TRANSACTIONS OF SOCIETY OF ACTUARIES
1983 VOL. 35

SEGMENTATION OF INSURANCE COMPANY GENERAL ACCOUNTS

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ABSTRACT

This paper describes a major refinement in methods of allocating general account investment income among lines of business, termed "segmentation." In a narrow sense, this is one more step in the evolution of the investment-year method; in a broader sense, segmentation provides the opportunity for major modifications in the structure and management of insurance company general accounts. The paper gives a detailed description of the segmentation plan recently adopted by the authors' company, then discusses the implications of segmentation for a company's ability to manage its asset and liability cash flows, for the design of insurance and pension products, for the design of investment strategies, and for the valuation of liabilities.

INTRODUCTION

Recently, our company, the Equitable Life Assurance Society, a multiline mutual insurance company domiciled in New York, embarked on a major modification in structure and management of its general account, which we have termed "segmentation." A number of other companies have modified their general account operations in ways that are similar in concept to our form of segmentation but different in detail. This is only one of a number of approaches by which company managements can gain a better understanding of their asset and liability relationships and address imbalances that may exist between their assets and liabilities.

Segmentation, for the purpose of this paper, is subdivision of an insurance company's general account operations into "segments," each segment derived from a specific grouping of insurance or pension products, each with an identifiable portfolio of investments tailored to meet the needs of the products included in the segment. All investment results of a segment's portfolio, including net investment income, principal repayments, and capital gains and losses, are allocated to the segment. Traditional investment-year methods are still used for allocations among statutory lines of business included within a segment, and to classes of policies or individual client funds within a line of business.

This maintenance of identifiable investment portfolios for segments of the general account is solely for the purpose of allocating investment results among the segments. The general account continues to operate as a single pool of assets, all assets owned by the general account as a whole, and all assets continuing to stand behind all general account obligations. In this respect, "segmentation" does not constitute a "segregation" of assets in the sense of a separate account, subsidiary, or separate company whose assets may not be available to assure the solvency of the company or enterprise as a whole.

In a narrow sense, segmentation can be viewed as merely a further refinement in methods of allocating investment income among lines of business and as one more step in the evolution of the investment-year method. In a broader sense, segmentation enables a life insurance company to invest its cash flow in ways that directly recognize the differing investment needs of the different kinds of insurance and pension products included in its general account, affording the opportunity to match better the company's assets and liabilities.

In the broadest sense, segmentation opens the door to a new way to manage a life insurance company—matching the design, pricing, and administration of its insurance and pension products (and the investment of the assets created thereby) to the realities of the present and expected future environment, with its volatile economic and financial conditions and the insurance, pension, and investment marketplace they create.

This paper opens with a review of traditional methods for the allocation of investment income, with particular emphasis on investment-year methods, and considerations that have led insurance companies toward segmentation. This is followed by a detailed description of the segmentation plan adopted by our company and the problems of implementing such a plan, including implications for the company's investment organization and how it relates to the management of the company's various product lines. We then turn to the broader implications of segmentation in terms of a company's ability to manage its asset and liability cash flows and the relationship between the two, including the design of insurance and pension products that comport with the realities of investments available to support the products, the design of investment strategies to meet the needs of the insurance and pension products, and implications for the valuation of liabilities.

While this paper is concerned solely with segmentation of insurance company general accounts, we note in passing that many of the concerns leading insurance company managements to consider segmentation also apply to the management of pension plans, particularly pension plans with multiple groupings of benefits having different cash-flow patterns. Here, segmentation may serve to facilitate an improved matching of the plan's assets with the liabilities for the different groupings of benefits.

TRADITIONAL METHODS FOR INVESTMENT INCOME ALLOCATION

Before 1961, assets of life insurance companies were mostly in general accounts with assets supporting individual life, health, and annuities pooled with assets supporting group insurance and group pensions. Insurance companies were required under state laws and regulations, especially regulations of the New York Insurance Department, to use what amounted to portfolio interest rates based on book value for allocating the investment results from this pool of assets among lines of business and for allocations to dividend classes or individual client pension funds within a line of business. Under the portfolio method, each general account investment was, in effect, shared by each line of business, and by each pension client, in proportion to the line or client's share of the total general account assets, or in proportion to mean reserves. The portfolio method was easy to understand and simple to administer but did not permit a company to credit current interest rates on current increments to cash flow. This was a serious concern in times of rising or falling interest rates.

In 1961, Edward A. Green introduced the investment-year method (IYM) of allocating investment income in his landmark paper, "The Case for Refinement in Methods of Allocating Investment Income" [3].

Recognizing the inherent conflict of strict application of the principles of "equity" and "pooling of risk" in the allocation of investment income for dividend distributions, Mr. Green called for the "allocation of investment income which recognizes the fact that funds received at different times are invested and reinvested at different rates of interest" (p. 309). Through an allocation of investment income based on the calendar year in which invested money is received, Mr. Green asserted that the investment-year method recognized "that amounts made available for investment at different times are invested at different rates and, hence, contribute differently to the investment return of the entire portfolio" (p. 310).

Under the traditional form of IYM, each general account investment is still shared by each line of business but with the shares based on the distribution by line of business of total funds made available for investment in the year the investment was acquired. Typically, the funds made available for investment in a year are considered, for this purpose, to include both insurance cash flow for the line (considerations less benefits, applicable expenses, and other deductions) and investment cash flow allocated to the line (cash investment income, principal repayments, and realized capital gains net of losses less applicable expenses and other deductions) from existing investments. Such principal repayments and capital gains and losses are allocated to the line using the same investment-year allocation percentages as for allocating investment income.

In 1961, shortly after Mr. Green's paper was presented, New York's Regulation 33 (referred to also as 11 NYCRR Part 91) was modified to permit allocation of investment income and capital gains and losses using an IYM. Since 1961, multiline insurance companies have generally adopted IYM for allocations among lines of business and within lines to customers for various lines of business, chiefly within the group pension and group insurance lines where policyholders' rights to withdraw funds are generally restricted to specified maturity dates or made subject to market-value adjustment to offset risks to the company from investment antiselection.

Much of Mr. Green's paper and its extensive discussion were devoted to theoretical and practical considerations for the adoption of IYM as a device for determining group pension contract dividends. It was noted that a more refined degree of equity among group pension contracts is particularly important because of the substantial flexibility in the timing of considerations and withdrawals permitted under such contracts. It was also noted that corporate customers may be less tolerant of pooling of investment risks than they are of pooling mortality risks. But Mr. Green also advocated the use of IYM for the allocation of investment income among lines of business, especially where the method is used for allocations among individual pension clients within the group pension line. IYM is especially appropriate for allocations among lines of business, Mr. Green states, "where there is any marked variation in the pattern of growth of the different funds."

At first, IYM was generally not used for allocations among dividend classes within the individual life insurance line of business and other lines with guaranteed policy-loan and cash-surrender provisions where policy reserves are very similar to demand deposits. With the very significant change in the interest rate environment in recent years, however, even this has changed, and many companies now use some modification of IYM in the development of interest rates for use in their individual life dividend scales. This seems particularly appropriate where different generations of a company's policies have widely different policy-loan provisions or scales of cash-surrender values. A discussion of the arguments for and against use of IYM for allocations within the individual life insurance line of business may be found in the 1977 paper by J. Edwin Matz and Franklin E. Peters, "Investment Generations Revisited" [5].

CONSIDERATIONS LEADING TOWARD SEGMENTATION

As stated earlier, at the time when IYM was being introduced, nearly all insurance company assets were held in companies' pooled general accounts. Not long after, however, separate accounts and other forms of separately managed segregated-asset portfolios were introduced, which permitted companies to provide distributions of investments different from those of the general accounts for clients with need for such differences. This in turn enabled companies to begin to address the different investment needs of certain of their clients and to begin to develop investment strategies tailored to meet the clients' specific needs.

Pooled separate accounts were first authorized in the early 1960s to permit insurance companies to accommodate pension clients wishing to invest in common stock. Starting with pooled common-stock separate accounts, the concept was expanded to include pooled separate accounts dedicated to publicly traded bonds, direct placement securities, real estate, and short-term paper. The concept was further refined by the introduction of series of pooled closed-end portfolios of direct placement securities open to contributions for a specified period with all income and principal payments paid out as the investments mature. Other refinements included balanced funds composed of publicly traded bonds and common stock as well as some short-term paper.

This concept of dedication by type of investment in pooled separate accounts is now being expanded to focus on particular industries or particular types of investment. Examples are pooled separate accounts dedicated to special growth stocks, specific types of real estate (e.g., new properties, developmental, or debt/equity), common stocks of natural resources or energy companies, bonds with maturities up to one year in length, intermediate-term bonds, longer-term bonds, or bonds whose maturities will be varied according to the interest rate cycle.

The separate-account concept has also been extended to accommodate the needs of a specific pension client—that is, a separate account consisting solely of assets attributable to one client, which might include any combination of types and durations of investments that comport with the investment needs of that specific client.

One particular example of a separate account dedicated to the needs of a specific pension client that is receiving increased attention by pension plan managers, and by insurance companies providing services to pension plans, is the so-called dedicated bond portfolio, a structuring and dedicating of an investment portfolio to meet expected payments to a closed block of retired employees. Using computer programs designed for the purpose, a portfolio composed of high-quality publicly traded bonds is constructed to meet the expected cash flow for those benefits without need for future reinvestment. The portfolios can even be adjusted from time to time to recognize variations of actual cash flow from expected. The purpose is to combine a dependable high rate of return on the funds supporting the benefit liabilities with a high degree of certainty in meeting the liabilities without the risk of market loss in liquidation or loss of investment income for reinvestment.

Since the advent of separate accounts and other forms of segregated asset portfolios, an increasing proportion of life insurance company assets is being held in such accounts, including a major portion of the total penson assets managed by insurance companies. This has necessitated the development of sophisticated accounting and allocation procedures for companies with segregated asset portfolios, and the problem of allocation of investments among different investment accounts has become commonplace. Companies engaged in such business have needed to adopt carefully drawn, nondiscriminatory investment procedures and practices in order to avoid the risk that competition for what appear to be the more desirable investments might lead to inequities in allocations among lines of business and among classes of insurance and pension customers.

Legislation in the late 1960s and early 1970s, which permitted companies wider latitude in establishing subsidiaries for ancillary businesses, has further accentuated the growth of multiaccount investment activities within a life insurance enterprise, increasing the need to address and solve problems of assuring an equitable allocation of investments among separately managed investment portfolios.

The development, and extensive sale, of interest guarantee contracts in the middle and late 1970s provided perhaps the greatest impetus for consideration of investment practices more clearly in line with the nature of the liabilities being funded by the assets created. The "opportunity" to receive large sums of money under competitive interest guarantee contracts brought with it the "necessity" for a coordinated, continual interface between the product departments and the investment departments.

Some companies, including our own, developed and are operating a portion of the interest guarantee business in a separate account. This has provided a direct linkage of assets and liabilities, even though guarantees must be supported by investments that meet the legal requirements for the general account and even though the guarantees of the separate account can call upon the surplus of the company, hence on the assets of the general account, for support if the separate account's assets are insufficient to meet the liabilities for the account. This fact of general account assets' standing behind liabilities outside the general account applies, of course, to all separate accounts, but the risk to the general account from "traditional" separate accounts is very little while the risk associated with interest guarantees in a separate account can be quite substantial.

Other companies responded to the special needs of their general account interest guarantee and other pension business by instituting limited modifications to their IYM systems. One such limited modification was to identify certain classes of investment as less appropriate for the group pension business than for other lines of business because there are no scheduled repayments and/or no assured investment income stream from such investments, or because investment earnings are deferred, or for other reasons. The modification would simply allocate the results from such investments among lines of business other than the group pension line in proportion to the funds made available for investment from those other lines, then allocate the remaining investments among all lines in proportion to the remaining funds available for investment. Examples of investments singled out for such treatment might include deep-discount bonds, common stocks, equity real estate, and certain subsidiaries.

Even with separate accounts and these other innovations of the 1960s and 1970s, we were not satisfied with our company's ability to match investment results to particular products, and we proceeded to conduct a thorough examination of our general account operations in the light of our particular financial structure and our strong multiline character. Among the questions considered in our analysis were the following:

1. What is the mix of our company's insurance and pension products? What are the differing types of liabilities of the various product lines? How do liquidity needs differ from one line to another?
2. How are assets being managed? How does asset management comport with liability management? Do assets comport with liabilities?
3. What is our corporate structure? Are different lines of business managed as one company, several companies, or through subsidiaries? To what extent are segregated-asset portfolios used or desired?
4. What financial management system exists? Does management have the information to satisfy itself that assets and liabilities are being managed in proper relationship to one another?
5. What is the tax position of the company?

In particular, we noted that the different product lines in our general account had very different investment needs. The pension interest guarantee business remaining in the general account requires a very high degree of matching of maturities of assets and liabilities. Matching of maturities is also critical for group nonparticipating annuities. Other pension general account products without interest rate guarantees and permitting withdrawals only with market-value adjustments require attractive rates of investment return with generally less concern over asset duration, aside from consideration of the long reserve tails associated with annuity guarantees included under such contracts. Individual annuities with guaranteed preretirement cash values require a high degree of asset liquidity.

Group life and health insurance, with its seasonal highly volatile fluctuations in cash flow, also requires strong asset liquidity, except for post-retirement continuance funds and certain other group insurance funds with liability characteristics similar to pension general account funds without interest-rate guarantees, and reserves for long-term disability income and survivor income benefit claims, which are similar to guaranteed annuity reserves. Individual life insurance, with its guaranteed cash values and policy-loan provisions accompanied by long-term insurance guarantees, has its own unique liability characteristics and investment needs.

With these widely disparate needs, our senior management concluded that some way must be found to tailor the investments made, held, and sold to the needs of the respective lines of business, pension and others, and to dedicate the investment results from specific investments to the specific insurance and pension product lines for which the investments were acquired. At the same time, given our particular management structure and our mix of business, we decided not to attempt to segregate assets supporting the businesses now in our general account but rather to continue one pooled general account with segmentation of assets within the general account for the purpose of allocating investment results among the major types of business.

THE EQUITABLE'S SEGMENTATION PLAN

As adopted by our company, segmentation structures the general account into five business segments, each with its own portfolio of investments dedicated to meet the specific needs of the segment's business. In addition to the five business segments, a corporate segment was established to accommodate those investments held within the general account in accordance with over-all corporate objectives.

The five business segments we decided upon are individual life and health, group life and health, individual annuities and supplementary contracts, pension interest rate guarantees and nonparticipating annuities, and other pension business. Specific decisions to combine two or more lines of business in a single segment and to subdivide the group pension line into two segments were based partly on our analyses of the cash-flow and liability structures of the respective insurance and pension products, partly on the ability of a particular product or collection of products to generate sufficient funds to support the cost of maintaining a separate portfolio of investments and to permit an appropriate degree of diversity of investments in the portfolio, and partly on the organization and management structure of the respective insurance and pension product areas.

In future years, it is possible that additional business segments will be added, or that certain of the existing segments will be subdivided. We already see major classes of business within existing segments where separate investment strategies would be appropriate and may be needed for satisfactory insurance and investment management. Our growing variable life insurance business would be an example of such a need, were it not for the fact that it has already been set up as a separate subsidiary company and is not invested within our general account. Companies with significant amounts of universal life insurance in their general accounts may feel the need for a separate segment for such business if the liability structure and investment needs of universal life are seen to be materially different from those of more traditional forms of individual life. In such case, universal life might be combined with other individual accumulation-type products, including various forms of deferred annuities and individual IRA plans, which in turn might be split off from the more traditional forms of individual annuities, especially immediate annuities and supplementary contracts without cash withdrawal options. Group life and health might be subdivided between the longer-term liabilities associated with long-term disability income and survivor income benefit claims and post-retirement continuance funds, and the shorter-term liabilities associated with hospital, dental, major medical, and similar forms of coverage. Small group, association, Keogh, and group IRA plans are other possibilities for separate segmentation in future years.

Each business segment has its own portfolio of allocated investments. New investments are acquired for a segment portfolio from the actual cash flow of the businesses included in the segment in accordance with an investment strategy tailored to the specific investment needs of the business. A particular investment may be acquired for a single segment or may be shared by two or more segments. Existing investments at the time segmentation is introduced may be allocated to run out in accordance with prior allocation ratios (prospective segmentation) or may be assigned to specific segments to create an inital structuring of the segment portfolios comparable to what might have emerged if segmentation had been in effect in prior years (retrospective segmentation). Our company chose the prospective approach as most appropriate for our purposes and most compatible with current New York insurance regulations, noting also that this would be consistent with the manner in which IYM was initially introduced in the company. Whether segmentation is prospective or retrospective, precise rules are needed to assure a proper allocation of investment results from existing investments.

A fund account is maintained for each business segment for the purpose of measuring the cash flow of the products in the segment and hence the funds available for investment. Premiums, considerations, and other insurance income are credited directly to the segment fund accounts; benefit payments, client withdrawals and dividends, and other insurance disbursements are charged directly. Investment income, capital gains net of losses, principal repayments, and other investment results from investments acquired for a segment, or from shares of existing investments allocated to a segment, are credited to the segment fund accounts either as received, or as currently as possible (e.g., in monthly distributions among the segments). Expenses, commissions, and taxes may be charged to the segment fund accounts currently, for instance on a monthly basis, using estimated allocation ratios to the extent necessary, recognizing the possible necessity for later adjustments to correct the allocations. The main point is that the segment fund accounts must reflect, as closely as possible, the current cash flow of the insurance and pension products in the respective segments and the investments supporting these products.

As stated earlier, there is a corporate segment to accommodate those investments held in the general account for overall corporate purposes, which may not comport with the current specific investment needs of any one business segment. Examples of investments that may be held in the corporate segment are home-office properties, certain subsidiaries, long-term growth or "venture" investments, and investments acquired primarily for corporate social purposes. These corporate investments are placed in a separate portfolio to facilitate overall centralized control and management of such investments.

In our company's segmentation plan, the corporate segment is treated as a pool of investments shared by the respective business segments. A list of existing investments was identified as appropriate for the corporate segment when segmentation was introduced, and these investments were placed in the corporate segment. All future investment results from these initial corporate segment investments are shared among the five business segments using the IYM allocation percentages applicable to the respective investments when the corporate segment was established. From time to time thereafter, the business segments are assessed on an appropriate basis to provide funding for the acquisition of new investments or the growth of existing investments in the corporate segment. Future investment results from these new acquisitions or additions are allocated among the business segments in proportion to their respective contributions to the funding of such investments.

As stated earlier, the more traditional methods of allocating investment income—that is, portfolio average and investment-year methods—require that investment results from each investment be shared among all lines of business with the percentage shares determined automatically by formula and not subject to management's discretion. The segmentation plan described in this section can be viewed as a logical extension of the more traditional allocation methods under which the investment results from each investment are still "shared" among all lines of business with the percentage shares determined for each investment at the time of acquisition, but determined by management and not automatically by formula. Here, subject to management's discretion, an investment may be shared among all product lines, or among only certain product lines with 0 percent shares for the excluded lines, or allocated entirely to one business segment with 0 percent shares for product lines in all other segments.

IMPLEMENTATION OF SEGMENTATION

The first step in the implementation of our segmentation plan was to work out precise rules for the allocation of existing investments among business segments. As stated earlier, we adopted a prospective approach to segmentation, under which existing investments were allocated using the same percentage shares that had applied in the past for allocations among lines of business under the investment-year method.

Having determined applicable allocation percentages for each existing investment, we then needed to determine how these investments would be managed under segmentation. We decided that the larger existing direct placement, mortgage, and real estate investments should be continued on an "undivided share" basis with the investment results from these investments allocated among the segments as they emerge. Investments of this kind accounted for some 75 percent of our total existing investments at the time.

For publicly traded bonds and stocks that could be easily subdivided into smaller holdings, we concluded that maintenance of undivided shares was unnecessary, and we actually subdivided each such investment among the segments, using the existing allocation percentages but with appropriate rounding to avoid odd lots. This permitted investment managers for the business segments to dispose of one segment's share of such investments without consulting managers for the other segments. In addition, certain classes of smaller mortgages were distributed among the segments by means of a random unit allocation process, producing a distribution of aggregate amounts equivalent to the prior allocation percentages.

Implementation of our segmentation plan did require major changes in our company's accounting systems to assure timely and accurate monitoring and reporting of cash flow for each of the business segments. In particular, this included a prompt allocation of investment results by segment *when received* rather than once a year as required under traditional IYM procedures. These changes were very costly, but the changes would probably have been made in any case, with or without segmentation, because of a perceived need by company management for more current information on cash flow from the different insurance and pension products than could be provided with existing systems.

An important consideration in any segmentation plan is the need for detailed rules and procedures for allocating new investments to specific segments as well as for sharing investments among two or more segments. These are needed to assure fair treatment of all lines of business and all classes of policyholders and to avoid the possibility of unfair competition among product lines for the more desirable investments. In this respect, Equitable had the benefit of extensive prior experience in the allocation of direct placement and real estate investments among its general account, separate accounts, and other investment portfolios managed by our investment people, and already had in place working rules and procedures for such allocations. Of particular concern here is the allocation or sharing of investments among participating and nonparticipating classes of products, and, for stock companies, allocations among policyholder and shareholder accounts.

Another important consideration was the need for rules and procedures to accommodate negative cash flow in one or more business segments. Under traditional investment-year methods, negative cash flow in one line of business is covered automatically by assigning to that line a negative share of the investments in that generation—which is equivalent to a loan to that line from all other lines at terms set automatically by IYM allocations. Under segmentation, negative cash flow in one segment could be covered by liquidating existing assets in that segment, by borrowing from other segments, or by borrowing externally. If intersegment borrowing is permitted, care must be taken in designing the rules and procedures to assure equity among the segments in the terms of the borrowing, both as to interest rate and duration of the loan. If borrowing is limited to external sources, negotiation of the terms of borrowing becomes easier, but recognition must be given to the fact that the borrowing is backed by the credit of the entire company, not just the segment doing the borrowing, and this represents some risk and therefore cost to the other segments.

There were many other practical details and decisions to be made in implementing segmentation. Among other questions that needed to be addressed were the following:

1. *Can assets be traded among segments?* If so, what rules should apply? The problem here is to assign a fair value to the assets for the purpose of effecting the trade, and fair values may be difficult to obtain for this purpose. Because of this, we decided not to permit the trading of existing assets among segments, at least initially.
2. *Can advance commitments be made?* If so, how are they backstopped? Advance commitments have been an important aspect of life insurance company investment strategy, particularly with regard to direct placements, commercial mortgages, and real estate. While the practice has seemed less attractive during the rapid rise in interest rates of the late 1970s and early 1980s, companies will no doubt want to continue to commit funds in advance in the future. Under segmentation, advance commitments can be made for investments of a single segment or to be shared among two or more segments. If the company has entered into a commitment for a segment, what happens if the cash flow for that segment turns out to be less than sufficient to cover the commitment? One approach is to develop rules and procedures for the orderly backstopping of commitments by the other segments whereby the other segments are permitted, or required, to cover the commitments. Alternatively, the segment making the commitment could be required to cover the commitment itself with the resulting shortfall treated the same as any other negative cash flow, requiring the segment to either sell assets or borrow money.
3. *How are sales of existing undivided-share investments managed?* In Equitable's segmentation plan, those existing assets that could be conveniently subdivided into smaller units were divided and distributed among the segments. The remaining undivided-share assets generally cannot be subdivided without in effect rewriting the terms of the investment. In most cases, therefore, sales of existing undivided-share investments will have to be managed at the company level with all sharing segments required to participate in the sale.
4. *What rules should there be for restructuring or refinancing of existing shared investments?* The opportunity frequently arises for changing the terms of an existing shared investment (e.g., as to duration, interest rate, call protection), or its structure (e.g., converting debt to equity), or to expand the investment through some form of refinancing. If the change is acceptable to each of the segments sharing the investment, then the investment can continue on the same prior shared basis after the change is made. If the change is acceptable to some but not all of the sharing segments, one approach is for the segment or segments desiring the change to pick up the entire changed investment and

for the product lines in the segment, including whatever surplus has emerged from the historical operation of the products to date. Assets of a business segment, measured by the fund accumulation for the segment, include both the investments in that segment's portfolio and the applicable share of each of the corporate segment's investments. The corporate segment in Equitable's segmentation plan does not represent an identification of Equitable's corporate surplus as such.

Depending on corporate structure and objectives, other companies will undoubtedly arrive at different aproaches to the treatment of corporate investments and corporate surplus. For example, while our approach was to leave all statutory surplus in the fund accounts of the business segments, other companies will prefer to establish a "corporate surplus account" which will be a separate fund account maintained in addition to the segment fund accounts containing some portion of the company's statutory surplus, as well as a stock company's statutory capital.

There are several possibilities for such a corporate surplus account. The corporate account may contain all the statutory capital and surplus with increases in surplus generated by each business segment transferred each year from the segment's fund account to the corporate account. Alternatively, the corporate account may contain all "free" statutory capital and surplus, defined as that amount deemed available for new ventures as opposed to that required to handle the business needs of particular segments. Or the corporate account may contain all statutory capital and surplus adjusted for surplus strain on new business and repayments of surplus strain from business in force. In any case, shareholder dividends, if applicable, would be charged to the corporate account.

If there is a corporate surplus account, then it will no doubt become the fund account for the corporate segment, leaving the fund accounts for the business segments, now reduced by surplus transferred to the corporate account, consisting solely of investments in their own segment portfolios. In such case, if the corporate account includes all statutory capital and surplus, then management may want to invest only a portion of the corporate segment in so-called corporate-purpose investments with the remainder invested in more traditional general account investments.

IMPLICATIONS OF SEGMENTATION FOR EQUITABLE'S INVESTMENT ORGANIZATION

The volatile and unstable financial markets and dramatic changes in interest rates, both upward and downward, that have characterized the economic environment of recent years have posed challenges for the management of life insurance company investments that have transcended the make the remaining payments under the original investment to the remaining segments as the payments come due. In the case of a restructured investment where a current fair market appraisal is required as part of the restructuring, it may be reasonable to treat the entire investment as if sold at its fair market value and picked up by the acquiring segment or segments as a new investment.

5. *How should short-term investments be handled? Should there be a single pool shared by all segments, or a separate short-term portfolio for each segment, or a separate segment for short-term investment needs?* When segmentation was first introduced, Equitable managed all its short-term investments in a single pool shared by all the segments. Gradually, as the specific short-term investment needs of the different business segments have become clearer, such investments have been handled partly within the separate investment portfolios maintained for the business segments and partly in a common pool. Eventually, we expect that the short-term investment pool will be limited to what is needed to cover the company's overall daily cash-flow needs, with all other short-term investments held in the separate segment portfolios.
6. *Is any special treatment needed for capital gains and losses?* To assure that segmentation is consistent with the principle of equity among lines of business and classes of policyholders in the allocation of investment income, we believe it important that capital gains and losses be allocated to the business segments that give rise to them. If the investment strategy for a particular segment calls for higher current yields at a possible sacrifice in quality, then equity requires that the lines of business in that segment absorb any capital loss that may result from such lower quality. We have found it useful also to allocate and manage the mandatory securities valuation reserve by segment, on a basis consistent with prior methods of allocation among lines of business.
7. *How should statutory limitations be controlled?* Do all segments meet all requirements, or can certain segments exceed limitations if overall requirements are met by the general account? In general, each business segment in Equitable's plan is expected to comply with the statutory limitations as if the segment stood alone. However, there will be instances where one segment will choose not to use up all of its limitation and this will need to be monitored at the company level to see whether such margins can be transferred to other segments.
8. *How does segmentation affect, if at all, the allocation of expenses and taxes?* Segmentation itself need not in any way affect the methods of allocation of expenses and taxes among lines of business. However, because the investment actions of the respective segments can affect the company's overall tax status, particularly as to capital gains and losses, overall monitoring of the tax implications of each segment's investment actions is essential.

CORPORATE SEGMENT VERSUS CORPORATE SURPLUS ACCOUNT

In the segmentation plan adopted for our company, the fund account for each business segment includes all assets that have been accumulated power and sensitivities of traditional general account practices. In addressing the challenge, we needed to develop investment strategies and an allocation process which could achieve several objectives:

1. To produce optimal investment return and lower net costs to policyholders for different insurance and pension products having widely different liability characteristics.
2. To permit widest scope of coverage and optimal degree of flexibility to encourage funding and discourage antiselection, regardless of whether interest rates are high or low.
3. To enhance equity among all classes of policyholders in the general account in terms of investment return, quality, and diversification.
4. To provide an appropriate matching of assets and liabilities to minimize the risk to the insurer from changes in the interest rate environment.

The principal business purpose of segmenting our general account was to accommodate, for each of our major lines of business, the investment policy and strategy most appropriate to its business needs and liabilities. It has become increasingly clear in recent years that no single investment strategy can serve well all of a multiline company's major lines of business. Optimal response to the dynamic economic and financial markets in which we operate requires recognition of the nature and duration of liabilities, which vary importantly from one line of business to another.

For Equitable, segmentation required a complete reorganization of its general account investment-portfolio management to permit close coordination with the product managers of the respective business segments in identifying the liability characteristics and investment needs of each class of insurance and pension products and in developing an investment program (policy and strategy) most appropriate to the needs of the products.

For each segment we appointed an investment program manager to work with product-line management in developing policy and strategy. The investment program manager is charged with management of the segment's own liquidity, diversification, and cash flow, based upon such policy and strategy. Although investment program managers are skilled investment professionals, they generally do not make specific investment decisions. They plan and program the account and manage its mix and timing, but they rely upon investment production professionals within our various investment departments, organized by type of investment, to make and supply the specific investments to meet the investment program objectives. This is particularly important in that a company could be eaten alive by investment expense if it were to create a separate investment organization for each segment.

Actuaries have contributed significantly in the establishment of investment policy for our business segments. They have participated with product managers and investment managers in defining the risk and return assumptions inherent in the design of products, assessing the impact of income taxes on investment strategy alternatives, and coordinating overall asset management with liability requirements as to liquidity, diversification, asset mix, maturities, quality, and size of investments. Sophisticated cash-flow forecasting tools, models for measuring the trade-off between risk and return, and techniques for matching assets and liabilities are particular contributions within the province of actuarial expertise.

While the separate portfolios are tailored to the needs of the respective segments, there still remains an overriding need for overall coordination at the chief investment officer level to assure that consistent policies are adopted for all general account segments as to tax treatment, capital gains, statutory investment limitations, and overall structure of general account assets.

EARLY REACTIONS TO SEGMENTATION

Equitable's general account segmentation became effective January 1, 1981, and we have every reason to be satisfied with its operation. We believe we have launched a new era in managing our company, with a very desirable resulting interface between our product managers and investment managers. Product managers are gaining a better understanding of the investments supporting their products and are better able to anticipate the characteristics of new investments required for their respective businesses. Investment managers are gaining a better understanding of the liability characteristics and investment needs of the respective product lines and are better equipped to serve their clients' needs. From a corporate financial standpoint, segmentation offers the opportunity for tighter monitoring and control of cash flow, and an improved risk posture for the company as a whole.

There is no doubt that segmentation has enabled us to develop information that will permit a better matching of assets and liabilities and a better control of the process of meeting liquidity needs. The net cash flow available for investment in each segment is analyzed at least monthly, and full-year cash-flow forecasts are maintained on an up-to-date basis. Projections of investment cash flow expected from existing investments in each future year are prepared on a regular basis for each segment as are projections of insurance cash flow under the segment's existing policies and contracts. Both are valuable tools for better understanding the relationships of assets to liabilities in each segment. Further, it has been our experience to date that segmentation is forcing critical examination of our investment practices—why are we making certain investments, and which of our product lines want a certain investment? In a sense, this process of evaluation has been almost as important as the results achieved, and we are beginning to see the possibility of significant product changes on the horizon. That is, segmentation not only has meant a better matching of investments to insurance and pensions (assets to liabilities) but also could lead to a much better matching of insurance and pensions to investment (liabilities to assets).

Introduction of segmentation has not come without problems. The increased accounting and systems work has been considerable, and the "real time" atmosphere needed for such work has been demanding. Further, we may have lost some investment advantages of scale, and we may have developed some unnecessary overlap in margins and liquidity. The participation of insurance people in the investment policy process may have slowed down decision-making somewhat. Our investment production management has been limited in regard to making advance commitments and placing sizable real estate and direct-placement deals. The limited availability of corporate-segment funds has slowed investments of the institutional type. There has also been a tendency to emphasize current yields and liquidity, and, if this tendency continues and expands, there could be important implications for long-term capital formation in this country. Some of these results are the product of the difficult financial environment in which we have operated in the 1980s, and time will tell whether the other impacts upon investments have been advantageous or disadvantageous.

Of course, with the sizable blocks of existing assets in each of our segments when segmentation was introduced, it will take a number of years to gain the matching of assets and liabilities we need and desire for each of the segments. Our heavy past emphasis on long-term direct-placement securities and mortgages and their relative illiquidity and nonmarketability, especially in the economic environment of recent years, have made the task even more difficult. Sales opportunities for direct placements and mortgages are infrequent, and sales can be costly in terms of impact on earnings and surplus. As a result, restructuring of assets may not take place much faster than new cash flow and rollover of old investments will permit. In the interim, a greater portion of net cash flow available for investment is likely to be channeled into shorter- and intermediate-term, publicly marketable securities because of perceived increased liquidity needs and the need to shorten the assets in several of the general account segments to better match the liabilities in those segments. This can greatly reduce the funds available for investment in direct placements, long-term mortgages, and real estate investments.

What does this portend for the future? Will there be significant future changes in our overall investment mix? Will there be fewer traditional long-term bonds and mortgage investments? Will there be fewer large real estate ventures? Will there be more publicly traded bonds as compared to direct placements? Will the emphasis be on the short term and the intermediate term? Will investments tend to be smaller transactions? Will there be more or less emphasis on "inflation-proofing"? What place will there be for common stock and equity real estate? Will investments become more conservative, or will they become more aggressive?

SEGMENTATION ALTERNATIVES

The plan of segmentation outlined in this paper is very comprehensive, and, as we have mentioned, the cost of implementing such a plan can be considerable. Our company's senior management concluded only after thorough study that this approach was most appropriate given our corporate structure and objectives and given our mix of business. Clearly, this form of segmentation will not be appropriate for all companies. In particular, such a plan should be considered only for multiline companies with materially different investment needs for different lines of business and of sufficient size to justify the additional cost. For other companies, with different circumstances, there are a number of alternatives that might prove as satisfactory in achieving management's objectives, at considerably less cost.

One alternative is to limit the number of segments to two—one segment for the group pension business and one segment to accommodate all other general account business. This approach gives full recognition to the special investment needs of the interest guarantee business and other forms of pension business. It does not address the possibility of differing investment needs among the remaining lines of business and whether those needs can really be accommodated within one pooled investment strategy.

Another alternative is to establish pools of each major type of investment, with bonds subdivided among longer-duration, intermediate-duration, and shorter-duration maturities. Each segment then acquires shares in each of the pools of investments rather than identifiable individual investments to meet its investment needs.

Also, a company may be able to limit somewhat the expense of modifying the costly current monitoring of cash flow by segment by determining the segment shares of each of the major pools of investments after the year is over, on the basis of an after-the-fact review of the investment needs of the respective business segments. This approach loses much of the close interaction between insurance and pension product managers and investment-portfolio managers that is possible under full segmentation; however, it does permit a variation in investment strategies among the business segments and thus can achieve a good measure of segmentation's goals at much less initial cost.

IMPLICATIONS OF SEGMENTATION FOR PRODUCT DESIGN

The hidden—and perhaps greatest—advantage of segmentation has been the cross-pollination of product managers and investment managers, which produces not only a new way of investment but also a new way of insuring. With knowledge of the characteristics of investments available to support respective products, we are designing and pricing products to take advantage of such investments. Investment considerations are increasingly becoming active, rather than passive, determinants of product design. Further, with the experience of reduced cash flows during the recent period of rising interest rates and resulting disintermediation, beginning in 1980, we are beginning to recognize the costs of guaranteed cash and policy-loan values, the delay in group insurance premium payments, and the recapture of group pension funds. At the same time, we are also recognizing the possible costs of long open periods for contributions under guaranteed interest contracts during periods of falling interest rates and the resulting intermediation.

There is no doubt that our traditional products have become substantially more interest-rate-sensitive, and that disintermediation and intermediation are problems with which we must cope. We see the increasing need for new products, with new investment strategies, to respond to changed economic and financial market conditions. And with the greater sophistication of our customers and increased competition for savings dollars from outside the life insurance industry, there is greater and greater need to "be on the market" with current rates of return. This means shorter and shorter maturities, and greater use of equity and money-market investments acquired through "active" portfolio management. The need for very close coordination of product design, pricing, investment philosophy and strategy, and investment performance is crucial.

Some have called this a "product revolution," pointing to the significant new product developments of recent years and the plethora of life insurance and annuity products emerging monthly. Changing interest rates and inflation—and concomitant high expense rates and higher taxes—are the chief factors causing these product changes. Excess interest annuities, variable annuities, and wraparound annuities are examples of the newer annuity offerings. Individual life insurance innovations include adjustable (or indeterminate) premium life, universal life, and variable life products. With differing degrees of emphasis, these new product innovations and hybrids of them either (1) capitalize on high interest rates when they are available, (2) attempt to adjust to inflation, (3) reduce expense loads, or (4) reduce impact of taxation—all to produce more competitive and flexible products for our customers.

As these newer product forms take hold—and they surely will if recent economic trends continue—they will substantially alter the way insurance companies invest. Greater emphasis on short maturities, publicly traded bonds, stocks, and money-market instruments will mean a significant change in life company investing. Since insurance companies have historically been a major factor in long-term capital markets, these trends in insurance company investment will have a profound impact on the economy and financial markets.

A major feature of the newer forms of annuities and life insurance is the elimination, either directly or through design, of the disintermediation impact under conditions of rising interest rates of policy loans and surrender values. Variable life insurance provides cash values that vary depending on the investment performance of an underlying separate account, and both loans and surrenders are taken down based on such values, which vary according to current markets. To the extent that universal life insurance provides current market yields on policyholder fund balances, the disintermediation incentive is effectively eliminated through product design.

In contrast, the traditional whole-life purchaser has a guaranteed minimum cash value, a policy-loan right to such cash value, and a below-market rate of interest on the loan as well. The United States is one of the few life insurance markets where guaranteed minimum cash values and maximum fixed-rate policy loans are required by law, except for variable annuity and variable life insurance products. Fully guaranteed cash values are not required in Canada or the United Kingdom. Variable policy loan-rate legislation currently being enacted will help reduce the risk of disintermediation under conditions of rising interest rates, but the ultimate solution might be changes in nonforfeiture laws to either eliminate minimum cash values and policy-loan rights or permit payment of such values only in installments over a minimum period of years. Serious consideration is already being given to the possibility of such changes by insurance company managements and by regulators.

Newer forms of benefits may also result in greater need for segmentation or subsegmentation of accounts. Some insurance regulators have indicated that perhaps segmentation should be required for all products that depend directly upon investment-income results, those, for example, in which investment income is indexed to the Treasury Bill rate, the prime rate, or another index. This could even apply to products of the universal life type, where there is a need to be sure that guaranteed or declared yields are being matched by investment experience. Further, such products may require a different investment policy, and the results of investments supporting them should not be buried with the experience of other products. Again, segmentation affords another opportunity for both better management and better regulatory supervision.

IMPLICATIONS FOR INVESTMENT STRATEGY

It is clear that one of the major challenges for the investment management of life insurance companies today is how to invest company assets to match liabilities and how to do this in such a manner as to obtain consistently positive and real rates of return in the face of continuing levels of inflation.

In addressing this challenge, the investment manager needs first to understand the liabilities underlying each of the company's products—expected amounts and expected timing of future payments to insurance and pension customers, as well as the extent to which such amounts and timing may vary from expected—and then to structure the company's assets to accommodate an investment policy and strategy most appropriate to meet the needs and liabilities of the company's various products. Under segmentation, such matching of assets and liabilities is made easier, because the major product lines are distinguished and separated.

Life insurance companies have always attempted, in general terms, to match their assets to their insurance liabilities. But, until recently, the challenge has been largely academic, at most an overall qualitative judgment. As George Conklin said in a chapter on investments in the *Life and Health Insurance Handbook* [1]:

> This reasonably predictable flow of funds, plus the long-term nature of life insurance contracts, has led life insurance companies to emphasize the long-term outlook in their investment decisions. A life insurance company is much less exposed than other financial institutions to the risk of having to liquidate investments in a seriously depressed market. Therefore, under normal circumstances, it can concentrate on the total return to be expected over the life of the commitment without being much concerned about interim fluctuations in market value.

However, the stability of the economic environment that Mr. Conklin refers to no longer exists. The current environment requires specific attention to matching assets and liabilities. What quantitative techniques currently exist, or are currently being used, for matching assets and liabilities?

The earliest such actuarial technique is the system of absolute matching developed by Haynes and Kirton and described in Volume XXI of the *Transactions of the Faculty of Actuaries*, "The Financial Structure of a Life Insurance Office" [4]. This is essentially the technique now used by our company and others in developing "dedicated bond portfolios" for closed groups of retired lives under pension plans.

"Modern" methods for matching assets to liabilities, which did not require the absolute matching of the earlier approach, were presented in British insurance and actuarial journals in the 1950s and 1960s in papers by Redington [6] and others. Irwin Vanderhoof adapted the British approach to American conditions in several papers during the 1970s (e.g., [12], [13]).

In the second of these two papers, "Choice and Justification of an Interest Rate," Mr. Vanderhoof introduced two important new concepts to the problem of asset and liability matching. The first was the use of a number of scenarios of future annual changes in "reinvestment rates," that is, the rates anticipated for new investments in future years. The second was the recognition that investment cash flows are a function of the economic environment, that is, of future reinvestment rates. By trial and error, he endeavored to determine gross investment and reinvestment strategy that would achieve the proper relationship between the durations of assets and those for the insurance liabilities.

In 1980, James Tilley wrote a paper entitled "The Matching of Assets and Liabilities" [9], which extends and improves the Vanderhoof techniques. Here Mr. Tilley made two important contributions to the study of asset and liability matching. The first was to recognize that insurance cash flows are also a function of the economic environment, which has really been the serious problem of the insurance industry for the past ten years. He then went on to demonstrate that there was a good method in the form of linear programming to solve for a desired result among the various possible scenarios. Using modern computer technology, Mr. Tilley was able to work with very large and detailed scenarios and develop methods for solution.

It is not the purpose of this paper to engage in a lengthy discourse on techniques for matching assets and liabilities or on the larger topic of "immunization of portfolios." It is sufficient to indicate that this is a burgeoning opportunity for actuaries fascinated with the investment world and intrigued by the machinations of the economic and financial markets. Much remains to be done to develop practical applications of immunization techniques to segmented portfolios of assets and liabilities.

IMPLICATIONS FOR THE VALUATION OF LIABILITIES

For several years, the Society of Actuaries' Committee on Valuation and Related Problems, chaired initially by C. L. Trowbridge and now by Donald Cody, has struggled with the problem of valuing insurance company assets and liabilities under conditions of inflation and changing interest rates. The committee's preliminary report, published in the *Record* for the 1979 Society of Actuaries regional meeting in New Orleans [10], points to the need for a valuation system that requires company assets and liabilities to be valued on a consistent basis. The committee identified the several types of risks that can impact on the solvency of an insurance company and that should be recognized in any valuation of company assets and liabilities, noting that the risk of loss due to changes in the interest rate environment, termed C-3 risk by the Trowbridge committee, was probably the most significant risk in the then current economic environment.

Subsequently the Society formed a task force under the Trowbridge committee to perform the research needed to identify and measure C-3 risk, the so-called C-3 Risk Task Force. By the time of writing, this task force has already completed a substantial amount of research into the C-3 risk characteristics of several types of insurance and pension products, and the results may be found in interim reports of the task force in the *Records* for the Society's 1981 Atlanta meeting, 1982 Houston meeting, and 1982 Washington meeting [7].

While much research remains to be done into the measurement of C-3 risk and the other risks impacting on insurance company solvency, practical applications of the techniques developed by the C-3 Risk Task Force are beginning to emerge. One state, New York, now requires a company using the more liberal valuation interest rates permitted in the Standard Valuation Law for annuities or guaranteed interest contracts to submit with its annual statement an actuary's certification that specific tests were made to measure the adequacy of the assets supporting the reserves in the annual statement for annuities and guaranteed interest contracts to fund the company's obligations under those contracts. The tests would require projections of insurance cash flow from the company's annuities and guaranteed interest contracts and projections of investment cash flow from the assets supporting the reserves for these products, both projections under a variety of assumptions as to future interest rates.

Of crucial importance in performing these tests is the task of identification of the particular assets supporting the company's annuities and guaranteed interest contracts and the investment cash flow expected in future years from those assets. For a company that is segmented, the task of identifying the assets supporting each of the major product groups becomes a relatively straightforward by-product of the segmentation process; otherwise, such identification may be more complicated.

REGULATORY ENVIRONMENT

The New York Insurance Department's Regulation 33 (also known as 11 NYCRR Part 91) requires for all life insurance companies doing business in New York that net investment income be allocated among lines of business in proportion to mean reserves or by use of an investment-year method in accordance with rules specified in the regulation. To the extent feasible, net investment income is to be allocated within lines of business by the same method used for the distribution among lines. A company proposing to adopt an investment-year method must file a full description of its plan with the superintendent of insurance. Any deviation from the rules specified in Regulation 33 requires the approval of the superintendent as being equitable and as being necessary for reasons of feasibility before the method can be adopted.

Segmentation, as described in this paper, may be viewed as a new approach to the allocation of investment income in which the investment-year method as prescribed under Regulation 33 is applied separately to each of several business segments in the general account. Our company submitted a detailed description of its segmentation plan to the superintendent pursuant to the requirements of Regulation 33, and the department determined that our proposal was acceptable.

In a 1981 talk to the Hartford Actuaries Club, John S. Thompson, Jr., a supervising actuary at the New York State Insurance Department, listed eleven items that should be included in preparing a written description of a segmentation plan for submission to the New York department: (1) a statement of the reasons for introducing segmentation and basic objectives of the proposed program, (2) a precise definition of the business segments, (3) a description of how the system will operate to avoid unfair discrimination in the allocations of investments among segments, (4) a description of changes in company organization contemplated in connection with segmentation, (5) a description of how cash flow will be measured for each segment, including treatment of negative cash flow, (6) rules for the sharing of investments among business segments, (7) a description of how assets held at introduction of the program will be treated under segmentation, (8) a clear statement that all assets of the general account continue to stand behind all liabilities (i.e., that segmentation does not imply segregation of assets), (9) a description of how investment strategies are expected to be developed for the respective segments, (10) how segmentation might be expected to impact on the company's financial results, and (11) rules for allocations of investment income among lines within a segment and within lines of business.

In a subsequent conversation, Mr. Thompson has added two further items that should be included in a company's segmentation plan, namely, (12) a statement that the segmentation plan applies to all businesses included in the general account, not merely to certain specified businesses, and that the implications of segmentation are fully understood by management in all of the general account business areas, and (13) a description of the changes that will be needed in the company's accounting systems to accommodate segmentation, or at least a statement indicating that management understands the scope and magnitude of the changes that will be needed.

New York has traditionally led other United States jurisdictions in the degree of regulation applicable to the allocation of investment income by line of business. A company will need to comply with the specific requirements of each state in which it operates; if the company does business in New York and complies with the requirements of Regulation 33, however, it is likely that the company will also comply with the investment income allocation requirements of other states as well.

The Canadian Department of Insurance permits a variety of methods for the allocation of investment income among lines of business in the annual statement, subject to the requirements that investment income allocated to the shareholder's fund account not exceed the amount that would be allocated under a mean-fund basis and that capital gains and losses be allocated on a mean-fund basis.

Canadian requirements for the valuation of liabilities place responsibility on the valuation actuary to use valuation interest rates that are appropriate to the circumstances of the policies being valued with no statutory restrictions on the rates chosen, implying that the actuary must consider the assets backing the liabilities and reflect any serious mismatching between assets and liabilities in the valuation interest rates. This has led a number of Canadian companies to adopt some form of segmentation for management purposes and for the purpose of establishing a basis for valuing liabilities, even though some modification may be needed for allocating investment income among lines of business in the annual statement as indicated in the preceding paragraph.

ACKNOWLEDGMENTS

A preliminary draft of this paper was circulated among a large number of interested persons during the summer and fall of 1982. We have received a large number of very helpful suggestions and comments on that draft, and most of these have been reflected in the final paper. The authors both wish to express their thanks to each and every one of those who responded to the draft, either orally or in writing, and for the valuable contributions each made toward completing this paper.

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DISCUSSION OF PRECEDING PAPER

D. ALLEN LONEY:

Messrs. Attwood and Ohman are to be congratulated on a fine paper which describes very readably the Equitable's approach to segmentation. My company, Canada Life, introduced a rather similar program on 1 January 1982 and the following comments touch on a few areas where our approach was different:

1. *Reasons for introducing segmentation*. The authors described the investment management, product-related and environmental reasons. Also important is the fact that segmentation with its highly visible, automatic and equitable allocation of investment results between segments enables credible profit results to be established for each business segment.

   This has obvious advantages to management in reviewing the performance of those responsible for the business segments and in equitably establishing the dividends payable to policyholders.

   In addition, in Canada, the valuation actuary has considerable freedom to determine the valuation basis. The basis must be appropriate to the circumstances of the company and the policies in force and must produce reserves that adequately provide for future obligations. The accepted method of achieving this is by using assumptions which are a combination of expected experience and a provision for adverse deviation.

   Obviously expected experience regarding future investment return is to some degree a function of the return on assets already in place, particularly for contracts which are single premium in nature. The valuation actuary's selection of the interest assumption is much more firmly based if there is some way of systematically associating particular groups of assets with particular liability blocks. Segmentation is perhaps the most explicit and practical of such methods.

   One attribute of segmentation which we found particularly attractive was the relative ease of comparing asset structure (term to maturity, quality, and so on) with liability structure. Other systems may produce a reasonable allocation of investment income but do not lend themselves as readily, flexibly or visibly to study of the asset structure.

2. *Definition of the various segments*. In the final part of the paper the authors refer to the Canadian annual statement. In our segmentation we in fact followed the Canadian annual statement line-of-business defini-

tions. This resulted in six operating funds in each of the four countries in which we operate. These funds are life, health and annuity, with a group and individual version of each.

One great advantage of this decision was the fact that our accounting system was already equipped to handle this subdivision. However, we found that it was necessary to establish subfunds in the group annuity and individual annuity funds to adequately manage our investments corresponding to liabilities with short, medium and long term interest guarantees. Subsequently, subfunds have been established to handle universal life products in the U.S. and Canadian individual life funds. The subfunds do not have the full accounting system support of the main funds but are controlled by periodic comparison of the assets and liabilities.

3. *Initial size of segment and corporate surplus*. The authors draw attention to the various choices as to treatment of surplus when establishing segmentation. At Canada Life we established each operating fund with assets equal to fund liabilities plus an amount of "working capital" which was determined by formula (For the concept see discussion by J. C. Maynard *RSA* Vol. 7, No. 3, pp. 1061–1083). The remainder of surplus (that is, total surplus less the total working capital of the six operating funds in each country) was established as a seventh fund, development surplus. Its role is, where necessary, to finance developments throughout the company as well as the traditional buffer role of surplus, should adverse experience exhaust the working capital of an operating fund.

   In the absence of any transfers into or out of a particular operating fund the change in the working capital of the fund represents the profits generated by the fund. These can be studied over any time period desired (months or years) and can be easily adjusted to remove investment earnings on average working capital in the period under review if so desired.

   The information now available at fund level means that various difficult questions as to optimum surplus level, rate of growth and profit level can now be addressed at the segment level. This perhaps increases the chance of practical resolution compared to addressing those questions at the total company level where reasoning is complicated by heterogeneity of the parts comprising the whole.

   The assets of our development surplus are mainly of the "corporate purpose" nature described by the authors, particularly long–term growth investments.

4. *Treatment of existing assets when introducing segmentation*. It can be argued that retrospective allocation of existing investments among segments is inequitable since it involves deciding which assets are associated

with the various policyholder categories *after* the event. We rejected this argument on the grounds that although a formal segmentation was not previously in place, an implicit segmentation was in place even if it was not defined with complete precision. For example, we were implicitly segmenting investment income each time we determined the interest component of our dividend scale.

Unlike the Equitable, we did not have a well-developed and sophisticated investment-year method in place. However, we were able to directly allocate a high proportion of recent years' investments because we had detailed documentation on the purposes of those investments, for example, to validate individual annuity, group annuity, and so on. By recreating past cash flows of the various segments we were able to subdivide the balance of assets purchased in each year. This was easier than it may seem since our segments were based on annual statement definitions.

DONALD R. SONDERGELD:

Let me congratulate the authors on an excellent paper. My remarks are intended to add to the understanding of the concepts contained in the paper.

It is true that segmentation can be viewed as a refinement of the allocation of investment income—whether the method is the new-money allocation method, or the aggregate (portfolio) allocation method, which ignores year of investment. However, I prefer the authors' other much broader definition and see segmentation as a means of tailor-making an investment policy to be consistent with the expected cash-flow of an insurance product and/or line-of-business after defining how the investment risk is distributed between the policyholder and the insurance company. Where practical, all products that require different investment policies should be placed in separate segments. This has been the natural treatment of separate accounts. They have a separate investment policy and, in addition, the policyholder usually assumes the entire investment risk.

If there is more than one insurance product, and/or line-of-business within a segment, then the investment-generation method may be viewed as providing equity in the allocation of the investment income within the segment to product, and/or line-of-business. A deficiency in the investment-generation method is that it does not distinguish between the length of the assets by generation applicable to different lines-of-business. Segmentation is needed so that the appropriate investment policy can be pursued; whereas, the investment-generation method of allocation of investment income may be utilized within a segment for reasons of policyholder equity.

As chief actuary of three life insurance companies owned by The Hartford, I am very much involved with segmentation. These companies are Hartford Life, Hartford Life and Accident, and Hartford Variable Annuity. By having three separate companies, we have been able to accomplish many of the objectives of segmentation by placing products with similar investment characteristics in a common company. I say "many," as three are not enough. We found that, to better manage our business, we needed more than three segments. We, therefore, filed and received approval from New York to set up two segments, as of January 1, 1979, in Hartford Life—one for group annuity and one for "all other" business. Assets were allocated between these portfolios, using a retrospective approach. We recently identified a need for additional segments in that company and set up three more segments on January 1, 1983—one for universal life business and the other two for single-premium annuities.

The Hartford Life and Accident, a company outside of New York, contains all of our group life, group health, and individual health business. It also contains some individual life business, and we have recently set up a separate segment for universal life. Hartford Variable Annuity consists largely of public employee deferred-compensation business and some tax-deferred annuity business, and we are considering segmenting some of that business.

I have been especially interested in having consistency at my company among three items; the actuarial formula and assumptions that actuary uses in pricing (or profit-testing) a product, investment policy (including segmentation of assets and matching of assets and liabilities), and the management reporting of earnings. Our segmentation plan was developed to make it easy to tie these items together. The following comments apply to the section in the paper titled, "Corporate Segment Versus Corporate Surplus Account."

We do not have a corporate segment, but, perhaps, should have one. We do have a corporate line–of–business for management reporting purposes. The financial results of the corporate line–of–business are buried in a statutory line–of–business for statutory reporting. Let me describe our method of operation at Hartford Life prior to 1 January 1983. Our method has not changed, but the description is easier to make as we only had two segments prior to this date. Group annuity was one segment with all other business together in the other segment. We had three major management lines–of–business: group annuity, individual life, and corporate. Group annuity had assets in its own segment, and "all other" assets were contained in the other segment. The assets in the group annuity segment equal statutory liabilities for the group annuity line–of–business. Statutory after-tax earnings are transferred out of the group annuity segment to the corporate line–of–business each month. If the earnings are negative, cash is transferred from the corporate portion of the "all other" segment to the group annuity segment. We apply the new–money method separately within each segment.

We have assets equal to the sum of two major items in the "all other" segment: a) statutory liabilities for individual life and b) total statutory surplus. This latter item consists of three pieces: i) benchmark surplus for group annuity, ii) benchmark surplus for individual life, and iii) "free" or corporate surplus. Benchmark surplus is described in my paper, "Profitability As A Return On Total Capital," in *TSA* XXXIV, 1982, pp. 415–29, and is "the amount of statutory surplus that is needed for each line–of–business in order to reduce the probability of insolvency to management's comfort level." It is based upon the various risks associated with in-force business. Our basic measuring rod of financial performance is return on total capital. This return can be determined for each line–of–business each month using the approach described in that paper.

For management reporting of statutory earnings, after-tax earnings for the group annuity line-of-business equal the statutory after-tax earnings from the group annuity segment plus after-tax investment income on group annuity benchmark surplus. After-tax earnings for the individual life line–of–business equal its statutory after-tax earnings plus after-tax earnings on individual life benchmark surplus. The balance represents the earnings of the corporate line–of–business. After various GAAP adjustments are made, we have GAAP earnings by line–of–business.

In summary, our group annuity product segment is operated as a separate company with zero statutory surplus. This is a major departure from the Equitable's approach where accumulated assets remain in the product segment.

Realized capital gains and losses, after-tax, are part of the statutory after-tax earnings which I referred to above. Although I am not overly concerned with the format of the statutory blank, a current deficiency in that blank is that any realized capital gains and losses, which are allocated to group annuity policyholders, affect the increase in group annuity reserves; whereas, realized capital gains and losses are excluded from the summary of operations in the statutory blank. We do adjust for this in our management reporting.

As you can see from the above description, the corporate line–of–business represents the stockholder interest. The corporate line–of–business finances the new business drain and receives renewal earnings (if positive) as compensation from the operating lines–of–business. For products containing cash values, or products on which the investment earnings are allocated to policyholders, we believe that assets in the "product segment," as a minimum, should equal the policyholder account value. If there is enough cash in the corporate line–of–business, we plan to have assets in the product segment kept equal to the statutory liabilities. The additional assets needed in the product segment above the cash value minimum could be made available in other ways, such as by transferring securities into the product segment.

As an example, consider a pure endowment policy maturing in one year for $11,000. There are no expenses or taxes. The valuation interest rate is 10 percent and money is invested at 13 percent. The reserve at the beginning of the year is $10,000 ($11,000 ÷ 1.10) and the minimum amount needed for matching cash–flow is $9,735 ($11,000 ÷ 1.13). The minimum amount in the product segment should be $9,735, but The Hartford has chosen to have the full $10,000 statutory reserve in the segment. Either cash or securities worth $265 on a book basis could be placed in the product segment to bring the total to $10,000. Alternatively, a company might choose to handle the extra $265 outside the product segment.

With the above in mind, my final comments will be on negative cash–flow. If the statutory earnings in the product segment are negative, we move cash from the corporate line–of–business into the product segment. It is not borrowed at an explicit rate of interest as the corporate line–of–business represents the stockholder's interest and corporate surplus is being invested in the product segment. It is expected that such investment will be repaid via future statutory earnings that are moved from the product segment to the corporate line–of–business. The corporate line–of–business expects to realize the internal rate of return used in pricing the product. On the other hand, a situation may develop where there are positive earnings but negative cash flow within the product segment. Rather than liquidate securities, the product segment may borrow cash at an appropriate interest rate from other segments or from outside the company. This could occur if there is an asset-liability mismatch in the product segment.

KENNETH W. STEWART:

Messrs. Attwood and Ohman are to be commended for a fine paper. Mean funds and investment–generation approaches could be viewed as the first and second waves, respectively, in allocating investment results. If so, segmentation is the third wave. Unlike the older approaches in which investment strategy arose largely by implication or default, segmentation provides an architecture for explicit strategies to acquire, hold or dispose of specific assets to support the needs of appropriately defined business segments.

The authors' work shows two of the hallmarks which distinguish excellent papers from those which are merely good. First, they balance thoughtful and probing questions with practical, albeit somewhat general, answers to some of those questions. Second, while providing many valuable insights into the Equitable's segmentation process, they have taken pains to examine the implications for both smaller and larger companies, and both stocks and mutuals. This paper is a worthy addition to our literature and should be included in the Fellowship syllabus without delay.

Messrs. Attwood and Ohman seem to suggest that the principles of sound management and fair dealing between participating and nonparticipating business should apply, *mutatis mutandis*, with equal rigor to both stock and mutual companies. I would like to explore this idea from a Canadian perspective.

In Canada both stock and mutual companies have the power to write participating and nonparticipating business, and most do so. Section 84 of the Canadian and British Insurance Companies Act provides that participating policyholders of a stock company are entitled to share in at least 90 percent to 97.5 percent of the profits arising from the participating business with the percentage depending upon the size of the mean participating fund.

Companies must keep separate accounts (in the sense of segregated funds) for accident and sickness policies and for policies whose reserves vary depending on the market value of a specified group of assets. Companies are not required to segregate annuity business.

Historically, life branch assets have been viewed as a corpus, backing the expectations of life branch policyholders as a whole. Yet Section 83 of the Act provides the following:

> "*Every company, notwithstanding anything to the contrary in any special Act or elsewhere, shall keep separate and distinct accounts of participating and nonparticipating business.*"

This section has been interpreted over the years in a limited sense as identifying premium and claims and allocating investment income, expenses and taxes in order to complete the "fund accounting" rather than in the fuller sense of the "prudent management" concept and the tailor-made investment strategies implied and enabled by segmentation.

Nevertheless, Section 83 in particular, as well as the Act as a whole, gives the federal Department of Insurance wide ranging power to ensure solvency on behalf of all policyholders and equitable treatment in the allocation of investment income, expenses and taxes on behalf of the participating policyholders. What assurance do we have of fair dealing with participating policyholders of a stock company in a segmented asset environment? Do similar principles apply in a mutual company to guide proper management and disclosure of the condition of nonparticipating business in which it has invested participating policyowner funds?

I believe that the first guarantee against inequitable treatment of any stock/policyholder interest lies in undertaking to develop and execute appropriate investment strategies. Proper recognition of the fiduciary aspect of participating business, in a stock or mutual company, requires that the investment strategy be first and foremost appropriate to the nature of that business. The expectation of shareholders (or the participating "owners" of a mutual company) of good financial management of their businesses extends this same observation to nonparticipating segments.

I suggest that the formation and execution of investment policy, including allocation of new asset opportunities to segments, should embody these five principles:

1. Participating or nonparticipating segments with substantially dissimilar liability characteristics, liquidity requirements, risk tolerance or income tax considerations may have different investment strategies.
2. Differences in investment strategy between segments should be justifiable by reference to material differences observed or postulated in their liability characteristics, liquidity requirements, risk tolerance or income tax considerations.
3. Participating customers should not be excluded from any major source of investment income consistent with their asset/liability management needs.
4. An allocation system is demonstrably fair if, whenever the investment strategies of two or more segments call for investment in a particular homogeneous class of assets, the segments share new investments of that class in any time period in proportion to the funds they have for investment in that period.
5. New investments may properly be structured and acquired to match specific asset/liability management needs of a particular segment.

I believe that these principles enable development of investment strategies and systems for allocating new assets which are flexible, practical, equitable and economical. They also provide a structural base for a rigorous link between strategic and tactical investment planning and daily operations.

The second guarantee lies in operating rules designed to prevent material inequity in the practical application of these high level rules. Large or unusual assets might be shared on a pro-rata basis between two or more segments, but the vast majority would be earmarked for a single segment. Residential mortgages seem to be the primary area calling for a specific procedure to avoid unfair discrimination in allocating members of a homogeneous asset class. Pursuit of appropriate strategies seems to require that investment management have the freedom to acquire and trade assets in most categories by direct reference to the investment strategy defined for each segment with due regard for principles of equity.

Equitable allocation of homogeneous asset classes can be tested quite simply after the fact by examining the average yield by type of assets acquired for each segment on a consistent basis over reasonable time periods. This would enable both internal policing and external scrutiny of allocation practices.

Another safeguard comes from proper management of the cash–flow available to invest by segment, the "fund accounts" in the authors' terminology. It seems clear that maintenance of orderly fund account balances by segment would be an outward and visible sign of a well-tuned cash forecast and forward commitment process. Excessive positive or negative balances would indicate a need to tighten up procedures or improve data or simply a need to liquidate some assets.

Perhaps the authors' response to discussions of their paper could indicate further how the allocation of investment opportunities and the coordination of supply and demand have been accomplished. I am particularly curious to know how the practice of separate investment program managers has evolved.

(AUTHORS' REVIEW OF DISCUSSION)

JAMES A. ATTWOOD AND CARL R. OHMAN:

We would like to express our thanks to Messrs. Loney, Sondergeld and Stewart for their written discussions. Their comments are very helpful in showing how the concept of segmentation is adapted to meet the different circumstances and needs of different companies. Particular thanks to Messrs. Loney and Stewart for providing a Canadian perspective and to Mr. Sondergeld for that of a United States stock company.

Equitable's segmentation has been in effect three years as of this writing. Viewed as a modification in the method of allocating investment income, segmentation has been fully operational for the three years, and the results are gratifying. Viewed more broadly as a major modification in structure and management of the general account, this has been more of an evolutionary process. The accounting and cash–flow management aspects of the segmentation plan emerged rather quickly when the plan was adopted and have operated effectively throughout. Investment policies and strategies for the five business segments and the management structure needed to carry out investment policy and strategy for each segment (including establishment of the necessary effective interaction between investment and insurance managers) have emerged more slowly, and are still evolving, but progress to date has been considerable. Some aspects of segmentation at Equitable, such as the role of the corporate segment in relation to corporate surplus, are not yet fully developed and the underlying concepts will no doubt be further modified as experience with segmentation emerges.

Again, we want to thank all of the many individuals who contributed to the preparation of this paper, either by helping to make segmentation work at Equitable and other companies or by commenting on the paper itself in one or more of its various stages of writing.