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ACTUARIAL ASPECTS OF STATE REGULATION OF INDIVIDUAL VARIABLE ANNUITIES

HARRY WALKER

ABSTRACT

This paper discusses the actuarial aspects of state regulation of variable annuities, with particular reference to individual rather than group variable annuities. The following points are covered.

1. There should be a reasonable upper limit imposed by regulation on the assumed rate of investment return (AIR) for individual but not for group variable annuities. Under current conditions 5 per cent is suggested as a reasonable upper limit.

2. Companies should not be required to guarantee the expense and mortality factors under a variable annuity contract.

3. There should be regulatory restraints on the table of mortality used to compute the first annuity payment under a variable annuity only if the insurer does not guarantee that benefit payments will not be adversely affected by mortality experience. Companies should feel free to use any table of mortality if benefit payments are not to be affected by mortality experience.

4. The paper proves that the use of an AIR higher than $3\frac{1}{2}$ per cent does not result in any strain on surplus arising from the need to comply with the $3\frac{1}{2}$ per cent interest requirement in the valuation laws.

5. There is discussion of grace, reinstatement, and nonforfeiture provisions for individual variable annuities.

6. Transfers of surplus from a separate account to the general account, and conversely from the general account into a separate account, are discussed.

INTRODUCTION

IN MARCH of this year the author was asked to serve as chairman of the Actuarial Subcommittee on Variable Annuities and Segregated Accounts (a subcommittee of the Joint Actuarial Committee of the Life Insurance Association of America and the American Life Convention). The Subcommittee's function was to make recommendations with respect to those aspects of state regulation of variable annuities considered to be of an actuarial nature. The Actuarial Subcommittee worked closely

with the Industry Advisory Committee that has proposed model regulations which reflect the conclusions discussed in this paper. The focus of the paper is on individual rather than group variable annuities.

THE ASSUMED RATE OF INVESTMENT RETURN (AIR)

The amount of the initial annuity payment under an individual variable annuity contract depends upon assumptions with regard to mortality and the annual rate of investment return. The number of "annuity units" of income is then equal to the initial annuity payment divided by the dollar value of the annuity unit at the commencement of annuity payments. The number of annuity units of income remains constant thereafter during the lifetime of the contract, but the dollar value of the annuity unit will fluctuate, depending upon the relationship to the AIR of the actual net investment return (including dividend income plus realized and unrealized capital gains, less any deduction from investment return permitted by contract to cover investment expense, taxes, mortality risk, or other charges). If, for the valuation period, interest corresponding to the AIR equals i' and the net investment return is at the rate i'', the annuity unit value will change by the factor $(1 + i'')/(1 + i')$ as a result of the investment experience of that period.[1]

The AIR affects only the incidence of annuity payments and not the value of the "expected" payments to be received, if the mortality experienced corresponds to the assumed mortality. A very low AIR will tend to produce sharply increasing annuity unit values (and annuity payments), while a very high AIR will be likely to result in decreasing annuity values (and annuity payments) at times.

Since the AIR affects only the incidence of payments if actual mortality follows the expected mortality, is there any need for regulatory restraints on the AIR? In the absence of any upper limit to the AIR, Company A, issuing a variable annuity with mortality "guaranteed" (i.e., mortality results will not affect annuity payments), could combine an excessively high AIR with an unduly conservative table of mortality and could quote the same first annuity payment for a given amount applied to the purchase of the annuity as that quoted by Company B, which has combined a reasonable AIR with reasonable mortality assumptions. It would take a fairly sophisticated buyer to realize that Company A's rate structure has had built into it provision for substantial mortality gains that will not

[1] As a practical matter, the dollar amount of an annuity payment may be based either on the annuity unit value as of a specified valuation period in advance of the due date or on the average of the annuity unit values over a specified period prior to the due date (the latter to minimize fluctuations in annuity payments).

redound to the benefit of the variable annuitants and that annuity payments after the first payment are likely to be greater in Company B than in Company A. Because of this possibility of abuse, there should be a reasonable upper limit to the AIR in an individual variable annuity.

Companies issuing variable annuities typically will also offer fixed-dollar annuities, and any limit imposed on the AIR should not be such as to create a bias in favor of either form. Many companies now sell fixed-dollar immediate annuities with rates reflecting the current high rate of return on new money invested in fixed-dollar obligations. With this in mind, we can see that under current conditions any upper limit imposed by regulation on the AIR should be of the order of 5 per cent, with provision for a higher AIR with the approval of the commissioner. A maximum AIR lower than 5 per cent would produce a substantially lower first annuity payment under a variable annuity than that under the corresponding fixed-dollar contract. This does not preclude a company's using a lower AIR if it believes that it can successfully market its product on this basis, where there would admittedly be a greater expectation of increased future annuity payments under the contract.

Instead of limiting the net AIR used to determine the initial annuity payment under an individual variable annuity, one might consider the alternative of proposing a maximum limit on the assumed gross investment rate (i.e., before any deductions to cover investment expense, taxes, mortality risk, or other charges). If this were done, two companies using the maximum assumed gross investment rate but using different expense or mortality risk charges would, in effect, be using different net AIR's and provide for different first annuity payments for the same consideration. I do not believe that this would be a proper regulatory result.

No limit should be imposed on the AIR under group annuities, at least where wholly or partly financed with employer money. Employers are generally sophisticated buyers, and therefore there is little need for a limit. Any limit on the AIR which precluded a rate that was desirable to the employer and acceptable to the insurance company could create a strong inducement to employers to invest their pension funds in an uninsured pension trust without such restrictive regulation rather than in the insurance company.

SHOULD THE INSURER BE REQUIRED TO GUARANTEE EXPENSE AND MORTALITY FACTORS?

Where a variable annuity contract includes mortality and expense guarantees, the level of benefits under the contract will be affected only by the investment results of the separate account. Where the mortality and

expense factors are not guaranteed, the level of benefits will also be affected by the future expenses of operation and the actual mortality experience.

If the insurer guarantees that the level of benefits will not be affected by mortality or expense results, it is customary to impose a risk charge, through a deduction from the earnings of the separate account, to establish a contingency fund (which may be part of the surplus of the separate account) to minimize the likelihood of losses from increased longevity or increased expense rates in the future. If the insurer adopts a conservative approach to setting the risk charge in relationship to the mortality guarantees, the risk charges may prove to be redundant as the experience evolves, in which event the variable annuitants would have fared better under a contract with no risk charge and no guarantee as to mortality. Accordingly, companies should be free to offer both types of contracts to the public, leaving it up to the purchaser to decide whether or not he wants to buy a contract under which he pays a price for the guarantee that mortality experience will not affect the level of benefits. If the holder of a variable annuity is willing to accept the ups and downs resulting from fluctuating investment results, he may very well be prepared to accept as well fluctuations due to mortality, if he can thereby avoid the payment of a mortality risk charge.

ASSUMED TABLE OF MORTALITY

Regulatory restraints should be imposed on the table of mortality used by the insurer in computing the first annuity payment under a variable annuity if the insurer does not guarantee that benefit payments will not be adversely affected by mortality experience. As is true in the case of an unduly high AIR, the use of a mortality table with unrealistically high mortality rates is likely to produce disappointing results to the annuitant if the difference between "actual" and "expected" mortality is reflected in his annuity payments. Accordingly, where the insurer offers no mortality guarantee, the assumed table of mortality should be reasonably conservative—for example, the *a*-1949 table (ultimate) or any modification of that table not showing a higher mortality rate at any age—with authority given to the insurance commissioner to approve the use of other mortality tables acceptable to him.

There is, however, no reason for regulating the table of mortality used to compute the first annuity payment if the insurer guarantees that benefit payments will not be adversely affected by mortality experience. Clearly there is no need for regulation on this account to avoid misleading the annuitant. Any concern for the financial solvency of the operation should be handled by appropriate valuation standards.

VALUATION RATE OF INTEREST

It can be demonstrated that the mechanics of operation of a variable annuity are such that the insurer will automatically be complying with the minimum valuation requirements of the statutes if reserves are computed for an annuity with level payments equal to the dollar amount of annuity income at the time of valuation, on the basis of a table of mortality satisfying the valuation law and a rate of interest equal to the AIR.

When we state that reserves for a particular class of contract are to be held on the basis of a specified table of mortality and a specified rate of interest, this means that the reserves held will be sufficient to provide for the *benefits guaranteed by the contract* if the insurer earns interest each year at the specified rate of interest and experiences mortality in accordance with the specified table of mortality.

In the case of an annual variable annuity with an AIR $= i'$, the *benefits guaranteed by the contract*, if the net investment return each year proves to be at the rate of $3\frac{1}{2}$ per cent (the valuation interest rate), will decrease in geometrical progression or increase in geometrical progression, depending upon whether i' is greater or less than $3\frac{1}{2}$ per cent. Each payment will equal $1.035/(1 + i')$ times the preceding payment. The present value at $3\frac{1}{2}$ per cent interest of these decreasing or increasing payments, as the case may be, is exactly equal to the present value at the rate of interest i' of a level annuity under which each payment is equal to the payment currently being made at the time of valuation.

This can be simply demonstrated as follows: Assume that K = annuity payment (in dollars) currently being made at the time of valuation; valuation interest rate $= 0.035 = i$; and AIR $= i'$ (e.g., 0.05). If interest at the valuation rate is earned each year in the future, the annuity payment due one year hence equals $K(1 + i)/(1 + i')$; the annuity payment due two years hence equals $K(1 + i)^2/(1 + i')^2$; etc. Reserve on valuation basis is

$$K\left[\frac{1+i}{1+i'} \cdot v p_x + \frac{(1+i)^2}{(1+i')^2} \cdot v_2^2 p_x + \ldots\right]$$

$$= K[v' p_x + (v')_2^2 px + \ldots] .$$

It follows from the above that the insurer can feel free to use any AIR in determining the first annuity payment under a variable annuity contract without being concerned about the necessity for any strain on surplus arising from the need to comply with the $3\frac{1}{2}$ per cent interest requirement in the valuation laws.

GRACE, REINSTATEMENT, AND NONFORFEITURE PROVISIONS

Variable annuity regulations should recognize that the conventional grace, reinstatement, and nonforfeiture provisions applicable to fixed-dollar individual deferred annuities must be modified if they are to be made applicable to variable annuities. Under grace and reinstatement, it should be made clear that stipulated payments to the insurer made late rather than on the due date will not be used to purchase accumulation units based on the unit value on the due date. The nonforfeiture provisions of those states that prescribe minimum nonforfeiture values for fixed-dollar individual deferred annuities are clearly inapplicable to variable contracts.

The model regulations proposed by the Industry Advisory Committee include the following provisions (for adoption in a particular state if the insurance laws of the state now prescribe grace, reinstatement, and nonforfeiture provisions for a fixed-dollar individual deferred annuity):

No individual variable annuity contract calling for the payment of periodic stipulated payments shall be delivered or issued for delivery in this state unless it contains in substance the following provisions or provisions which in the opinion of the Commissioner are more favorable to the holders of such contracts:

(*a*) a provision that there shall be a period of grace of 30 days or of one month, within which any stipulated payment to the insurer falling due after the first may be made, during which period of grace the contract shall continue in force. The contract may include a statement of the basis for determining the date as of which any such payment received during the period of grace shall be applied to produce the values under the contract arising therefrom;

(*b*) a provision that, at any time within ——— year(s) from the date of default, in making periodic stipulated payments to the insurer during the life of the annuitant and unless the cash surrender value has been paid, the contract may be reinstated upon payment to the insurer of such overdue periodic stipulated payments as required by the contract, and all indebtedness to the insurer on the contract, including interest. The contract may include a statement of the basis for determining the date as of which the amount to cover such overdue stipulated payments and indebtedness shall be applied to produce the values under the contract arising therefrom;

(*c*) a provision specifying the options available in the event of default in a periodic stipulated payment. Such options may include an option to surrender the contract for a cash value as determined by the contract, and shall include an option to receive a paid-up annuity if the contract is not surrendered for cash, the amount of such paid-up annuity being determined by applying the value of the contract at the annuity commencement date in accordance with the terms of the contract.

SURPLUS IN THE SEPARATE ACCOUNT

In the normal operation of a separate account supporting variable annuities, surplus may ultimately emerge from the contractual risk charges made against the investment results of the fund to cover mortality and expense guarantees and from any excess of loading over expense requirements. Surplus may also result from actual mortality during the payout period that is heavier than expected mortality (in the case of a variable annuity with mortality guarantees).

The surplus emerging from the operation of the separate account will be needed principally to help meet the contract obligations if future mortality should be lighter than that expected. Since the extent of this need will increase as the unit values of the separate account increase, the insurer may wish to retain such surplus in the separate account to be invested in assets that will change in value as the unit values of the separate account change. There should be no requirement that surplus in the separate account be transferred to the general account.

There should be restraints on the unwarranted transfer of surplus from the general account into a separate account. The model regulations provide that such transfers may be made only to establish the separate account or to support the operation of the contracts with respect to the separate account to which the transfer is made.

DISCUSSION OF PRECEDING PAPER

JOHN K. BOOTH:

Mr. Walker's paper offers many valuable insights into the problems which must be faced in regulating this new and complex product. I would like to expand on some particular problem areas of variable annuity regulation. The opinions expressed in this discussion are my own and do not necessarily represent the views of the New York State Insurance Department.

Individual variable annuities will be sold primarily to unsophisticated buyers, and, therefore, in order to avoid misrepresentation, such contracts should conform to the buyer's general conception of what a variable annuity is and does. Most buyers will be motivated to purchase a variable annuity as a hedge against inflation and will realize that the variable annuity operates in such a way that the risk they assume is quite similar to the risk of investing in common stocks or mutual funds. This is a type of risk with which buyers are reasonably familiar. On the other hand, if the contract requires the purchaser to assume the mortality risk, the average purchaser is not likely to fully understand the nature of his undertaking. If inflation continues but a medical breakthrough reduces mortality rates so as to more than offset investment gains, his variable annuity will have failed its primary purpose. Insurers are familiar with the mortality risk and will prepare themselves as they see adverse mortality trends develop. Will the individual purchaser of a variable annuity have such foresight?

I feel that, for the protection of the public, insurers should be required to guarantee the assumed expenses and mortality under individual variable annuities. If the risk charge made for these guarantees should prove to be redundant, the situation could be corrected through dividends.

Another area of concern is the initial payment rate under a variable annuity. The Report of the Subcommittee on Variable Annuities and Segregated Accounts of the Joint ALC-LIAA Actuarial Committee contains the following statement: "One of the most difficult concepts to explain, even to otherwise well-informed people in the life insurance business, is how the amount of a variable annuity payment goes up or goes down, after payment begins, to reflect the investment results of the separate account." Faced with this difficulty, it is likely that the level of the initial payment rate, because of its simplicity, will become the

standard for measuring the "cost" of a variable annuity contract, just as the ten- or twenty-year net surrender cost has become the standard for measuring the "cost" of a life insurance policy. As Mr. Walker has shown, however, the initial payment rate can be increased at no cost or risk to the insurer through the use of a high AIR.

Of particular concern is the display in a deferred variable annuity contract of an initial payment rate at retirement based on a high AIR. This will illustrate a much higher initial payment rate at retirement than can be shown in a guaranteed deferred fixed-dollar annuity contract and may mislead the buyer into purchasing the variable contract because he believes it has an inherently lower "cost." Thus the purchaser may be exposed to the vicissitudes of the equity market because of an illustrated future initial payment rate which may itself become inappropriate by the time the purchaser reaches retirement. An individual's choice of a variable annuity or a fixed annuity should be based on his preference for equity or debt investments, not on the apparent advantage of a larger initial payment rate. To avoid misrepresentation, there should be a requirement that variable annuity initial payment rates should be made approximately equal to the corresponding initial payment rates for fixed annuities. It should be noted that such a restriction would not necessarily force the buyer of a deferred variable annuity to take an initial payment at retirement based on the initial payment rate shown in the contract. The purchaser could be given an option at retirement to start either with the contractual initial payment rate or with the initial payment rate used for immediate annuities being issued at that time.

Another interesting question pertains to the level of surplus within the separate account. If experience should indicate that future mortality will be lighter than has been assumed in the rate structure, the increase in the amount of annuity payments t years from now to lives now age x could be represented as

$$\frac{\prod_{s=1}^{t}(1 + i_s'')}{(1 + i')^t}(l''_{x+t} - l'_{x+t}),$$

where

i' = AIR.
i_s'' = Net investment return, including realized and unrealized capital gains.
l'_{x+t} = Assumed number of lives surviving to receive payment at $x + t$.
l''_{x+t} = Revised estimated number of lives surviving to receive payment at $x + t$, based on experience mortality trends.

As we have seen in the paper, the proper amount to be set aside to cover such a mortality loss is equal to $(v')^t(l''_{x+t} - l'_{x+t})$. However, unless this amount is increased each year by a factor of at least $(1 + i''_s)$, additional amounts will have to be drawn from surplus of the general account to fund the annuity payments of year t. Since the separate account is protected from claims of the general account, equity demands that claims of the separate account against the general account should be minimized. Therefore, an experience fluctuation fund to cover possible adverse mortality trends in a rising investment market should be maintained within the separate account. Such a fund could be accumulated from experience gains of the separate account and risk charges. If the separate account earnings rate exceeds that of the general account and at the same time it becomes evident that the separate account rate structure has become inadequate, transfers should be made to the experience fluctuation fund from the general account in order that these amounts set aside from the general surplus will increase in proportion to the additional liabilities. The maximum target for the experience fluctuation fund and its rate of accumulation should be set so as to afford maximum protection to the general surplus of the company and at the same time to avoid the accumulation of excessive surplus in the separate account. There are bound to be considerable differences among various companies in the degree of risk assumed and in their opinions as to what level of surplus satisfies these objectives. Therefore, any regulation on this subject should specify only that a reasonable amount of surplus be accumulated within the separate account rather than set forth any formula for accumulating such surplus. Of course, what is reasonable at one point in time may be quite unreasonable several years later in view of emerging experience; therefore the experience fluctuation fund should be subject to review in the light of changing criteria for reasonableness.

I would like to express my appreciation to Mr. Walker for illuminating this subject. I would also like to thank Mr. Landis, of the New York Insurance Department, with whom I have had a very interesting exchange of ideas on this paper.

ARDIAN C. GILL:

I am glad that Harry Walker presented this paper. Most of us have paid little attention to the regulatory aspects of variable annuities, and we are indebted to Mr. Walker for focusing our attention on this subject.

Most annuity regulations or statutes now on the books deal not at all with variable annuities, or they tend to force them into the mold of the conventional annuity. Mr. Walker's landmark paper causes us to recognize some of the differences between the two. And indeed they are different. I hope that this paper will begin a dialogue among the members that will bring us to a full realization of those differences. Mr. Walker has taken a giant step in that direction. This discussion attempts to inch a little further forward.

A sizable section of the paper deals with the assumed interest return (airily referred to as AIR), and this discussion similarly deals principally with the AIR and secondarily with mortality assumptions.

The Assumed Investment Return (AIR)

Regulation is supposed to be conservative in the public interest. When it comes to interest rates, we tend to correlate conservatism with lowness. The author has, perhaps, startled some people with a suggestion that, "under current conditions," an interest rate of 5 per cent might be assumed, *with provision for a higher rate*, if approved by regulatory authorities.

Why not a low "conservative" rate, such as $3\frac{1}{2}$ per cent, a typical maximum rate in states with variable annuity regulations or statutes? Mr. Walker explains his recommendation by the statement, "Companies issuing variable annuities will typically also offer fixed-dollar annuities, and any limit imposed on the AIR should not be such as to create a bias in favor of either form." I think there are more basic reasons for rejecting a lower limit. These are traceable to the differences between fixed-dollar and variable annuities. The considerations underlying the choice of an interest rate for a fixed-dollar *guaranteed* annuity depend on whether it is immediate or deferred. The interest assumption for a conventional deferred annuity is related to a company's *long-term minimum* portfolio interest rate. The interest assumption for immediate fixed-dollar guaranteed annuities is related to a company's *current* fixed-dollar earnings, with due recognition of long-term yields for rollover and reinvestment of investment income. The AIR for a variable annuity is related to the *long-term average* investment earnings on its common stock fund. What the relationship is depends on what allowance is made for expected changes in the cost of living and, if one chooses, for expected changes in the level of living of the population. Typically, consideration is given only to cost-

of-living changes, which is the assumption in this discussion. There may be other objectives, as will be set forth later. But, whatever the objectives, it is clear that the considerations underlying the choice of an AIR for a variable annuity are different from those underlying the choice of interest assumptions for either a fixed-dollar immediate or deferred annuity. What is proper for fixed-dollar guaranteed annuities may be quite out of place when it comes to designing or regulating variable annuities.

An insurer, or a regulator, may have as an objective in setting a proper variable annuity AIR minimizing the chance of a decline in income from one year to the next. Clearly, the lower the AIR, the better the chance of avoiding this decline. It is interesting to examine just how much better this chance would have been historically for various AIR's. For this purpose, Standard and Poor's Common Stock Price Index has been combined with Moody's Dividend Yields for the period 1929–66 to obtain

Assumed Investment Return (Per Cent)	Years of Declining Income
0	10
1	12
2	12
3	12
4	12
5	14
6	14

hypothetical accumulation unit values. The results, ignoring expense charges, are shown in the accompanying tabulation. The method is not exact, since the list of stocks is not the same, but I do not believe that this has a significant effect.

Thus, viewed retrospectively, it would have been impossible to avoid, through regulation, years of declining income. Further, the choice of an interest rate between the lowest regulatory rate (3 per cent) and the 5 per cent proposed in the paper under discussion would not have significantly affected the chance of avoiding a decline in income. It is a fact of equity life that fluctuations in value tend to be considerably greater than this interval.

Another objective is safety underlying guarantees. An insurer may conclude that the question is independent of the assumed investment return, since the risk of gain or loss from that element has been shifted to the annuitant. This overlooks the fact that, other things being equal, a lower AIR means larger "reserves" in all years after the first and, since the

mortality increment is the product of $1/p_x$ and the reserve before adjustment for survivorship, the mortality risk is actually increased by reason of the lower AIR. This effect on "reserve" levels becomes proportionately higher at the older ages, where there is more uncertainty about annuitants' mortality. (In this connection, the author's suggestion that companies be allowed to retain surplus in the separate account is germane.) Thus, while a low-interest assumption provides safety in a conventional annuity, the same is not true for a variable annuity.

What is the proper AIR to match income with changes in cost levels? Using the consumer price index and the hypothetical accumulation unit value changes referred to earlier, the proper AIR's have been calculated in the accompanying tabulation. These AIR's are such that the income

First Year t	Year $t+n$	AIR
1930	1940	0.9%
	1950	2.9
	1960	6.5
	1966	6.9
1940	1950	5.0
	1960	9.4
	1966	9.3
1950	1960	13.9
	1966	12.0
1960	1966	8.9

in year $t + n$ equals the income in year t adjusted for changes in the consumer price index during the n year interval. It should be noted that these are not average investment-return figures but, rather, investment returns with allowance for CPI changes.

There is little guidance here for the regulator or the insurer. We might conclude from the above that some sort of CPI linkage will be necessary if the variable annuity's objectives are to be achieved. Otherwise the range of our choice is wide. If we limit the comparison to a decade, the proper AIR lies between 0.9 and 13.9 per cent; for a twenty-year interval, between 2.9 and 9.4 per cent; and, for the single 30-year interval, 6.5 per cent. No attempt has been made to be exhaustive but, rather, to illustrate that a "proper" maximum AIR does not exist and that there are many reasonable choices ranging even well above the 5 per cent mentioned in the paper. It would be unfortunate if the regulator were to con-

clude from the low derived rates of the 1930–50 era that a low AIR is in the public interest. As indicated earlier, such is not the case.

If further evidence is needed, the accompanying tabulation may provide it. It compares, for the thirty-seven-year period beginning in 1930, the variable annuity income under an AIR of 3½ per cent versus 5 per cent. The 3½ per cent based income starts at $1,000 per year, while the 5 per cent is the equivalent under the Progressive Annuity Table for a male, aged 65, purchasing a ten-year certain and life annuity.

Income Year	Variable Annuity Income Beginning in 1930		Consumer Price Index (1930=1,000)
	AIR		
	3½ Per Cent	5 Per Cent	
1930..	$1,000	$1,116	1,000
1931..	687	756	911
1932..	386	418	818
1933..	498	532	775
1934..	548	578	801
1935..	592	615	821
1936..	855	875	830
1937..	862	870	859
1938..	658	655	844
1939..	694	681	832
1940..	649	627	838
1945..	969	872	1,077
1950..	1,288	1,078	1,440
1955..	2,973	2,316	1,603
1960..	4,133	2,996	1,771
1966..	6,147	4,087	1,943

It is apparent that neither income schedule fits the consumer price index very well. However, the 5 per cent fixed income weathers the storm of the 30's better by providing more income annually for eight years and more total income for sixteen years. For the next decade annuitants fare better under the lower-interest assumption, if we ignore the value of the earlier income differences, but, again, neither pattern fits too well the pattern of the consumer price index. By the end of the period the few surviving annuitants (now age 101!) are receiving incomes over three times the CPI under the 3½ per cent assumption and over twice the CPI under the 5 per cent assumption. Both results are excessive, but the difference between them illustrates one unfortunate effect of an interest assumption that is too low—that is, it produces an income pattern that bears some

resemblance to a tontine arrangement. Numerous tests have been made with hypothetical AIR's and assumed level earnings ranging between 3 and 10 per cent, with the same pattern emerging *whether the AIR is higher or lower than the assumed earned rate;* that is, (1) the annual income is higher for eight or nine years with a higher AIR; (2) the total income received is higher for fifteen to seventeen years; and (3) if the excess income is reinvested at the assumed earned rate, its value exceeds the lower AIR cumulative income value for up to nineteen years.

On balance, regulations should not seek to mandate a low AIR, since a higher rate better serves the large majority of annuitants and better meets the objective of a variable annuity. I therefore agree with the author's conclusion that AIR's of 5 per cent or more should be permitted but for different reasons—reasons that stem from the different nature of the variable annuity rather than from the idea that starting incomes under conventional and variable annuities should be comparable to avoid "bias." In fact, one can defend the position that the starting incomes under conventional and variable annuities *should* be different, since one is guaranteed while the other entails risk. Thus the considerations of purchase are analogous to those that influence a decision between investment in bonds or in stocks. One may take a risk on his stock investment, hoping for greater gains from it than from a bond.

At another point the author brings out that an excessively high AIR in combination with an unduly conservative mortality table can produce the same starting income as a more soundly conceived combination. From this it is concluded that an upper limit on the AIR is needed in order not to mislead the public. I would think that a direct approach would be preferable here, that is, that the contract should specifically state the AIR and further state that, if the fund does not earn that rate, the income will decline.

Mortality Assumptions

The proper choice of a mortality table for regulatory purposes is also based on different considerations from those that would govern for a conventional annuity. In a conventional annuity there are often interest margins to help offset potential mortality losses. In a variable annuity, with mortality guarantees, the mortality assumption stands more on its own feet, with only accumulated risk charges to help offset losses.

When the insurer does not guarantee mortality, the paper suggests the *a*-49 Ultimate Table, with modifications of that table allowed if the

annuitant meets the test of not having a higher mortality rate at any age. I would suggest an alternate test for this purpose and for the guidance of regulatory authorities in comparing tables with their valuation standards. The test would merely be to compare life expectancies. As pointed out earlier, the lower the AIR, the greater the mortality risk by reason of higher "reserves" after the first year. Life expectancies can be viewed as life annuities with zero interest rates. Thus a comparison of this function would be conservative enough without comparing q_x at every age. While the life-expectancy comparison could be required at every age, it should be sufficient to show that, in the aggregate, the test is met. If this test is used, the profession may, at last, have found some use for the actuarial oddity called the life expectancy.

Throughout this discussion I have placed the word "reserves" in quotation marks, since the "reserve" for a variable annuity is actually the fund on hand for the annuitants.

The author has demonstrated compliance with valuation standards by using the AIR instead of the valuation rate. This is apparent from general reasoning, since the investment risk has been shifted to the annuitant. In the final analysis, the answer to state supervision of the variable annuity assumed investment return lies more in *revelation* than in *regulation*. Companies should be required to state clearly the assumed investment return, but there should be no arbitrary limit on it. We are left with concern for mortality as the only reason for valuation standards. If there were no existing annuity valuation statutes, it might have been better to approach this problem directly through the life-expectancy test suggested earlier; the insurance commissioner could merely insist on a "satisfactory" mortality assumption, whether or not mortality is guaranteed. Faced with existing statutes, the author has done the regulating agencies and the industry a service in showing how they apply to the variable annuity when its peculiarities are taken into account. We are all in his debt for the light this paper sheds on the regulatory aspects of variable annuities. It is devoutly to be wished that the efforts of his group will lead to revision of some statutes or regulations that were placed on the books before as much thought had been given to regulation of the variable annuity.

HOWARD H. HENNINGTON:

This discussion will comment on only one of the important points brought out by Mr. Walker in his interesting paper; that is the point related to a maximum assumed rate of investment return. Mr. Walker sets

up an example whereby Company A might issue a variable annuity with a high assumed rate of investment return combined with a conservative mortality table and Company B might quote the same first annuity payment using a lower assumed rate of investment return and a less conservative mortality table. Mr. Walker suggested that it might take a fairly sophisticated buyer to understand the relative merits of the two offers. I believe that a buyer of a variable annuity should understand how it will vary and should understand the concept of an assumed rate of investment return (sometimes also called the "base rate"). If the buyer understands these matters, he should know the amount of the specified base rate, so that he will know what investment results are needed for the variable annuity payments to go up and what investment results will lead to a reduction in variable annuity payments. I think we should do all we can to make sure that the buyer understands how the payments vary. An illustrative chart can be very helpful in demonstrating the point. Instead of preventing abuse by regulating a maximum AIR, it seems to me that abuse might be prevented by requiring that the insurance company inform the purchaser as to the base rate used and how the payments vary. The specific base rate can be almost as important as the more fundamental distinction between a variable annuity and a fixed annuity.

If an individual is making a choice between a variable annuity and a fixed annuity, it is important that his decision be based on the merits of the respective annuities and the suitability of each in his particular circumstances. When a choice is involved, it is sometimes better for the choice to be made in a setting where the amount of the first annuity payment under the fixed annuity is approximately the same as the amount of the first annuity payment under the variable annuity. If the first annuity payment amounts under the two annuity types are not the same, an individual might often be unduly influenced in the direction of the larger first annuity payment. Some people today may feel complacent if the figures are such that the individual will be influenced toward the fixed annuity instead of the variable annuity, but there should really be no prejudice toward either product in the annuity payments quoted by the insurance company. I think it is desirable for state regulation to permit sufficient flexibility so that a company could use a rate for the variable annuity that produces approximately the same first annuity payment for both products. There should also be sufficient flexibility for product design. The base rate for determining the annuity variation is part of the product design, and a company may want to offer several base rates for use in different circumstances.

MAXIMILIAN WALLACH:*

Mr. Walker's paper deals with problems of concern to the life insurance industry and the regulators on state level. It seems to me that Mr. Walker referred only once to the SEC and even then without mentioning it by name, when he used the term "sophisticated." This term is not a mathematical term; it is not even based on logical reasoning. I would say this term, to a great extent, reflects emotional involvement. Personally, I do not think that actuaries or even lawyers should use this term.

It is, however, through the use of the term "sophisticated" that one arrives at advocating a limit of the AIR for individual annuities but not for group annuities. In addition, Mr. Walker seems to fear that group annuities might go uninsured, if the AIR is limited for groups. He does not mention that, if individuals have no other place to go but to an insurance company, a limit on the AIR becomes justifiable.

Possible abuse is the reason given for the establishment of this principle. However, there is the risk that some could interpret it as a step in the direction of rate regulation. If the states generalize this preventive principle and apply it in some other area, "where it hurts," industry might find itself in a tough spot. Who is to judge how far one is to go before any signs of abuse are even on the horizon? Abuses by companies or agents should be dealt with directly as they occur.

As a practical matter, is it necessary to prescribe the use of a given annuity table as well as the AIR, or is the former sufficient? If the use of a given annuity table is prescribed, and the terms of the variable contract are clearly described, why should it be necessary to limit the AIR? Precise information concerning the role of AIR (limited or not) will show the trend variable annuity payments will have to take—after the first annuity payment is established, the course is set and is *not* arbitrary. What is not known, in advance, is the *experienced* rate of *investment return*, which I like to call EIR ("actual" may be a better term, but it would make the use of initials difficult).

I think we should avoid overstressing "the hedge against inflation in the long-run theory." The AIR could be and should be a useful tool in the design of a variable contract pattern.

I would like to comment on the "Valuation Rate of Interest." If Mr. Walker had assumed a valuation interest rate of $i = 0.04$ (or let us say, 0.03) instead of 0.035, the formula would read exactly the same, namely,

* Mr. Wallach is Actuary of the Department of Insurance, Government of the District of Columbia.

$K \times \ddot{a}_x^{\text{AIR}}$, where K is the annuity payment (in dollars) currently being made. The result would even be the same if "each i" equals "each EIR" for the same respective period of time. (This narrative description is avoiding the use of indices to stay within the terms used by Mr. Walker.) A "washout" occurs in each of the above assumptions. What meaning can then be attached to the 3½ per cent valuation law? I am afraid the answer is "None," except for the case of the New Jersey statute where the AIR is limited to the valuation rate of interest—and even then the results are due to the AIR limit, if used, rather than the valuation rate of interest.

Let us discuss the company's contractual guarantees in order to determine the need, if any, of a statutory valuation rate of interest. In life insurance and fixed annuity contracts the insurer guarantees a rate of interest return. The regulator, for nonforfeiture and reserve purposes, prescribes the use of a maximum rate of interest, currently 3½ per cent (N.Y., 3 per cent); in prior years it was 4 per cent, and in some states in the good old days it was whatever the company had assumed at the time of issue. It is a *long-term experience rate*, or an arbitrary rate declared to be *safe*, depending upon which school of thought you follow. Regardless of what it is, the statute says what it shall be. In the case of variable annuities the contract provides for passing on the net EIR. Consequently there is no need to value the annuity payments, to be made in the future, on a basis other than the EIR. It is safe, it is in accordance with the contract, it meets the separate account concept, and, last but not least, it is practical.

Mr. Walker seems to recommend that we use 3½ per cent in the 3½ per cent states, 3 per cent in the 3 per cent states, and so forth. On this basis a company, licensed in several states, complies automatically with any and all laws. I would prefer an explanation based on "each i" equals "each EIR." Now, how about K? The K's of the future are unknown but predetermined, being a function of $(1 + \text{EIR})/(1 + \text{AIR})$. How about the known K, which equals the annuity payment (in dollars) *currently* being made at the time of valuation? It is a function of the first payment times the respective ratios $(1 + \text{EIR})/(1 + \text{AIR})$ for each period of the past, which are all known; it is not a function of the valuation rate of interest.

The question not as yet answered is whether we can read this into the existing state laws or whether these laws must be amended. For the sake of clarity and better understanding of the underlying principle, the laws should be rewritten, if for no other reason than to nail down the concept and to avoid "fluctuations" in the interpretation of current laws.

One more thought about the AIR. A literal interpretation of the limit imposed on the AIR may not accomplish the objective. For instance, the present value of future level annuity payments based on an interest rate which equals the maximum permitted AIR can be equated with the present value of a series of future annuity payments where the first payment is higher than the level payments and the subsequent payments decrease uniformly.

If h, an assumed interest rate, is higher than the maximum AIR, annuity payments meeting the above requirement would be as follows:

$$\text{First payment} = \ddot{a}_x^{\text{AIR}}/\ddot{a}_x^{h};$$

$$\text{Second payment} = \text{first payment} \times (1 + \text{AIR})/(1 + h);$$

$$t\text{th payment} = (t-1)\text{th payment} \times (1 + \text{AIR})/(1 + h).$$

A company could offer a basic, decreasing annuity within the limit imposed on the AIR but having a higher first payment. This would be within the letter of the model regulation if not within the spirit. Subsequent payments would decrease if each EIR were less than h, would be level if each EIR equaled h, and would increase if each EIR were greater than h. In case of variations in the EIR's the same would hold true in relation to the immediately preceding payment—the pattern would be one of an aggravated "zigzag" line.

While it may not seem so, I have tried to be brief in my comments, which is the reason for selecting only two paragraphs of Mr. Walker's paper.

Mr. Walker's great contribution will be of even greater importance with a widespread discussion here and in local actuarial clubs. It certainly will create an awareness of actuarial problems peculiar to variable annuities.

DONALD D. CODY:

It has been my pleasure to work with Harry Walker on the Joint Actuarial Subcommittee on Variable Annuities and Segregated Accounts, and I commend Mr. Walker and my fellow committee members for the carefully developed Committee Report, which is reflected in Mr. Walker's paper.

At New England Life we have developed the actuarial mathematics behind the mechanics of variable annuity contracts, the underlying separate accounts, and the associated accounting procedure as an aid to making basic decisions. Strangely, this actuarial mathematics is un-

available in any useful form in the literature. I thought, therefore, that our simplified outline of the actuarial mathematics would be helpful not only for a fuller appreciation of Mr. Walker's paper but also for students and for companies involved in the layout of complete variable annuity systems. The mathematics is almost trivial, but the basic concepts are deceptive and complex.

Without intent to share blame, I am grateful for suggestions made by Tom Mitchell, F.S.A., an associate of Mr. Walker's, and by my New England Life associates, Harold Ingraham, F.S.A., and Larry Ehrhart, A.S.A.

ACTUARIAL MECHANICS OF THE VARIABLE ANNUITY AND THE SUPPORTING SEPARATE ACCOUNT

This illustrative analysis is developed for a variable annuity portfolio involving registration of the separate account under the Investment Company Act of 1940 and the use of prospectuses according to the Securities Act of 1933.

I. *Assets of the Separate Account*

n = Duration in valuation periods (12 months per year, or 53 weekly periods per year, or daily for days when the New York Stock Exchange and the company are open).

A_n = Assets (in dollars) at market value on valuation date at end of valuation period.

N_n = Number of investment units in force at n.

u_n = Investment unit value (IUV) in dollars at n, assumed to be determined at the end of the valuation period for all assets in the account.

u_0 = \$1.0000 for $n = 0$, at date separate account becomes effective.

P_n = Stipulated payments (in dollars) made between $n - 1$ and n.

C_n = Net value of P_n after deduction of charges for sales and administration and premium taxes (expenses of principal underwriter—salaries; rent; postage; telephone; travel; legal, actuarial, accounting, and office expenses; and premium taxes; but *not* capital gains taxes and other taxes based on income, assets, or existence of assets behind separate account; auditing expenses for such assets; expenses of board of managers; or fees for mortality and expense guarantees and for investment management and advisory services). This charge is typically broken into sales charges, administration charges, and premium tax charges, and may be higher in the first year of contract, lower for ten years, and still lower in years 12 and later. C_n buys investment units at duration n.

B_n^i = Benefits (in dollars) becoming payable between $n-1$ and n. With each benefit is associated a number of canceled investment units: N_n^i computed, for example, as follows, where $i = ', ''$, etc.:

1. Aggregate death or redemption benefits valued at duration n:

$$N_n' = \frac{B_n'}{u_n}.$$

(Where B_n' in the variable annuity accumulation period is not the net asset value contractually, N_n' must be taken as the actual investment units canceled.)

2. Aggregate annuity payments, valued at duration $n-a$, where a might be established as not more than four weeks for a valuation period of a week:

$$N_n'' = \frac{B_n''}{u_{n-a}}.$$

(Another method would be to define u_{n-a} as the average IUV during the second month preceding the month of payment.)

The basic reconciliation equation in the accounting of investment units of the separate account is as follows in idealized form:

$$N_n = N_{n-1} + \frac{C_n}{u_n} - \frac{B_n'}{u_n} - \frac{B_n''}{u_{n-a}};$$

$$u_n N_n = \frac{u_n}{u_{n-1}}(N_{n-1}u_{n-1}) + C_n - B_n' - B_n''\frac{u_n}{u_{n-a}}.$$

Since $u_n N_n = A_n$,

$$A_n = \frac{u_n}{u_{n-1}} A_{n-1} + C_n - B_n' - B_n''\frac{u_n}{u_{n-a}}.$$

Hence

$$\frac{u_n}{u_{n-1}} = \frac{A_n - C_n + B_n' + B_n''(u_n/u_{n-a})}{A_{n-1}},$$

which is the theoretical investment unit value change factor. As shown below, the actual IUV change factor assumes that a equals zero, so that the contingency charges are required to absorb this discrepancy along with other discrepancies arising from delays in entering income and disbursement items in the accounts.

II. *Variable Annuity Investment Fund and Surplus*

In variable annuity contracts, the basic separate account mechanism involves an investment unit value change factor u_n/u_{n-1}, which is the above with u_{n-a} taken as u_n. The resultant gain or loss is absorbed in the contingency charges made against the investment income credited to the

separate account. Following is the description of the typical contractual formula:

$$A_n = A_{n-1} + C_n - B_n' - B_n''$$

$+ I_n$ (investment income)

$- E_n'$ (investment expenses other than E_n'')

$- E_n''$ (investment management fees)

$+ G_n'$ (realized capital gains [or losses])

$+ G_n''$ (unrealized capital gains [or losses])

$- E_n'''$ (expense of fund accounting)

$- E_n''''$ (expenses of board of managers)

$- F_n'$ (FIT and other taxes on realized capital gains)

$- F_n''$ (FIT and other taxes on investment income and fund assets)

$- P_n'$ (contingency charges for mortality risk)

$- P_n''$ (contingency charges for expense guarantee)

$- P_n'''$ (profit charges)

(all for valuation period between $n-1$ and n).

Rearranging, we obtain the contractual IUV change factor

$$\frac{A_n - C_n + B_n' + B_n''}{A_{n-1}} = 1 + \frac{I_n - E_n'}{A_{n-1}} + \frac{G_n' + G_n''}{A_{n-1}} - \frac{E_n'' + E_n''' + E_n''''}{A_{n-1}} - \frac{F_n' + F_n''}{A_{n-1}} - \frac{P_n' + P_n'' + P_n'''}{A_{n-1}}.$$

This change factor differs slightly from the theoretically correct one as described in Section I above, and the effect of the differences is covered by the contingency charges (P).

The term

$$\frac{I_n - E_n'}{A_{n-1}} + \frac{G_n' + G_n''}{A_{n-1}}$$

is defined as the gross investment rate in the contract.

The E, F, and P terms can be handled differently to adjust the gross investment rate to an adjusted gross investment rate and to a net investment rate. The most general handling involves the use of a single separate account to underlie all classes of contracts with different unit value tables

for different policy classes. These tables would trace the development of the IUV for each policy class by establishing an adjusted gross investment rate which is common to all policy classes and applying E, F, and P terms appropriate to each different policy class to establish a net investment rate peculiar to each class. Reconciliation to the whole separate account would be made by unit share accounting for each policy class using the IUV for each such policy class. Obviously, the sum of the products of number of unit shares and the IUV must equal the assets of the separate account at the end of each valuation period, as described later.

As an illustration, the gross investment rate might be adjusted to an adjusted gross investment rate by deduction of the following items common to all classes of policy:

$$\frac{E_n'' + E_n''' + E_n'''' + F_n''}{A_{n-1}}.$$

$E_n'' + E_n'''$ are usually contractually limited at most to 0.5 per cent of A_{n-1}. Usually E_n'''' and F_n'' are not limited.

Finally, the net investment rate would be defined as the adjusted gross income rate minus items peculiar to each class of policy, where A_{n-1}^i and $(P)^i$ are the assets and contingency charges applicable to policy class:

$\frac{F_n'}{A_{n-1}^i}$ = Capital gains tax which may vary, as between qualified and nonqualified plans—no maximum.

$\frac{(P_n' + P_n'' + P_n''')^i}{A_{n-1}^i}$ = Contingency charges which may differ, as between classes of deferred and immediate annuities, mortality guarantees, etc. The maximum value would vary by policy class, ranging from perhaps 0.5 to 1.25 per cent per year.

$\frac{F_n''}{A_n}$ = Any taxes other than capital gains tax—probably the same for all classes—no maximum.

Policy classes, for example, might be individual tax-sheltered annuities, group tax-sheltered annuities, individual H.R. 10 annuities, nonexempt pension trust corporate plans, and unqualified immediate annuities.

The separate account (registered investment company) supporting the various classes of variable annuity would also have an associated surplus account. This surplus account would be established with seed money and would be debited or credited with gains or losses from the operation of the separate account. This account is part of company surplus funds and would be invested in a pro rata cross-section of the separate account and surplus account as a whole.

It is possible to determine u_n for each contract classification by the formula of the contract. However, N_n for each policy classification must be determined on an approximate basis except at year end or at, say, quarterly intervals. This is because actuarial liabilities will be determined only at year end or at quarter end. Such N_n for each contract classification can be approximately determined as follows at intermediate valuation dates:

$$N_n = N_{n-1} + \frac{C_n - B_n' - B_n''}{u_n}.$$

(The system alternatively might derive the number of investment units paid out during the annuity payment period by direct calculation from the annuity units paid out by use of formulas in Section III.)

At year or quarter end, a corrected N_n' can be calculated as follows for each contract classification:

$$N_n' = \frac{L_n}{u_n},$$

where $L_n = \Sigma$ (u_n multiplied by deferred annuity investment units) + $\Sigma\, K_t\, \ddot{a}_{x+t}$, the sums being over all contracts. (See Section III for second term.) This will involve a credit to surplus of a mortality gain in dollar amount $N_n u_n - L_n$ at year or quarter end for each contract classification. Through the year or quarter, $N_n\, u_n = A_n$ for each contract classification is a reasonable approximation to the correct A_n.

There may also be dollar transfers between contract classifications, such as at retirement between the classification for deferred annuities and one for annuities being paid. Canceled units in the first classification are converted to dollars, using the appropriate IUV, and the dollars are then converted into units in the second classification, using its IUV.

All sales, administration, premium tax, expense, and contingency charges are credited to surplus, and actual expenses and taxes are debited to surplus through the usual income and expense accounts.

III. *Payout Period*

(Annuities other than life annuities are consistently developed.)

The convention of an immediate variable annuity due, payable monthly, is that, in terms of investment units, for each unit paid out in the first month, V^{t-1} units are paid out in the tth month, where $V = 1/(1 + i)$ and i is effective monthly assumed investment return (AIR), usually between 3.0 and 6.0 per cent per annum. The present value of a variable life annuity due in investment units is thus

$$\ddot{a}_x = \sum_{t=0}^{\infty} {}_tp_x \cdot V^t,$$

where the income in the first month is one investment unit and ${}_tp_x$ is in monthly intervals.

Variable annuity contracts provide that C dollars of net stipulated payment will provide $K_0 = C/\ddot{a}_x$ dollars in the first month. They also define an annuity unit in terms of the valuation period (assumed here to be one month; see Sections I and II) with an annuity unit value of $(au)_n = (u_{n-a}/u_0)\, V^{n-a}$ in dollars. The annuity unit value change factor is $(au)_n/(au)_{n-1} = (u_{n-a}/u_{n-a-1})\, V = V$ times IUV change factor for duration $n - a$.

The value of $(au)_0 = \$1.0000$ is established at the effective date of the separate account. Historical records of $(au)_n$ corresponding to 100 $(au)_0$ are tabulated in the prospectus.

Variable annuity contracts provide, for an annuity purchased in interval n, that the monthly annuity payment in annuity units is determined as $K_0/(au)_n$, and this stays constant during the lifetime of the annuitant.

Then the dollar annuity payment in the tth month subsequent to issue of the annuity is defined as

$$\frac{K_0}{(au)_n}\,(au)_{n+t-1}\,.$$

This reduces to

$$\frac{K_0}{u_{n-a}}\,u_{n-a+t-1}\cdot V^{t-1} = K_{t-1}$$

in dollars, where

$$K_{t-1} = \text{Annuity payment in dollars in } t\text{th month};$$

$$\frac{K_0}{u_{n-a}} = \text{Investment units payable in the first month};$$

$$\frac{K_0}{u_{n-a}}\,V^{t-1} = \text{Investment units payable in the } t\text{th month}.$$

This is in accordance with the convention stipulated in the first paragraph of this section. The term $u_{n-a+t-1}$ translates the investment units into dollars at valuation period duration $n - a + t - 1$. The last formula can be used to derive the number of investment units paid out each month directly from the number of annuity units paid out.

It is notable that the valuation reserve in investment units at duration $t - 1$ is

$$\frac{K_0}{u_{n-a}}\,V^{t-1}\sum_{s=0}^{\infty}{}_sp_{x+t-1}\cdot V^s$$

$$= \frac{K_0}{u_{n-a}}\,V^{t-1}\,\ddot{a}_{x+t-1}\,.$$

In dollars, this becomes

$$\frac{K_0 V^{t-1}}{u_{n-a}} u_{n-a+t-1} \ddot{a}_{x+t-1} = K_{t-1} \ddot{a}_{x+t-1} .$$

In other words, only the current (t) month's dollar payment and the AIR are involved, as is proved by Mr. Walker in his paper.

There are federal and state laws and regulations imposing constraints on the free choice of AIR and mortality table. An AIR of 3.5 per cent is desirable to accomplish the inflation-offset objectives, but unfortunately an AIR of 5 per cent is probably needed to sell this product in competition with fixed-dollar annuities in some circumstances. A free choice to permit the annuitant to select an AIR between 3.5 and 5 per cent in a contract is desirable. This might involve various sets of annuity unit values, such as at 3.5 and 5 per cent in the prospectus.

Mr. Walker points out in his paper that an overconservative mortality table combined with a high assumed investment return is misleading because of the inherent profits hidden in the conservative mortality table. I would suggest additionally that the use of an overliberal mortality table with a low assumed investment return and a very high risk charge is equally misleading. Either technique presents a purchase rate which, on the face of things, is quite attractive but can hide large profit margins. I suggest that in the deferred variable annuity there is no substitute for a precisely appropriate mortality table with realistic projections for mortality improvement built in.

CHARLES B. BAUGHMAN:

There will be much opposition to the limit of 5 per cent for the AIR recommended by the subcommittee. There is a strong feeling in our business that we should be free to provide any AIR which fits the needs, demands, and philosophies of the various companies and their prospective individual annuitants.

Let me point out a serious problem which would arise if there were no limit. Some companies would offer annuities with an AIR much higher than others for the purpose of appearing to have excellent rates when the actuarial equivalent of benefits would be relatively low. The 5 per cent limit is an effective way of forcing additional disclosure inuring to the benefit of our nonactuarially trained public.

Nevertheless, a company desiring to offer an annuity rate with the first monthly payment based on a higher AIR can do so by offering a "decreasing" variable annuity. For example, if an AIR of 6 per cent were

desired, an AIR of 5 per cent could be used with the number of annuity units decreasing at an effective annual rate of 0.9433 per cent, this per cent being one minus the quotient of 1.05 and 1.06. The same theory developed by Mr. Walker in showing that the valuation rate of $3\frac{1}{2}$ per cent is equal to guaranteed benefits at the AIR will also show that the payments on the "decreasing" annuity at an AIR of 5 per cent are equal at all times to the payments on a comparable "level" annuity at an AIR of 6 per cent.

CONRAD M. SIEGEL:

Mr. Walker has prepared a very interesting paper. I was particularly interested in the section involving the guarantee of expense and mortality rates and the charge therefor. I am somewhat doubtful that an individual purchaser will be permitted to choose, within the same insurance company, from two alternate types of variable annuities—one with expense and mortality rates guaranteed with a charge therefor and one without such guarantees and charges.

Most of the contracts which I have seen to date do provide for guarantees of expense and mortality rates and do involve charges therefor. In order to evaluate, in a very rough fashion, the level of adverse experience that can be provided for by a typical charge, I did some calculations. I took a deferred level premium annuity, issued at age 40 to a male retiring at age 65. The death benefit before retirement was the accumulation, and the annuity was payable for life. The loading for sales and administrative expenses approximated 5 per cent of premium. The investment management charge was approximately one-third of 1 per cent of assets annually, and the charge for guarantees was approximately 1 per cent of assets annually. I assumed that the gross rate of return was exactly equal to the assumed investment result plus $1\frac{1}{3}$ per cent. My calculations indicated that the 1 per cent charge for the guarantee of mortality and expense rates was equivalent in value to any one of the following three items:

1. An amount sufficient to provide for an age setback of ten years, which, in some quarters, is equivalent to two and one-half centuries of mortality improvement (*TSA*, II, 279).
2. An amount sufficient to provide for additional sales and administrative expense charges of 3 times the guaranteed charges.
3. An amount sufficient to provide for additional investment management charges of 3 times the basic charge.

Since these charges for mortality and expense guarantees appear to be essentially nonparticipating, I would pose the following questions:

Should state regulation be concerned with the size of these charges and their description? Should the charge be labeled "Provision for profits in excess of losses on mortality and expense guarantees"?

CHARLES T. P. GALLOWAY:

The company with which I am associated has had in effect for about seven years an arrangement with a mutual fund under the terms of which the owners of the mutual fund shares can assign them to a trust fund from which they will receive a variable annuity payout. A guarantee of the annuity mortality and the expenses associated with the monthly payments is provided by the contract with the insurance company. The AIR for this arrangement was chosen so that, on certain assumptions as to the growth rate in the mutual fund and increases in the cost of living, the variable annuity would grow at a sufficient rate to cover the increases in the cost of living.

Under current conditions, when rapid increases in the cost of living are taking place and a variable annuity would seem to be a very logical form of retirement income, the salesmen for the plan have run into considerable buyer resistance because the high rates of interest being assumed in regular guaranteed-dollar immediate annuity calculations cause the initial payments to be considerably higher than those under the variable annuity. It seems that an individual retiring is very reluctant to accept the prospect of a lower income during the first ten or fifteen years of his retirement in order to have a hedge against inflation. This view may, or may not, be logical and it may, or may not, be possible to deal with it by selling some form of "decreasing" variable annuity, but in any event it suggests that it may not be possible to select an AIR which will meet Mr. Walker's other objectives without creating a bias in favor of fixed-dollar annuities, simply because the purchaser may attach considerably more importance to the early years of retirement relative to the late than an actuarial calculation does.

PETER L. HUTCHINGS:

I would like to make three small points about this thought-provoking paper. First of all, there is one phrase in Mr. Walker's paper that confuses me a bit; that phrase is "indebtedness including interest." It seems to me that a premium loan feature is inappropriate for a variable annuity. If you loan a man premiums to buy units, you have in effect a margin account. I doubt if this is what we have in mind for a variable annuity. There are also obvious legal problems.

Second, holding surplus in the separate account can be shown to com-

pletely insulate the company from the compounding of the mortality risk that results from investment success (EIR bigger than AIR), since this surplus grows at exactly the same rate as this risk. This little fact brings out the advantages of starting a variable annuity operation with some transferred surplus.

Third, the ultimate success of the variable annuity program for the contractholder will be almost entirely in the hands of the investment department. A modest improvement in performance will dwarf different mortality bases in its effect on the payments under the contract; we might well take it upon ourselves to start worrying about performance analysis and investment objectives as well as conventional actuarial concerns.

PAULETTE TINO:

Mr. Harry Walker makes these two points concerning variable annuities: (1) The AIR affects only the incidence of annuity payments but not the value of the expected payments to be received. (2) The reserve at any point is independent of the valuation rate of interest.

The extension of those points to equity plans involving active and retired lives leads to the following conclusions.

1. The equity plan benefits are influenced only by the amount of contributions required and the performance of the fund subject to adjustments for mortality experience. In other words, taken in the aggregate, a rich benefit formula valued on a high AIR is no better than a poor benefit formula valued on a low AIR, provided both lead to the same contributions invested in funds with the same returns. The benefits computed using the formula, coupled with the deferred annuity factors based on the AIR, provide the appropriate means to allocate the contributions among the employees. From this it follows that, for a given employee, the accumulated reserves at retirement under the two plans will be different. The difference will be more pronounced for the groups of very young and very old employees at the start of the plan with a switch in the most favorable plan when passing from one group to another.

2. When an equity plan is started, the valuation rate of interest is the AIR. The application of Mr. Walker's demonstration to deferred annuities shows clearly that a change in the valuation rate of interest—a request occasionally encountered by actuaries of equity plans—does not alter in any way the required reserves at any point of time for the units accumulated at the time of change.

Benefit on valuation date = $\$K$.

AIR = i'.

Valuation rate of interest = Theoretical rate of future returns = i.

$$\text{PV of benefits} = K \times \left(\frac{1+i}{1+i'}\right)^{65-x} \times v_i^{65-x} \times {}_{65-x}p_x$$

$$\times \left[1 + \frac{1+i}{1+i'} v_i p_{65} + \left(\frac{1+i}{1+i'}\right)^2 v_i^2 {}_2p_{65} + \ldots\right]$$

$$= K \times v_{i'}^{65-x} \times {}_{65-x}p_x \times \ddot{a}_{65}^{i'}$$

$$= \text{Reserve held on the original basis.}$$

If the change in valuation rate of interest is nevertheless required, the actuary may operate in one of two ways:

a) Carry the valuation in future years with two sets of benefits—one updated and valued on the basis of the old AIR, the other updated and valued on the basis of the new AIR. This procedure is cumbersome, since it requires two benefit records per employee, depending on the underlying AIR.

b) The difficulty in *a* may be obviated by adjusting the old units by the ratio of the old to the new deferred annuity rates at each attained age. From there on, past and future benefits will be updated and valued on the basis of the new AIR.

(AUTHOR'S REVIEW OF DISCUSSION)

HARRY WALKER:

In his discussion Mr. Booth has expressed the view that a mortality guarantee should be required in a variable annuity and has suggested that the situation could be corrected through dividends if the risk charges are redundant. It will, however, take many years before it can be determined from experience whether or not the risk charges are redundant, and accordingly any correction through dividends would redound to the advantage of the surviving annuitants rather than to those who have died and for whom the annuity has been most costly. Accordingly, the nonguarantee of mortality may prove to be less costly to variable annuitants than a contract with mortality guarantees.

I disagree with Mr. Booth in his view that under a deferred variable annuity the company should be required to provide for an initial payment at retirement that would be approximately the same under the variable annuity option as under the fixed annuity option. There are advantages in showing the same initial payment under the two options, primarily from the standpoint of contract simplicity, but I believe this should be permissive rather than required. Under a deferred annuity a company will necessarily use a conservative interest assumption for the

fixed annuity, with provision for excess-interest dividends under the option. The company should not be required to use the same low interest assumption for the variable annuity option, which involves no investment risk. Furthermore, a low interest assumption under the fixed annuity with excess-interest dividends will tend to produce decreasing payments, while a low AIR under the variable annuity option will tend to produce increasing payments and the resulting tontine effect.

Mr. Booth has suggested that the deferred variable annuitant, dissatisfied with the low initial payment due to a low AIR, has an adequate remedy if he is permitted to substitute the variable immediate annuity rate current at the time of settlement, where such rate is based on a higher AIR. Through such a substitution, however, the annuitant could lose the benefit of the original mortality guarantee for which he paid a risk charge.

I was pleased to note Mr. Booth's endorsement of the proposal made in the paper that surplus be maintained in the separate account for mortality fluctuation. I was also pleased with his thought that regulations should not prescribe any rigid formula for such separate account surplus.

Mr. Gill has made a valuable contribution in pointing out that there are reasons for permitting flexibility in the AIR that are perhaps more basic than my suggestion that companies be permitted to provide for an initial payment under a variable annuity that is not too far out of line with that under a fixed-dollar annuity. I agree with Mr. Gill's observation that the possible tontine effect of a low AIR tends to penalize unduly the annuitant who dies early, who in any event will have lost by the purchase of an annuity.

I disagree with Mr. Gill's suggestion, also made by Messrs. Hennington and Wallach, that, in lieu of imposing a maximum AIR, the public could be adequately protected by requiring the contract to state specifically what the AIR is and how the income will decrease if the fund does not earn that rate. A variable annuity contract is very complex, and in my view the public needs more protection than is implied by Mr. Gill's comment.

I have no quarrel with Mr. Gill's suggestion that life expectancies rather than individual q_x's be used as a measure of the adequacy of a mortality table, where the insurer does not guarantee mortality under a variable annuity.

I agree with Mr. Cody's observation that a low AIR and an overliberal mortality table combined with a very high risk charge can be just as misleading as a high AIR combined with an overconservative mortality table. I was pleased to find that Mr. Cody had decided to use the

vehicle of a discussion of my paper to have some of the mathematics of variable annuities published in the *Transactions*.

Both Mr. Baughman and Mr. Wallach have made the point that the maximum AIR prescribed in the regulations can be circumvented by offering a decreasing annuity which would, in effect, provide the same income as that provided under a conventional variable annuity with a higher AIR. I would not consider this a practical approach to circumventing the maximum AIR prescribed by regulation, as the contract would have to indicate quite clearly that the payments would decrease if the net investment return were to equal the AIR and that a higher return than the AIR would be needed to maintain level payments.

Mr. Wallach states that "the AIR could be, and should be, a useful tool in the design of a variable contract pattern." I subscribe wholeheartedly to this statement, and I would urge that companies be allowed wide latitude in selecting the AIR. It is a matter of product design. I agree, too, with Mr. Wallach's thought that we should avoid overstressing the "hedge against inflation in the long-run theory."

Mr. Wallach points out that the valuation rate of interest is in a sense meaningless for variable annuities, and this is true. However, in my paper I intentionally demonstrated that, regardless of the AIR, the insurer will comply with the valuation law if a satisfactory table of mortality is used. While the result should be obvious from general reasoning, I thought it would be well to prove the point mathematically to eliminate any question as to compliance with the standard valuation law.

Mr. Siegel has compared a typical charge for mortality and expense rate guarantees under individual deferred variable annuities with the cost of providing for possible mortality improvement in the future. There are many other risks to be covered by the charge for guarantees and factors other than mortality improvement that may influence the adequacy of the charge.

The margins for contingencies are quite different under variable deferred annuities than under fixed-dollar deferred annuities. On a fixed annuity there is usually an ample interest margin which can be used, if necessary, to help pay for mortality losses or unanticipated increase in expenses. Under the variable annuity there is no interest margin, and in most instances there are expense guarantees as well as mortality guarantees.

The lack of the interest margin is one factor in determining the size of the risk charge. A second factor under some contracts is the existence of a return of premium death benefit, which creates an additional mortality and investment risk. The third factor is the level of mortality guarantees

under the contract. A company with liberal mortality guarantees might be inclined to levy a higher risk charge than a company which offered conservative guarantees.

Mr. Siegel has not, in my view, given adequate emphasis to the risk of increased expenses and the need to cover in the charge against the fund the cost of administering annuity payments after retirement and the expense of setting up the annuity at retirement. This effectively comes out of the risk charge. There is also the risk that investment management expenses may exceed the charge for investment expenses. Furthermore, the excess of initial expenses and first-year sales commissions over the first-year loading will probably have to be recovered in part through the charges against the fund in the early years of the contract. In this connection, on contracts which terminate in the early years after issue, there may be a substantial loss to the insurer. This could radically reduce the actual surplus emerging from a class of individual variable annuities. Finally, there is the obvious expense risk of future inflation and the risk that the burden of multiple regulation of variable annuities may create heavy unanticipated expenses.

Mr. Siegel in his calculation has assumed a twenty-five-year period to retirement. In many cases there will be a far shorter period to retirement, and in many other cases the contract will terminate by death or surrender far short of the twenty-five-year period. This would reduce the surplus generated under a class of contracts.

I wonder whether Mr. Siegel, in his computation, has taken account of the fact that the federal income tax treatment (including treatment of capital gains) is quite different for earnings on the surplus in the separate account than for earnings on the assets equal to reserve liabilities. This could materially affect his conclusion that the 1 per cent risk charge "is equivalent to two and one-half centuries of mortality improvement." In any event, the number of years of mortality improvement covered by the risk charge depends on one's view of what rate of mortality improvement can possibly be achieved in the future.

In conclusion, the risk charge is influenced by many factors which may vary from company to company, and the level at which the risk charge is set necessarily involves a high degree of judgment.