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TWO ENHANCEMENTS TO INVESTMENT-YEAR ALLOCATIONS OF INCOME

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ABSTRACT

Direct extension of current investment-year methods to small subgroups within lines of business presents a number of problems. Practical methods of application may cause inconsistencies among sales concepts, pricing, allocations, and profitability measurement. In this paper, two practical problems are addressed, and possible approaches to solving them are discussed.

The author hopes to catalyze discussion within the actuarial community regarding situations in which it might be more appropriate to use techniques proposed herein rather than current investment-year methods.

I. INTRODUCTION

Two problems are perceptible with respect to most versions of the investment-year method of allocating investment income. They are the following:

1. Allocations are not synchronized with either the funding/pricing or the planning behind the purchase of assets with given maturities. The results are (*a*) potential inequities, (*b*) inappropriate data for fund accounting (i.e., profitability studies), and (*c*) problems with matching of asset and liability maturities for special blocks of business (to protect against disintermediation).
2. While the investment-year methods tend to improve equity, they generally decrease the beneficial results of investment pooling obtained with the portfolio approach. (One exception is Christopher Chapman's computer model method [2].)

This paper focuses on conceptual approaches to solving these two problems. These problems are becoming increasingly important for companies utilizing investment-year results within the ordinary life line of business.

Sections II–V deal with the first problem: funding/pricing amortization techniques are not synchronized with current investment-year methods. The illustration of this problem will assume that one is dealing with allocations within one particular line of business for which extensive cash-flow knowledge is available. The idealized case might be for a group of specially designed pension plans for which the company also provides enrolled actuarial services and detailed cash-flow projections. On the other hand, it must be recognized that actuarial projections are generally a conglomerate of assumptions, any of which may fail to resemble emerging experience.

Section VI deals with the second problem: investment pooling with investment-year methods. This problem is better viewed on the total company, or total segmented portfolio, level. However, it may be applied within a line of business.

II. ASSET DISPOSALS UNDER CURRENT METHODS

Cash flow into a company (positive) and cash flow out of a company (negative) are divisible into various components. Positive cash flow includes the sales price or maturity value realized on a previously acquired asset. Under many methods any profit or loss arising from such assets is treated as an increase or decrease in current-year funds. The asset cost, against which the gain or loss is calculated, is recaptured in cash and assumed to be reinvested at current new-money rates. (A declining index system does this directly, while a fixed index system does this indirectly as part of the rate structure.) Current applications treat rollover of old investments as an investment opportunity, ignoring the product-related activities that take place (such as payment of death benefits, policy loans, reinvestment, and so on).

III. MATCHING ASSET DISPOSALS—PENSION FUNDING

Any group of people covered by a pension plan is either "open" and subject to replacement (and even growth) or "closed." If any open group is large and subject to growth, the funding of retirement benefits is such that the cash outflow for any given year will be less than the cash inflow for the year. The pension fund balance generally continues to grow until such time as the group is no longer open. Current investment-year methods were generally designed for, and work well with, such large groups.

The other extreme might be characterized as a closed group with a minimum of two members. With such a small group, funding for retirement benefits often uses specific techniques that spread the cost of each retirement over a particular period. The spreading does not have to be level as to dollar amount but may vary in proportion to salary.

Spreading of costs is a key funding technique. It implies periodic deposits to pay for a specific event. It does not imply FIFO (first in, first out) or LIFO (last in, first out) concepts developed for accounting. It also does not imply accumulation of money while cash outflows are covered by loans from an external source. Most current applications of investment-year methods work on the assumption that all principal that is repaid, or returned at asset disposal, is then reinvested at the then-current rate. If cash withdrawals are needed, they are treated as loans or negative investments at the then current rates. Hence funding is not synchronized with investment-year allocation methods.

The following illustration is based on a theoretical individual policy pension trust (IPPT) deposit fund that credits interest on an investment-year method. The ideas behind this simplistic example hold equally well for small-group pension plans and for ordinary insurance products (discussed in the next section).

Illustration: IPPT Deposit Fund

1. BASIC ACTIVITY AND EARNINGS

TABLE 1A

ACTIVITY ON EVERY 1/1, EXCLUDING ASSET ROLLOVER

1. Normal cost contributions of $100 in years $Y-2$ and $Y-1$
2. Interest credits
3. A benefit payment ($63) under Plan A that was fully anticipated before contributions were made in year $Y-2$

Year	Plan A			Others			Grand Total	Interest Rate
	Principal	Interest	Total	Principal	Interest	Total		
$Y-2$....	$100	....	$100	$900	....	$900	$1,000	.10
$Y-1$....	100 −63	$10	47	900	$ 90	990	1,037	.15
Y......	....	17.05	....	....	238.50	....	....	....

TABLE 1B

CALCULATION OF INTEREST CREDITED ON 1/1/Y IN TABLE 1A

1. Using an investment-year method
2. Assuming no asset rollover, the fixed-index* basis equals the declining-index† basis

Year	Funds			Interest Rate	Investment Income		
	Plan A	Others	Total		Plan A	Others	Total
$Y-2$.....	$100	$ 900	$1,000	.10	$10.00	$ 90.00	$100.00
$Y-1$.....	47	990	1,037	.15	7.05	148.50	155.55
Total	$147	$1,890	$2,037	....	$17.05	$238.50	$255.55

* Fixed-index is the method that freezes the historical funds and adjusts investment income by altering the investment income rates.

† Declining-index is the method that decreases the historical funds as the assets puurchased with those funds mature or are sold.

2. CURRENT SYSTEMS FOR HANDLING ASSET ROLLOVER

Assume that the $63 benefit was projected and methodically funded; that $30 of the Plan A deposit in year $Y - 2$ would mature on $1/1/Y - 1$; and that $3 of investment income would be earned by that same $30. With an additional $30 from year $Y - 1$ deposits, a total of $63 is available to pay the $63 benefit. Also assume that the actual asset rollover on $1/1/Y - 1$ was $30, exactly as projected.

TABLE 2A

A *Historical Record* OF ACTIVITY ON EVERY 1/1, INCLUDING ASSET ROLLOVER

YEAR	PLAN A				OTHERS			
	Principal	Interest	Rollover	Total	Principal	Interest	Rollover	Total
$Y-2$....	$100	....	....	$100	$900	....	....	$900
$Y-1$....	100 −63	$10	$30	77	900	$ 90	....	990
Y.......	....	17.20	....	....	....	239.85	....	....

TABLE 2B

CALCULATION OF INTEREST CREDITED ON 1/1/Y IN TABLE 2A, USING A TYPICAL *Declining Index System*

YEAR	FUNDS			INTEREST RATE	INVESTMENT INCOME*		
	Plan A	Others	Total		Plan A	Others	Total
$Y-2$.....	$ 97	$ 873	$ 970	.10	$ 9.70	$ 87.30	$ 97.00
$Y-1$.....	50	1,017	1,067	.15	7.50	152.55	160.05
Total	$147	$1,890	$2,037	....	$17.20	$239.85	$257.05

* In all examples, this will be the result of multiplication of the fund for the year by the interest rate for the year.

Note that the rollover increases the total interest received from that calculated in Table 1B above. Also note how the result of the $30 asset rollover is spread to all plans.

TABLE 2C

CALCULATION OF INTEREST CREDITED 1/1/Y, USING A TYPICAL *Fixed-Index System*

YEAR	FUNDS			INTEREST RATE	INVESTMENT INCOME		
	Plan A	Others	Total		Plan A	Others	Total
$Y-2$.....	$100	$ 900	$1,000	.1015*	$10.15	$ 91.35	$101.50
$Y-1$.....	47	990	1,037	.15	7.05	148.50	155.55
Total	$147	$1,890	$2,037	....	$17.20	$239.85	$257.05

* $0.1015 = 0.03(0.15) + 0.97(0.10)$.

Again note how the result of the $30 asset rollover is spread to all plans.

3. PROPOSED CHANGE TO CURRENT SYSTEMS

Messrs. Matz and Peters [5] appear to be among the few who allude to the following concept: *If future negative cash flow is anticipated from current deposits, then future asset rollover coincident with such cash outflow might first be assigned to cover that outflow.* So far in this set of illustrations the outflow is being treated as a negative fund receiving the then-current new-money rate. This means that a segregation of "planned" (as opposed to "opportunity") rollover is necessary.

Assuming an exact matching of assets and liabilities, one might use all of the $30 of rolled-over assets to help fund the $63 benefit. This implies that the $30 was originally purchased with Plan A money. Therefore, the interest allocations in Table 2A ($17.20 to Plan A and $239.85 to others) change to $18.55 and $238.50.

TABLE 3A

CALCULATION OF INTEREST CREDITED ON 1/1/Y, UNDER ABOVE VIEWPOINT, USING A *Declining-Index Method*

Year	Funds			Interest Rate	Investment Income		
	Plan A	Others	Total		Plan A	Others	Total
Y−2.....	$ 70	$ 900	$ 970	.10	$ 7.00	$ 90.00	$ 97.00
Y−1.....	77	990	1,067	.15	11.55	148.50	160.05
Total	$147	$1,890	$2,037	....	$18.55	$238.50	$257.05

TABLE 3B

CALCULATION OF INTEREST CREDITED ON 1/1/Y, UNDER ABOVE VIEWPOINT, USING AN *Adjusted-Fixed-Index Method*

Year	Funds			Interest Rate	Investment Income		
	Plan A	Others	Total		Plan A	Others	Total
Y−2.....	$ 70	$ 900	$ 970	.10	$ 7.00	$ 90.00	$ 97.00
Y−1.....	77	990	1,067	.15	11.55	148.50	160.05
Total	$147	$1,890	$2,037	....	$18.55	$238.50	$257.05

In Table 3B, since there is no "extra" asset rollover, the tabular calculation will be exactly the same as in Table 3A (i.e., utilizing a change in fund). If there had been extra asset rollover, it could have been handled by a change in rates, exactly as the current fixed-index method now handles all asset rollover.

This procedure may be viewed as a cross between the current fixed- and the current declining-index systems illustrated in subsection 2 above. the result is a type of segmentation within a line of business.

IV. MATCHING ASSET DISPOSALS—INDIVIDUAL POLICY PRICING

Pension funding and individual policy pricing have commonalities. Uncertainty as to timing and/or amount of cash outflow may apply to both. The techniques of probabilities and averages can be employed to price for a group of individual policies in the aggregate.

The pricing actuary may perform a calculation for a group of 1,000 or more similar policies at the same time, calculate an average cost, and test that average cost as the periodic premium for each policy. For the group, the expectation might be that over the years (*a*) total premium income decreases; (*b*) annual investment income gradually increases, then declines; (*c*) expenses may have various patterns in early years but generally level or decrease in later years; and (*d*) various types of benefit payments continue to increase before declining to zero. The composite result is often many years of positive cash flow followed by years of negative cash flow.

An underlying assumption is that previously accumulated principal is available to cover anticipated cash outflow. It is not assumed that previously accumulated principal remains invested at its own rate while outflow is covered by loans at current rates from an external source. This eventually presents the same problem as that faced by the pension actuary.

If the solution used in Section III, 3, is chosen (i.e., first assigning asset rollover to cover anticipated cash outflow), a number of interesting questions arise. For instance, how does one define "anticipated"? This might lead to extremely complex calculations regarding "actual" versus "expected." On the other hand, simplistic assumptions might be employed. One extreme possibility is that all benefit payments might be classified as "expected" simply because they were priced for by the actuary, regardless of incidence. Such an assumption could be applied consistently over all years, even when cash flow was positive. There is no single correct solution, but it is important to recognize that alternatives are available.

V. MATCHING ASSET DISPOSALS—FINANCIAL ALLOCATION

The actuary must be concerned with properly relating gain or loss to its source. In a mutual company a prime objective is equity. In any company a prime function is profitability analysis or fund accounting.

The previous illustrations show how, under current methods, in times of rising interest rates, investment income can be taken from one pension plan and distributed to others. A comparable situation occurs during times of declining interest rates. When interest rates are not constant, (*a*) one segment can profit at the expense of another, and (*b*) over a period of years the actuary cannot receive a true picture of profitability from any one segment.

An alternate view of the financial allocation problem arises from current attempts at asset/liability matching. A step forward was taken by those companies instituting a segmented-portfolio method of accounting, whereby specific assets are purchased and earmarked for special blocks of business that (*a*) have unique investment needs and (*b*) are large enough to make unique investment management economically feasible. What can be done for blocks of business that have unique needs but are not large enough to warrant separate portfolios?

Suppose that, for each such block, the cash flow is known and specific assets are purchased to fund future benefits. How can exact fund accounting be done without the ability to allocate both the investment income and the principal obtained by asset rollover to the funds generating the specific assets?

One technique is to adjust current investment-year allocation methods to distinguish asset rollover that is used to cover cash outflow instead of being reinvested. This is a general concept (specifically illustrated above) that may be refined over the years to match other refinements in asset/liability matching. Perhaps another category will be distinguished: unplanned asset rollover generated to fund large unplanned cash-flow problems of a specific product (i.e., ordinary life policy loans).

VI. INVESTMENT POOLING

Christopher Chapman [2] has identified the basic criteria of a good allocation method. He would strive for "the stability and diversity of pooled investments which result from all lines sharing in the return of a common investment pool." Such pooling is a strong point of portfolio interest allocation. On the other hand, investment-year systems generally pool only within each investment generation. A problem is that the yield rate for any generation may swing more sharply up or down than if the risks are pooled over the entire portfolio. Other related problems arise due to capital gains/losses. Assume that a large investment in year $Y - 5$ becomes extremely profitable (the same point applies if earnings are reversed). Instead of earning an anticipated 8 percent, it is now earning at a rate in excess of 30 percent. Some of the questions that come up are the following:

1. If the asset is sold, should not the gain adhere to the $Y - 5$ generation, because it replaces their expectation of yield? If so, should the gain be spread over future years in order to avoid radical fluctuations in yield? If so, how many years?
2. If the goal is to have a zero net capital gain in any tax year, then items from other generations must be sold at a loss. What is the equitable treatment of the various generations involved? This question is especially troublesome if the sale at a loss would not have occurred otherwise.
3. If the investment-year-method convention is that bonds or mortgages going into default become nonannualized, and the resulting losses are shared by all generations, then should not unusually large capital gains be spread across the investment years?

I propose that each generation's initial investments be assigned a basic long-term yield rate (for the annual statement it could be estimated). The long-term rate assigned to each generation is of utmost importance and should be carefully chosen. The choice should not be simply the average new-money rate experienced for the period but should represent the average anticipated yield over the long haul. This implies the anticipation of capital gains from equity components. Since one cannot allocate more than the total income received, any misallocations implied by such assumptions eventually must be corrected to match actual receipts.

I further propose that this base rate be adjusted in each subsequent year for two reasons: to recognize asset rollover/reinvestment, and to allocate pro rata portfolio excess income/loss arising from investments purchased in all years. Such excess would be defined in terms of actual versus expected yield, but allocation would be based on yield and/or funds. The pro rata mechanism is then the basis for the pooling of risks due to erratic yields and capital gains/losses. The mechanism would balance the total income allocated to the total actually earned.

A side benefit of this approach is a procedure for allocating income on short-term assets. Because of increased policy loan activity and disintermediation risks, life insurance companies are attempting to shorten average maturities and maintain larger balances of short-term assets. Hence the allocation of income from short-term assets is becoming an issue. This approach would spread the difference in yield between long- and short-term assets over all generations.

VII. CONCLUSION

This paper has discussed two problems with, and presented two possibilities for, investment-year allocation methods:

1. Segmentation of rollover of assets into "planned" and "opportunity" rollover, with separate treatment in the income allocation process.
2. Investment pooling (including capital gains/losses) across investment years by use of a base yield rate adjusted by (*a*) asset rollover and (*b*) pro rata allocation of the difference between actual and expected yield.

The first concept might initially be utilized in allocations within a line of business that is well-suited for projection (e.g., a group of pension plans for which ERISA calculations and projections are being performed). As a practical matter it may be easier to apply the second concept at the total company level first, and later to produce allocations within lines of business.

The intent was to initiate discussions on some concepts that are becoming more and more relevant. Two of the emerging areas that involve these concepts are (*a*) asset/liability matching and (*b*) lost investment opportunity on a marginal basis. The latter attempts to assess costs equitably when actual activity is other than expected. This is a recent concept that is not supported by either a portfolio allocation method or an investment-year method that does not differentiate between actual and expected.

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