Actuarial Supplement to

The Retirement Shares Plan: A Breakthrough in Retirement Plan Design

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1. Introduction

The concept of a variable benefit retirement plan in which the plan pools all demographic risks and passes investment risk and reward to the individual has existed for many years. Duncan discussed the concept in 1952.[1] In 1953, the Internal Revenue Service issued a revenue ruling[2] stating that a plan that otherwise meets the qualifications of the Code and provides a benefit in which the dollar amount payable varies based on the market value of the assets from which the benefit is paid may still be definitely determinable. In 1963, Smith and McKelvey[3] proposed a method of valuing variable benefit plans with an innovative treatment of unfunded liabilities.

The concept is relatively simple. A plan sponsor funds deferred annuity benefits based on the assumption that plan assets will always earn a specific rate of return, h, referred to as the hurdle rate, the assumed interest rate or (in the case of the Retirement Shares Plan) the Share Interest Rate. To the extent that investment earnings are different than the hurdle rate, benefits are adjusted in subsequent periods to offset the investment gain or loss.

The adjustment to the benefit to offset the investment gain or loss is:

$$B_1 = B_0 \times (1 + i_1) / (1 + h)$$

where B_0 is the initial benefit payment, B_1 is the adjusted benefit payment and i_1 is the actual rate of return on plan assets between time 0 and 1. If the frequency of benefit payments and benefit adjustments is the same, i.e., monthly payments and adjustments, this adjustment in benefits will precisely offset any investment gain or loss. If the frequency of payment is greater than the frequency of adjustment, i.e., monthly payments and annual adjustments, a small investment gain or loss may occur with respect to assets backing benefits in pay status. However, no gain or loss will occur with respect to benefits not yet in pay status. For the balance of this discussion we assume the frequency is the same or, if not, that the resulting gain or loss is immaterial, or that investment earnings are adjusted to reflect this difference.

[1] "A Retirement System Granting Unit Annuities and Investing in Equities," Robert M. Duncan, *TSA* 1952, Vol. 4, No. 9.

[2] Revenue Ruling 185, 1953-2.

[3] "A Proposed Method of Valuing Variable Benefit Retirement Plans," Franklin C. Smith and Chandler L. McKelvey, *TSA* 1963, Vol. 15, Pt. 1, No. 43.

2. Liability Measurement in a Variable Benefit Plan

A variable benefit plan provides a series of benefit payments to an individual: B_0, B_1, B_2, B_3 …B_n. The plan has a hurdle rate of h. B_0 is defined based on the plan's provisions at the measurement date and is known. Subsequent benefit payments are determined by the formula:

$$B_n = B_{n-1} \times (1 + i_n)/ (1 + h)$$

where i_n is the actual rate of return on plan assets during the period between payment n-1 and payment n. Payments are made at the beginning of each period.

The asset needed to fund this benefit at time 0 regardless of the actual return on plan assets or the rate or return on fixed income investments is:

$$A_0 = B_0 \times (1 + v^1 + v^2 + v^3 + \ldots + v^n)$$

where v = 1/(1+h). Furthermore, the asset needed at any subsequent period is:

$$A_j = B_j \times (1 + v^1 + v^2 + v^3 + \ldots + v^{n-j})$$

This is demonstrated as follows. The actual return on assets varies each period and is expressed as i_t where t represents the time period between payments t-1 and t.

Assets at t = 1 are:

$A_1 = (A_0 - B_0) \times (1 + i_1)$ then substituting for A_0,

$A_1 = (B_0 \times (1 + v^1 + v^2 + v^3 + \ldots + v^n) - B_0) \times (1 + i_1)$ next simplifying,

$A_1 = (B_0 \times (v^1 + v^2 + v^3 + \ldots + v^n)) \times (1 + i_1)$ pulling out 1/(1 + h),

$A_1 = (B_0 \times (1 + v^1 + v^2 + \ldots + v^{n-1})) \times (1 + i_1)/(1 + h)$ and simplifying,

$A_1 = (B_1 \times (1 + v^1 + v^2 + \ldots + v^{n-1})$

By repeating this procedure we show that:

$A_j = B_j \times (1 + v^1 + v^2 + v^3 + \ldots + v^{n-j})$ and in particular,

$A_n = B_n$

The initial asset, A_0, is precisely sufficient to fund all benefit payments regardless of the actual return on assets. While this may seem amazing at first glance, it is necessary because the periodic adjustment in benefits, $B_n = B_{n-1} \times (1 + i_n)/ (1 + h)$, was defined in order to accomplish this intended result.

3. The Accumulated Benefit Obligation of Variable Plans

The accumulated benefit obligation determined pursuant to FAS 87 is the sum of A_0 over all plan participants and is independent of yields on current fixed income investments. A_0 is the reserve necessary to provide the benefits regardless of investment returns and is thus the amount needed to settle the obligation. The same value can be calculated by assuming a discount rate based on current high-quality fixed-income securities while assuming that the underlying assets will earn the same rate of return as the discount rate, thus resulting in an increasing stream of benefits if the discount rate is greater than the hurdle rate, or a decreasing stream if the discount rate is less than the hurdle rate.

Bader and Gold[4] state a principle of financial economics that "a liability is valued at the price at which a reference security trades in a liquid and deep market. A reference security (or portfolio) has cash flows that match the liability in amount, timing, and probability of payment." The reference portfolio for a variable benefit plan at time n is ***any portfolio*** that has a current market value equal to A_0 (summed over all participants). The composition of the portfolio is irrelevant, since the amount of future payments is dependent on the actual return of the portfolio.

In a Retirement Shares Plan, however, the allocation of assets to the various sub-portfolios is critically important. The participants have the ability to associate their accrued benefit with specific portfolios. In order to avoid investment risk, the sponsor must keep the plan fully funded and assets allocated properly to avoid a mismatch of assets and liabilities.

The sponsor should fund the full reserve (determined at the hurdle rate) when benefits accrue, allocate this funding to the sub-funds selected by participants and promptly re-allocate assets based on the appropriate reserves (also determined at the hurdle rate) when participants exchange shares. A failure to promptly fund accruals or re-allocate exchanges will not violate ERISA, but will expose the plan sponsor to investment risk with respect to the mismatched assets and liabilities.

Variable benefit plans will experience demographic gains or losses. These gains or losses will produce a surplus or unfunded liability. In order to avoid investment risk with respect to this surplus or unfunded liability, the sponsor should adjust the annual funding to keep assets and liabilities in balance.

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[4] "Reinventing Pension Actuarial Science," Lawrence N. Bader and Jeremy Gold, *The Pension Forum*, 2003.

4. Prevalence of Variable Benefit Plans

Qualified employer-sponsored variable benefit retirement plans are relatively rare in the United States. Despite the obvious financial benefits to the plan sponsor, the traditional variable benefit plan suffers a flaw—all participants are subjected to the same investment risk, and the risk level is determined by the plan sponsor, not the participant who bears the risk. In significant bear markets such as 1973-74 and 2000-02, benefits in variable plans decreased significantly for all participants, including retirees. Volatile benefits for retirees are generally unacceptable to retirees in particular, but also to most plan sponsors.

Sponsors of variable benefit plans have mitigated this risk by designing plans that are partially variable and partially fixed. Although all participants are still exposed to the same degree of risk, the total volatility of benefits is lessened since part of the benefit is fixed. However, to the extent any of the benefit is fixed, the sponsor is exposed to investment risk and interest rate risk with respect to these benefits.

The Retirement Shares Plan specifically addresses this flaw by allowing the participants to allocate their benefits to the classes of shares available. Thus a risk-averse retiree can be assured of a relatively stable if not totally fixed benefit, while other participants who are less risk-averse can have their benefit backed by a diversified or equity portfolio.