutely necessary to carry the benefits, he would feel that the additional premium was being invested for him when he might reasonably expect to invest in his own business to better advantage. In that connexion, they had to remember that they were not the only pebbles on the beach—that there were other methods of providing pensions. The President had referred to the private fund. There was also the deposit system which guaranteed a maximum and a minimum rate of interest and at the same time guaranteed the annuity rate.

Therefore, care must be taken when they loaded their with-profit premiums that they loaded for a specific purpose and not in order to provide a specific rate of bonus.

In that respect, they should beware of doing as some offices were doing, i.e. intimating that they were intending to declare on their pension business the

same rate of bonus as they were declaring on their ordinary with-profit business. That, he thought, was verging on the improper.

It was an important advantage of a with-profit scheme that an office could maintain for a long time a given rate of premium. The great trouble they had had in the past in non-profit business was the continual changes in basic premium rates resulting in uncertainties and complications in administration. If they could maintain the with-profit group deferred-annuity premiums for a long time, then, with the essential difference in the contributions to surplus of the various factors, sooner or later—and in his view very much sooner—any relation between the bonus declared on an endowment assurance and a with-profit deferred annuity would be, as their American friends said, purely coincidental.

A further point which had been made before was that whereas it was reasonable under an endowment assurance to allow the longest livers, if he might put it in that way, to secure the largest share of the surplus, it was quite the opposite with deferred annuities, at least as far as mortality profit (or the mortality margin in the premium) was concerned. In fact, theoretically, but probably not practically, the safest thing for an office to do was to declare a bonus payable on death in service and on the death of a pensioner. That sounded crazy, but it was not quite so crazy as it sounded. Some offices in considering with-profits schemes were more concerned with existing business than new business. So long as the period elapsing before the emergence of bonus was not too long, then it did not matter to the employer, since he alone was reaping the benefit of participation, at what point of time in the lifetime of any individual employee the bonus fell in.

Naturally his suggestion went too far. He would agree with those speakers who said that the distribution of bonuses should be deferred as long as possible, but presumably it was reasonable to distribute during the 'in-service' period the excess interest earned, or at least a large proportion of it. He did think, though, that in distributing at retirement the loadings imposed for adverse pensioners' mortality they were distributing according to the mortality of the wrong generation, and there was something to be said from the employer's psychological point of view for paying a respectable bonus on the early death of a pensioner.

One or two speakers had referred to §67, and he would like to underline what had been said. Again, the employer's outlook on a pension contract was rather different from that of individual policyholders. The employer regarded his contract as any other business contract—to be utilized to the maximum advantage. They had therefore to be extremely careful that they did not allow him to take advantage of them, perfectly legitimately, by the terms of the contract. That was particularly true of schemes approved under the Income Tax Act, 1952, section 379.

Finally, as to the timing of the introduction of with-profit business, was it wise, when there was some prospect of an equitable taxation system being introduced, to noise it abroad that there were profits to be made on pension business? No one would have said so five years earlier.

Mr J. M. Beattie said that there was one point on which he had hoped to have some enlightenment during the discussion. When they talked about deferred-annuity business with participation in profits, what profits were they talking about? They were accustomed to considering life-assurance business with participation in profits, they were also accustomed to considering that the life policyholder should share in the profits of the life and the annuity business. Was it suggested that the annuity participating policyholder should share in the

profits of the whole of the life and annuity business or in the profits of the annuity business only? If the latter, was it suggested that the life policyholder should thereafter share only in the profits of the life-assurance business?

There was one other question to which he would like an answer. If they gave profits on annuity business in the form of additions to annuities under pension schemes approved by the Inland Revenue, what was likely to be the attitude of the authorities to deferred-annuity schemes where the amount of the contractual deferred annuity closely approached the maximum the Inland Revenue would allow?

Mr D. M. Patton remarked that the previous speaker had anticipated the very question about profits which he himself was about to ask but he would like to go one step further. If it was intended that the pension policy with profits should share in the profits of the pension business only, where was the line to be drawn? If an endowment assurance was issued with an annuity option and the annuity option was exercised, did the profit or loss on the annuity option come under life business or pension business?

Mr L. Sankey observed that one very relevant point, when considering whether or not to transact only non-profit group pension business, had not been brought out. It was the question whether profit should be transferred between various classes of policyholders. At the time of speaking many companies had on their books a large volume of non-profit pension business. It could safely be said that, though perhaps some individual schemes which were effected at low rates of premium in the early days might show a strain, as a whole the business was not unprofitable. It followed that currently profits were emerging which might be used to augment the bonus to the participating policyholders in the ordinary branch—on the whole quite a different class of lives.

If things moved against deferred-annuity business when those deferred annuities became payable, losses might emerge which would have to be met out of the ordinary branch funds, possible at the expense of the participating policyholders. But in view of the longer term of deferred-annuity business, it would be mainly a fresh generation of ordinary life assurance policyholders who would be meeting the losses, their predecessors having reaped the earlier profits. He could quite imagine that at the time of speaking a self-employed person who had effected an endowment assurance policy with profits to make some provision for his old age might think it poetic justice that he should receive a larger bonus because of the profits of the pension schemes since those schemes had tax advantages that were denied to him. But his successors, if later they had to help to meet a loss, would think it anything but justice. On those grounds, he felt that they ought, as far as possible, to make each class of business self-supporting.

Mr F. M. Redington, in closing the discussion, said he would like first to say how much he valued the paper. He believed it was primarily meant to be an opening salvo in a subject that would be of great interest in the future. It had certainly proved most useful for discussion.

He agreed with so much of it that apart from one or two points to be mentioned later he need not refer directly to it. The authors had gone a great way towards proving the case for with-profit pension schemes as well as non-profit schemes. The answer to Mr Pearson was that no one was forcing a with-profit policy down anyone's throat. There would be a choice of a non-profit or a with-profit policy. It was a matter of judgment and for his part he would advise his brother, say, to take out a with-profit policy.

He had had the advantage of being present at the discussion on the paper by Elphinstone and Melton. Perhaps he might be forgiven for outlining the gist of the remarks he had made on that occasion, because he had tried to set out what seemed to him the fundamental principles.

First, there was a preamble: that there was great need in group business, even more than in individual business, for absolutely fundamental soundness. Group business was not a vast aggregation of individual units making a more or less homogeneous collection; it was a collection of discrete and non-aggregable units.

The four main principles that he outlined were, first, that he thought that the distribution of profit should be global and not individual. The essence of their entitlement to do the business at all was that they were *insurers*. When they were doing non-profit business their entitlement stemmed from the fact that they were guaranteeing the contracts. They had to make sure that it was global sharing for all that class of business and not profits for the individual schemes. Possibly the Americans made a mistake in sharing the profits of the individual scheme.

The second point was that true profits could not be distributed until realized. He had some concern lest short cuts were being taken to deal with that problem. The only part of the paper with which he really disagreed was § 73 where it was said that some years' experience of the participating deferred-annuity contracts might be required before the best method by which to value them was discovered. It was not that valuation itself mattered greatly but it seemed essential to know that the system was capable of sound valuation in order to know whether the system itself was sound. That could be illustrated by the biggest problem of all—what to do about profits to pensioners. Although there was something in Mr Fingstone's comments, he would accept the view that it was not normally practicable to distribute profits to pensioners. But how were pensions which were to fall due in the future to be valued during active service? Were they to be valued at 3% or 4½%, the latter being a guess as to possible future experience and the former the usual cautious basis? Every actuary considering with-profit business should ask himself that fundamental question. On the 3% basis he held up the whole of the 'after-retirement' surplus for the people on active service until the point of retirement when he had all the future surplus still to come and he could only distribute it to the wrong generation. The alternative was to value at 4½% but what actuary was going to do that? The only solution his own company could think of was a retirement bonus at the last possible moment of time.

Thirdly, there had to be economy in the bonus system. The business was for so long a term and there were so many possibilities in the long-distance future, that to have anything like the same buffer as under normal assurance business they would need an excessive bonus loading, one which it might be unwise to impose on the clients. The most common bonus system in use could be described as a rectangular or uniform bonus. They could gain in economy in everybody's interest if they had a 'triangular' or rising bonus, starting at nothing and rising to a maximum.

Fourthly, he believed that in principle they should start the business on the assumption that it would be a separate profit-sharing fund on its own. Any other assumption could be very unwise. He would not say that the principle could not be shaded in practice. For example, the establishment charges of that class of business could perhaps be borrowed from other sections.

The President had referred to two main ways of conducting pension-scheme business. Pension schemes were the area where two sections of the profession

might sometimes be in rivalry. There was room for mutual interest and respect. There had been occasions when his sense of justice had burned with sympathy first for one side and then for the other. However, those occasions had not been frequent and were not extended beyond the particular case. His point in raising that was that with the advent of with-profit schemes the rivalry might be keener. But he believed it was a worthy rivalry and it was in the public interest. He would plead that they should all be appreciative of one another's efforts and as a matter of habit make the assumption that their professional brethren were acting in a way which was worthy of their respect, and that they should try to earn that respect.

The very last point of all was that with-profit pension schemes were opening a new and exciting and in some ways a very difficult chapter in their professional lives. As actuaries they could claim to foresee the future, or more modestly to forecast the future, or more modestly still to estimate the future—or they could say they were doing their best. They would be wise to pitch their prophetic claims low. He agreed very much with Mr Haynes that they did not know what the future would bring. They did not know what the future rate of interest would be. But they did know—and that was their professional qualification—the effect of a change. They had to avoid implying too much professional authority for the merely human side of their estimates of pension-scheme costs and, most difficult of all, they had to try to prevent their business associates from taking their professional name in vain.

The President thanked Mr Redington for his wise remarks, and for his post-script to the remarks that he had made himself. He felt sure there would be a great deal of sympathy within the hall for Mr Redington's comments. As had already been said in the course of the discussion, the paper was the second within quite a short period on the same subject.

It was clear from the two discussions, both of which he had had the privilege of hearing, that the importance to actuaries of the subject was fully recognized. He felt sure it was an excellent thing that the tentative steps taken by a number of individuals into the hitherto rather unknown country of with-profit annuities should be followed by larger expeditions and full discussion, such as they had had that evening.

He wished to refer very shortly to the authors of the paper. Mr Ogborn had done much for the Institute. In fact, he had been absolutely untiring in his efforts for it, and presumably he would continue so to be. He would like the vote of thanks which he was about to propose to be regarded as including a recognition of all Mr Ogborn did for the Institute, and in particular what he did for the younger men by way of encouraging them. They had a very good example of that in the co-authorship of the paper. They would also like to express their thanks to Mr Wallas for the part that he had played in preparing the paper; he was sure it was no mean part. He would thank him also for closing the discussion which he would do very shortly. He would like to regard his work as the forerunner of other contributions which he would make to the Institute.

In conclusion he asked the meeting most warmly to support a vote of thanks to the two authors.

Mr G. E. Wallas, in reply, said that at that late hour he would confine himself to a very few points leaving the rest for a written reply.

The opener had given some figures which the authors both regarded as a valuable addition to their own table 4, but he seemed to prefer figures based on

reserves rather than on sums assured. The two viewpoints were both valid, but he himself preferred 'sums assured' because it showed the total possible liability. If an office with a fixed capital were to set out to transact only temporary assurances, it would look not to the reserves as a measure of what it was letting itself in for, but to the total sums assured, so he felt that 'sums assured' was a valid measure equally with 'reserves'. They supplemented each other. In table 4 the proportion of temporary assurance included in the non-profit business was almost the same in 1952 as in 1937 and so the temporary-assurance business did not invalidate the comparison based on sums assured.

The main purpose of the paper was to argue for a with-profit fund, in whatever form was preferred. The authors nailed their colours to that mast, and there was only one dissentient voice. He himself had not been convinced by Mr Pearson's arguments.

He was grateful to Mr Haynes for his remark regarding the diagram of the sums at risk which, as he pointed out, could be weighted by the curve of deaths. That brought out even more strongly the point they had made.

Three speakers had referred to the mean term of deferred-annuity business. There was, he thought, a common misconception that deferred-annuity business was by its nature very long term. He had done arithmetic on it at one time and another and he did not think that was quite true. It was not possible to talk about the mean term of an individual policy, because the mean term varied with duration. At the outset, it might be thousands of years. For a monthly premium it might be tens of thousands of years. A reasonable model had to be adopted and the authors had tried stationary funds, comparing deferred-annuity with whole-life. Speaking from memory, he thought whole-life funds were a little longer. If the funds were increasing at a rate of, say, 10% per annum the deferred-annuity business might, he thought, be a trifle longer, but there would not be much in it.

In answer to another speaker, the authors were not in favour of split funds. They did believe funds should be self-supporting—but self-supporting within the framework of the office as a whole.

On the method of sharing in profits, the balance of opinion seemed to be against the authors, as they expected it would be. They had listened with interest to the various methods advocated, and had no quarrel with them. Those methods might, in the future, become accepted. Their own preferences were different, but they were purely preferences. As they had pointed out, the methods were to some extent interchangeable.

He could only hope that Mr Redington's triangular bonus would give policyholders a square deal!

In conclusion, the authors wished to thank members for the reception given to the paper and for the very lively and interesting discussion it had provoked. He personally wished to thank Mr Ogborn. This was really Mr Ogborn's paper as all who knew him and had read the paper would realize. The speaker's own share had been little more than would normally qualify for an acknowledgment in the last paragraph. With characteristic generosity Mr Ogborn had insisted on giving him the honour of sharing the authorship, and he was very grateful.

The authors write:

In his reply to the discussion Mr Wallas referred to statements by some speakers to the effect that deferred-annuity business is very long term. By way of amplifying his remarks we would emphasize that the question of the mean

term of the business—an investment problem—is totally distinct from the problem of premium calculations which is dealt with in §§ 23–25, where it is shown that deferred-annuity premiums are more sensitive than life-assurance premiums to changes in the rate of interest on which they are based.

For a deferred annuity at age 65 without return of premiums effected at age 20, on the bases used in the paper, the mean term applicable to the contract after 1 year is 894 years, and after 1 month about 11,000 years. These high figures are of course of little real importance since they relate to such small reserves; they are quoted merely to emphasize that regard must be had for practical purposes to the liabilities as a whole. The following table shows the mean terms of stationary funds consisting of the contracts used for illustrative purposes in the paper, and on the same bases:

Class of contract (entrants at age 30)	Mean term (years)	Redemption date of interest- bearing bonds having equivalent mean terms
Endowment assurance at age 65	17·3	22·6
Deferred annuity at age 65, with return of premiums with interest	20·1	27·8
Deferred annuity at age 65, without return of premiums	20·6	28·7
Whole-life assurance	21·2	29·9

For similar funds whose new entrants have been increasing continuously throughout at the rate of 6 % per annum the corresponding figures are: whole-life, 39·9 years; deferred annuity without return, 39·4 years. (It is perhaps of interest that these figures are almost equal to the mean term of a perpetuity on the same basis.)

This seems to show that the mean term of deferred annuity business is not longer than that of *comparable* assurance business. In practice differences in the composition of the business (e.g. by ages at entry) and the preponderance of endowment assurances may tilt the scales.

On the general question, whether some system of participation in profits is essential to the healthy development of deferred-annuity business, we appreciate the support we received, especially from Messrs Haynes and Redington, and we are content to let the paper with the discussion on it speak for us without further comment. We wish to comment mainly on some broad questions of policy.

As Mr Beattie and other speakers mentioned, it is customary that life assurances which share in profits should share both in the profits of their own class and also in the profits of non-participating business, except where the constitution of the office provides otherwise. Should the with-profit deferred annuities be placed in a separate fund? What should be done with the profits of (a) existing (b) new non-participating deferred-annuity business? These are questions of policy for each office to consider. We took the view that it was desirable that the with-profit deferred-annuity business should share with the life-assurance business in the profits of the office as a whole. This keeps the position open and enables the actuary to deal equitably with the various contracts in the light of experience.

In framing any system of distribution of surplus the actuary must decide not only upon the form of the bonus but also upon the level of bonus loading; the latter question turns upon the amount of margin or protection that the actuary considers to be desirable in the premium scale. Though the circumstances differ

from office to office it seemed to us a good starting point to suggest that the level of bonus loading should be such as would give about the same protection as the bonus loading for with-profit endowment assurances. As some speakers indicated it may be possible to combine lower bonus loadings with some system of bonus which increases with duration such as Mr Redington's 'triangular bonus'.

It would be natural to hope that a participating system might come about by an evolutionary process whereby the right to participation in profits would be given in place of a reduction in premiums for new entrants. This has happened with other classes of life assurance. The current level of premiums for non-participating deferred annuities may contain some margin, more especially if the annuity fund is in the condition where the annuities paid exceed the interest income, so that the interest income is in effect received gross. (This is unlikely to be the condition of the fund if much new pension business is transacted.) It is a matter of opinion but we took the view that the current level of premiums would not support a bonus system and that some definite loadings must be added as a charge for the right to participation in profits.

Mr Raynes stressed the fact that a group pension scheme is a continuing contract, subject to agreement on the terms for new entrants. He suggested in effect that profits on existing business could be shared with the insured employers by reducing the premiums for new entrants. However, only profits can be shared in this way—not losses, since the premiums for new entrants could not be increased above the market level. Therefore, if this line of thought be adopted in practice, the actuary must ensure that the premiums are on such a level as will produce profits, that is to say on a with-profit scale. Thus the argument is one for with-profit business but with a special system of distribution of surplus.

There is no doubt, as mentioned by many speakers, that the special features of group pension business must be given due weight in adapting a system of distribution to that class of business. Many speakers argued that the suggested system of distribution of surplus would be inappropriate for group pension business. Our purpose was not to put forward a rigid system but rather to suggest an approach to the problem which might be useful. In framing the actual system of distribution it seems to us to be helpful to make a comparison with endowment assurances. It will be easier to be consistent if there is some reasonable link between the deferred-annuity and the endowment-assurance classes and such a link may initially be helpful in selling the new class. We would agree with Mr McKelvey that it is probably best to compare group pension business with single premium endowment assurances for the purpose of distribution of surplus.

The remark in §73 which was criticized was occasioned by the thought that the principles of valuation of annuity funds seem to us to require further investigation. Immediate annuities can safely be transacted upon the basis of a gross rate of interest. The existing system of taxation of the annuity fund, however, may require a net rate of interest to be assumed for a time under deferred annuities. The period during which interest is assumed to be net may be the whole of the deferred period or it may be a shorter period depending on the taxation position of the fund. Consequently at any one point of time the annuity fund may be regarded as comprising some business at gross rates of interest, some business at net rates of interest and, possibly, some business in intermediate states. Valuation of the whole body of contracts at a uniform average rate of interest can lead to nonsensical results. Yet it is not at all clear how to make an appropriate provision for the different gross and net rates of interest.