A PUBLIC POLICY PRACTICE NOTE

Exposure Draft

Variable Annuity Plans

December 2015

Developed by the Pension Committee
of the American Academy of Actuaries

AMERICAN ACADEMY *of* ACTUARIES

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The Committee gratefully acknowledges the contributions of former Academy Senior Pension Fellow Donald E. Fuerst.

AMERICAN ACADEMY *of* ACTUARIES

1850 M Street N.W., Suite 300
Washington, D.C. 20036-5805

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Introduction

This practice note is not a promulgation of the Actuarial Standards Board (ASB), is not an actuarial standard of practice, is not binding upon any actuary, and is not a definitive statement as to what constitutes generally accepted practice in the area under discussion. Events occurring subsequent to the publication of this practice note may make the practices described in the practice note irrelevant or obsolete.

This practice note was prepared by the Pension Committee of the American Academy of Actuaries (committee) to provide information to actuaries on current and emerging practices for measuring obligations of defined benefit pension plans that include variable annuity benefits. Cash balance plans that credit market rates of return are closely related, but are not addressed in this practice note. The intended users of this practice note are the members of actuarial organizations governed by the actuarial standards of practice promulgated by the ASB.

This practice note addresses several topics that have not yet been formally and explicitly addressed by the Internal Revenue Service (IRS), the Department of Labor (DOL), the Financial Accounting Standards Board (FASB) and the ASB. There is no assurance that such bodies would analyze these topics in the same manner as this practice note.

Measurements of defined benefit pension plan obligations include calculations that assign plan costs to time periods, actuarial present value calculations, and estimates of the magnitude of future plan obligations. The application of the information contained herein is intended to cover qualified and non-qualified plans, and governmental and non-governmental plans for which the actuary is subject to Actuarial Standard of Practice No. 4, *Measuring Pension Obligations and Determining Pension Plan Costs or Contributions* and Actuarial Standard of Practice No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations*.

This practice note addresses issues actuaries should consider when setting assumptions, or providing advice on setting assumptions, for funding (as permitted by law), and for financial accounting.

This practice note is intended to be illustrative and spur professional discussion on this topic. Other reasonable methodologies currently exist and new ones likely will evolve in the future.

The committee welcomes any suggested improvements for future updates of this practice note. Suggestions may be sent to the pension policy analyst of the American Academy of Actuaries at 1850 M Street NW, Suite 300, Washington, DC 20036 or by emailing pensionanalyst@actuary.org.

Variable Annuity Plan

A variable annuity plan is a pension plan in which the periodic benefit payable to a participant fluctuates based on a formula defined in the plan document.[1] The formula may define a change in the entire accrued benefit or a portion of the accrued benefit. If the formula change applies to less than the entire benefit, the plan has a bifurcated formula with both fixed and variable components. The fixed component of the benefit may be measured using traditional techniques. This practice note addresses only the variable component of the benefit.

The variable benefit formula may apply to all plan participants or only a designated subset of plan participants. This practice note addresses only those benefits accrued under the variable formula.

A variable annuity plan is usually a career accumulation plan in which the plan document defines the amount of benefit that accrues to a participant each year. The accrual formula could be based on current compensation (e.g., 1% x pay) or a fixed accrual ($X per year of service). The accrual for the plan year is generally not dependent on future changes in compensation, as it would be in a final average compensation plan. The annual accrual and the total accrued benefit are expressed as an annual amount payable at Normal Retirement Date (NRD) to the participant in the form of a life annuity. The annuity at NRD could be a single life annuity, or any of the other common forms of annuity typically available in a defined benefit plan.

The periodic adjustments in the plan benefit usually occur annually, but can also take place on a monthly, quarterly, or semi-annual basis. Monthly adjustments are common in insured variable annuity plans offered by some insurance companies. Annual adjustments are common in qualified pension plans sponsored by employers. Most illustrations in this practice note assume annual adjustments, although a "pure" variable annuity plan (defined below) would have adjustments made immediately prior to each payment.

Periodic adjustments generally apply to all accrued variable benefits regardless of the participant's status. Thus variable benefits are adjusted periodically for active members, terminated vested members, and retired members. Some variations of variable annuity plans may adjust benefits differently for various membership classes. For example, a fixed annuity plan could offer a variable annuity option at retirement or, alternatively, a variable annuity plan could provide a fixed benefit option at retirement.

[1] Treasury Regulation Section 1.411(a)(13)-1(d)(6) defines a "variable annuity benefit formula" as "any benefit formula under a defined benefit plan which provides that the amount payable is periodically adjusted by reference to the difference between a rate of return and a specified assumed interest rate."

The plan document defines the exact formula for the periodic adjustment. The most common formula first defines an assumed investment return, often referred to as the hurdle rate. The hurdle rate is expressed as an annual return, typically 3%, 4%, or 5%. Theoretically, any percentage could be used, but there are legal and practical limitations that usually confine the hurdle rate to not less than 3% (to comply with minimum distribution regulations) and seldom more than 6% or 7% (to avoid declining benefits). The hurdle rate is defined by the plan document and it is an integral part of the accrued benefit.

Periodic benefit adjustments are generally defined by comparing the hurdle rate to the actual return on a portfolio of assets for the adjustment period. The plan document generally defines the methodology for determining the actual return on assets. In qualified plans, the adjustment period is generally the plan year. The portfolio of assets for which the actual return is measured could be:

- The entire plan trust
- A designated subaccount of the plan trust
- A specific investment index (e.g., the S&P 500)
- A specific investment fund (e.g., a mutual fund or a separate account of an insurance company or investment firm)

Assuming a plan that pays and adjusts benefits annually, the plan would generally define the annual adjustment of benefits for a participant as follows (monthly benefit payments and adjustments are discussed below under *Variations*):

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

where B_n is the accrued annual benefit as of the first day of the plan year, i_n is the actual rate of return on the portfolio of assets during the period between the beginning of year $n-1$ and the beginning of year n (i.e., for the $n-1$ plan year), and h is the hurdle rate.[2] If $i_n = h$ then $B_n = B_{n-1}$. The formula makes the name "hurdle rate" clear, as the actual return must equal or exceed the hurdle rate to avoid a decline in the benefit.

The formula above produces the change in benefit ignoring additional accruals. For an active participant who is accruing benefits, the formula reflecting the benefit accrual for the plan year is as follows:

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

where INC_{n-1} is the incremental benefit accrual for service during the year under the plan formula (e.g., 1% x annual pay or $X, as in the prior examples). A variable annuity plan

[2] Some plans may define the adjustment as: $B_n = B_{n-1} \times (1 + i_n - h)$. This variation has some theoretical basis for plans that pay monthly benefits but determine the adjustment annually. The slightly larger adjustment compensates for the gains that develop if the actual return is higher than the hurdle rate.

makes no promise concerning a fixed or guaranteed level of benefits other than that benefits already accrued will not vary between scheduled adjustment dates. Benefits could theoretically go to zero if the portfolio of assets experienced a -100% rate of return (and there were no additional benefit accruals).

A pure variable annuity benefit is one in which the plan sponsor can be fully insulated from gains or losses due to investment performance. A pure variable annuity plan would have the following features:

- benefit adjustments are made immediately prior to each payment for benefits in pay status and at least annually for benefits not in pay status; and
- benefit adjustments are based solely on the performance of the assets backing the obligation during the period between benefit payments.

The plan sponsor may be fully insulated from investment gains and losses if:

- benefits are fully funded as they accrue and credited with investment gains or losses from the time they accrue; and
- demographic gains/losses are fully funded as they occur.[3]

The Mathematical Consequence

The appendix provides a mathematical demonstration for a variable annuity showing that the assets needed to provide all future benefits are independent of both market interest rates and the portfolio of assets that back the benefit. Thus, it is irrelevant whether the assets backing the benefit are composed of fixed income or equities. To put this differently, if a variable benefit is evaluated using the hurdle rate and an appropriate mortality assumption and the present value is $1 million, the present value is not affected by whether the $1 million is invested in bonds, equities, or even cash; the amount is expected to be sufficient regardless, with any variation related only to mortality experience different from assumed. The asset allocation will affect how the benefit changes in the future, but it does not affect the present value needed to provide those benefits.

There is an important corollary to this rule. If the valuation assumes that benefits will be indexed based on a specific return on assets, then to calculate the initial assets needed to provide the projected benefits, the projected benefits must be discounted using the same specific return on assets. The magnitude of the assumption is not relevant, but the return on assets assumption and the discount assumption must be consistent to determine the necessary starting assets.

[3] In theory, fully funding a demographic gain would require subtracting assets from the fund. In reality, this is generally impractical, so instead excess assets resulting from a gain would be offset against the cost of subsequent accruals or demographic losses.

This corollary may also be expressed with the discount rate set first. If the valuation assumes projected benefits will be discounted at a specific rate, then to calculate the initial assets needed to provide the projected benefits, the projected benefits must be assumed to change based on asset returns equal to the discount rate. Any other asset growth assumption will result in a present value that is either inadequate or excessive to provide the projected benefits.

Variations on Pure Variable Design

A pure variable design can be modified in a variety of ways. These modifications include:

Benefit payment frequency different from benefit adjustment frequency: The most common deviation from the pure variable model is monthly payment of benefits with only annual adjustment of benefit amounts. To facilitate administration, the actual change in benefit amounts is usually delayed a month or more to allow the administrator to determine these adjustments and implement the change. For a calendar year plan, the actual return on the portfolio of assets is generally determined for the calendar year and benefit adjustments are typically implemented in February or March of the following year, usually without any retroactive adjustment.

Separate non-variable floor benefit formula: A plan may provide the better of a variable benefit or a fixed "floor" benefit. This floor benefit may be set based on the same formula as the variable benefit (e.g., both fixed and variable formulas are 1% of pay for each year of service). Alternatively, it may be set at a different (typically lower) level to provide some limit on the downward adjustment to the benefit in the event of adverse investment experience (e.g., the benefit is the greater of a variable benefit of 1% of pay or a fixed benefit of 0.9% of pay). The floor benefit generally applies to the benefit in total, rather than applying separate floors to each year's accrual.

Grandfathered frozen benefit: When a plan is converted to a variable plan, the change is usually made prospectively, affecting only future accruals (the so-called A+B transition). However, it is possible to apply the variable adjustment to some or all of the accrued benefit as well. In such case, for U.S. qualified plans the accrued benefit must be protected as a minimum, in which case it acts as a floor benefit described above. Over time, as additional benefits are earned, the floor benefit is likely to become less significant (this is known as "wearaway"). On the other hand, for a participant who terminates employment shortly after the conversion, the floor benefit promise may continue to have significant value.

If the variable benefit plan is considered a statutory hybrid plan (i.e., a U.S. qualified plan and the hurdle rate is less than 5%), the frozen accrued benefit may need to be maintained without wearaway in addition to all prospective variable benefits. In this case, most sponsors will likely conclude that the A+B transition approach is the only practical option.

Limit on the annual benefit adjustment: The amount the benefit can be reduced or increased in any given year may be limited to a specified percentage (e.g., 5%). Any adjustment beyond this amount may either be carried forward to future years, or be treated as a plan gain or loss. Similarly, the annual adjustment may be smoothed over multiple years, rather than being recognized all at once.

Conversion from variable to fixed annuity at retirement: The plan may limit the variable benefit adjustment to active and terminated vested participants, permitting or requiring the conversion of the variable benefit to a fixed benefit at retirement. If prevailing market interest rates at which the benefit can be effectively annuitized are close to the hurdle rate, this conversion should have minimal cost. If market rates differ from the hurdle rate, the conversion will have a cost that must be borne by (i) the participant (in the form of a benefit adjustment); (ii) the sponsor (in the form of an increase/decrease in plan costs); or (iii) other participants (in the form of an adjustment to the annual increase/decrease in benefits). Where some group of participants is excluded from the annual benefit adjustment, assets backing the benefits of those participants are typically excluded when calculating the asset return used to determine the annual benefit adjustment. Any such exclusion would presumably have to be specified in the plan document.

Conversion from fixed to variable annuity at retirement: The plan may offer variable annuities as an optional form of payment at retirement (e.g., active participants may accrue fixed benefits, but be permitted to select a variable benefit at retirement). The conversion to a variable benefit can be made without gain or loss to the plan if the fixed benefit is converted to its equivalent lump sum value at current market rates and then the lump sum value is converted to a variable annuity using the variable hurdle rate.[4] If current market rates are close to the hurdle rate, the adjustment in the annuity amount may be small. However, when market rates are significantly different than the hurdle rate, the adjustment will be large. Alternatively, the plan may define a fixed basis for conversion from a fixed benefit to a variable benefit, but this structure introduces the potential for gains or losses and possible arbitrage. This approach may also distort the relative value of various optional forms of benefit.

This is not an exhaustive list of possible variations. When designing a new variable annuity plan, plan sponsors and their advisers should consider each variation carefully to determine the effects of deviation from the pure model. Whether the IRS would find all of these design variations acceptable for a U.S. qualified plan under current statutes and regulations is uncertain. In particular, benefit indexing that is not based on a "market rate of return" as defined by the current Treasury regulations may be problematic.

[4] As discussed below and in the appendix, the value of a pure variable benefit is usually calculated using the hurdle rate, thus the conversion from lump sum to equivalent annuity would use the hurdle rate.

Guidance from Actuarial Standards of Practice

Actuarial Standard of Practice No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations* (ASOP 27),[5] and Actuarial Standard of Practice No. 4, *Measuring Pension Obligations and Determining Pension Plan Costs or Contributions* (ASOP 4),[6] provide guidance to the actuary on selecting certain assumptions and on measuring the associated obligation that are essential to properly valuing variable annuities. Although neither ASOP 27 nor ASOP 4 specifically addresses variable annuities, they contain provisions that can aid the actuary.

Section 3.2 of ASOP 27 is particularly helpful and is reproduced here:

> 3.2 Identification of Economic Assumptions Used in the Measurement—The actuary should consider the following factors when identifying the types of economic assumptions to use for a specific measurement:
>
> a. the purpose of the measurement;
>
> b. the characteristics of the obligation to be measured (measurement period, pattern of plan payments over time, open/closed group, materiality, volatility, etc.); and
>
> c. materiality of the assumption to the measurement (see section 3.5.2).
>
> The types of economic assumptions used to measure obligations under a defined benefit pension plan may include inflation, investment return, discount rate, compensation increases and other economic factors such as Social Security, cost-of-living adjustments, rate of payroll growth, growth of individual account balances, and variable conversion factors.

Similarly, section 3.3 of ASOP 4 provides:

> Purpose of the Measurement—When measuring pension obligations and determining **periodic costs** or **actuarially determined contributions**, the actuary should reflect the purpose of the measurement.

Several purposes of the measurement are considered in this practice note, including funding calculations, financial disclosure, and determining actuarial equivalence. The unique characteristics of the variable annuity obligation in conjunction with the purpose of the measurement are integral to valuing variable annuities.

Section 3.12 of ASOP 27 deals with the consistency of material economic assumptions selected by the actuary and generally requires that all such assumptions for a particular measurement be consistent. In some cases the actuary will be required to use a prescribed

[5] Revised September 2013.
[6] Revised December 2013.

assumption. Regarding this, Section 3.12 of ASOP 27 provides that "Assumptions selected by the actuary need not be consistent with prescribed assumptions, which are discussed in section 3.13."

Based on consideration of the purpose of the measurement and the characteristics of the variable annuity, some actuaries believe it may be necessary to select economic assumptions that are consistent with the prescribed assumption in order to obtain an appropriate result. The primary basis for this conclusion is that the prescribed assumption represents a return on an asset portfolio (albeit, a theoretical portfolio) and that any assumption regarding benefit indexing based on portfolio returns should be based on the same assumption. The rationale for this argument is discussed in more detail in the next section.

The section titled "Valuing Variable Annuity Plan Variations" discusses features that may be incorporated within a variable annuity plan that may complicate the measurement of the associated obligation.

Section 3.5.3 of ASOP 4 provides guidance that is relevant in valuing these features:

> **Plan Provisions that are Difficult to Measure**—Some **plan provisions** may create pension obligations that are difficult to appropriately measure using traditional valuation procedures. Examples of such **plan provisions** include the following:
>
> a. gain sharing provisions that trigger benefit increases when investment returns are favorable but do not trigger benefit decreases when investment returns are unfavorable;
>
> b. floor-offset provisions that provide a minimum defined benefit in the event a **participant's** account balance in a separate plan falls below some threshold;
>
> c. benefit provisions that are tied to an external index, but subject to a floor or ceiling, such as certain cost of living adjustment provisions and cash balance crediting provisions; and
>
> d. benefit provisions that may be triggered by an event such as a plant shutdown or a change in control of the plan sponsor.
>
> For such **plan provisions**, the actuary should consider using alternative valuation procedures, such as stochastic modeling, option-pricing techniques, or deterministic procedures in conjunction with assumptions that are adjusted to reflect the impact of variations in experience from year to year. When selecting alternative valuation procedures for such **plan provisions**, the actuary should use professional judgment based on the purpose of the measurement and other relevant factors.

Traditional Liability Measurement of Pure Variable Benefits

The plan sponsor's commitment in a pure variable annuity plan can be thought of as the promise to fund a lifetime annuity under the assumption that plan assets always earn a return equal to the hurdle rate. If the sponsor funds the full value of the benefits that accrue each year, the benefit obligation will increase or decrease based on actual investment experience. If investment experience matches the hurdle rate, then the plan benefits are not adjusted and the assets will be sufficient to precisely cover all benefits (assuming other underlying assumptions—particularly mortality[7]—are met).

If the assets earn more than the hurdle rate, the benefits are adjusted upward by the same percentage difference so that the benefit obligation increases in lockstep with the assets. If the assets return less than the hurdle rate, the benefits are adjusted downward so that the benefit obligation decreases in lockstep with the assets. Investment gains and losses do not create surplus or unfunded liabilities; however, as noted, other non-investment experience gains or losses may lead to a surplus or deficit. If the sponsor adjusts contributions to account for the non-investment gains or losses as they emerge, assets and liabilities will remain in balance.

The sponsor's obligation is also independent of market interest rates. Because the obligation is tied directly to the performance of the portfolio of assets, changes in market interest rates have no effect on the sponsor's obligation. This is demonstrated mathematically in the appendix. Note that the benefit obligation described in the appendix is general and applies to both an accrued benefit and the annual incremental accrual of the benefit.

Traditionally, actuaries have often valued variable benefit plans by simply valuing a level annuity equal to the current nominal benefit (B_0) at the hurdle rate. The sponsor's obligation can be thought of as the amount needed to fund a level annuity at the hurdle rate. Any investment gains or losses adjust the actual benefits payable to the participant. If there are other gains or losses (e.g., mortality), the sponsor funds these as they emerge. Under the traditional method, the actuary would define the liability at time $t = 0$ of a benefit in pay status as:[8]

$$L_0 = B_0 \times (1 + v^1 + v^2 + v^3 + \ldots + v^{n-1})$$

[7] Other potential sources of gain or loss, such as early or late retirement, can be eliminated by providing actuarially equivalent benefits in those contingencies (with equivalence determined using the hurdle rate).

[8] In all demonstrations in this practice note, mortality is omitted to simplify the demonstration. In practice, the probability of survivorship is applied to all benefit amounts, but this has no effect on the conclusions demonstrated herein.

where $v = 1 / (1 + h)$ and n represents the number of years that payments are expected to be made.

If the actual assets at time $t = 0$ (A_0) are not equal to L_0, the plan has a surplus or deficit. If there is a deficit, the deficit is equal to U_0 where:

$$U_0 = L_0 - A_0$$

U_0 is the amount needed at time $t = 0$ to fully fund the plan. If this amount is not immediately funded, but is rather amortized over future years, the balance of the unfunded liability will grow with the rate of return on assets.[9]

As discussed above, if benefits are fully funded, then all investment gains and losses are passed on to participants and the plan will remain fully funded. If benefits are not fully funded, the plan sponsor's future funding obligation will be adjusted for any asset gains and losses on the unfunded portion of the benefit liability.

For example, consider a plan where the value of variable benefits earned at time $t = 0$ is $1,000,000 based on a 5% hurdle rate. If plan assets are $1,000,000, the plan will remain fully funded one year later (assuming there are no further benefit accruals), without regard to the asset return during the year. However, if plan assets are only $800,000 at time $t = 0$, the unfunded liability is $200,000. The sponsor might expect to be able to meet this obligation by contributing $210,000 ($200,000 increased at the 5% hurdle rate) to the plan on the next valuation date, but the actual contribution required to fully fund the benefit at that time will depend on the investment return during the year. If assets earn 15%, they will grow to $920,000. Plan liabilities will grow by the same 15% (5% interest at the hurdle rate, plus an approximately 10% adjustment to benefits for returns in excess of the hurdle rate) to $1,150,000. This means the sponsor would now have to contribute $230,000 to cover the unfunded liability. This $20,000 loss is equal to the 10% excess of the actual return (15%) over the 5% hurdle rate, applied to the $200,000 unfunded amount.

This example illustrates a fundamental difference between a variable plan and a traditional fixed benefit plan. In a traditional fixed benefit plan, investment gains will reduce any existing unfunded liability. In a variable benefit plan, investment gains will cause any existing unfunded liability to increase.

[9] Assuming no gains or losses from non-investment sources.

Potential Liability Measurement of Pure Variable Benefits Under Regulatory Requirements

Measurement of pension obligations, particularly the selection of the discount rate used to determine the obligation, is regulated or influenced in multiple ways. Pension obligations are determined for multiple purposes including funding, accounting, potential benefit restrictions, and disclosure. Most regulatory guidance is formulated under the implicit assumption that benefit obligations have a fixed value dependent on market-based bond yields or expected returns on plan assets. When applied to a pure variable annuity plan without a consistent adjustment to the expected indexing of plan benefits, this approach could produce a measurement of the obligation that would be either inadequate or excessive to fund the projected benefits. The following sections discuss this anomalous result and its implications in further detail.

To understand the interaction between the discount rate and the payment stream being valued, it is helpful to first consider some basic questions about a discount rate. In particular, what is it an assumption about?

This may seem like an unnecessary question, but it is an important one in the context of measuring variable benefits. The discount rate could be viewed simply as a prescribed component of a calculation that produces a value ultimately used in determining financial measures, such as required contributions or financial disclosure entries. As a prescribed component of a calculation, the discount rate has little or no implications on the other assumptions involved in the calculation.

When used as an assumption for future plan experience rather than simply a prescribed component of a calculation, the discount rate helps determine a present value of future payments that will be sufficient to provide those future payments assuming the present value grows at the discount rate. Thus, the discount rate by its very nature is both the rate at which the future payments are discounted and the rate at which the present value is assumed to grow.

A pension obligation, or liability, when expressed as a present value (rather than simply as a calculation component) represents the amount of money needed today to meet some future obligation. In calculating the present value, **the presumption is that the amount set aside will earn a return equal to the discount rate**. In other words, the discount rate is the assumption for the investment earnings on assets that would be sufficient to back the obligation. If this presumption proves correct, there will be sufficient assets to settle the obligation. If the presumption proves incorrect, the assets will be either insufficient or excessive. Regardless of actual experience, the presumption is that the liability will grow at the discount rate. In general, discount rates may be established with reference to different portfolios representing different levels of risk, but in all cases, the discount rate represents an investment return.

This analysis holds for any type of pension plan. The actuary may not believe that a prescribed discount rate is reasonable. However, it is nevertheless true that if assets backing the obligation are equal to the calculated liability and if those assets earn a return equal to the discount rate (and the other assumptions are also realized), then there will be sufficient assets to meet the plan's obligations.

This analysis is also consistent with private sector financial accounting, even though such accounting introduces an expected rate of return on assets that is different from the discount rate. Financial accounting provides that the discount rate is generally based on high-quality fixed income investments and that the expected return on assets is based on the actual investments. However, the expected return on assets is only used as a component of pension cost, and is independent of the growth in liabilities. The benefit obligation grows at the discount rate, not the expected return on assets, thus supporting the concept that the assumption concerning the discounting of future cash flows and the growth of the obligation is one and the same assumption.

A pure variable annuity plan uses the same portfolio to determine the benefit indexing and to back the obligation. Determining the benefit adjustment based on the return on one portfolio of assets but discounting the obligation based on the expected return on a different portfolio of assets is internally inconsistent and produces a fundamental mismatch. If the obligation is discounted based on the expected return on a particular portfolio (e.g., high-quality fixed income securities), then the underlying presumption is that assets set aside to back the obligation earn a return equal to the discount rate. In a pure variable annuity plan, the terms of the plan require that benefits are adjusted based on the return on the assets backing the obligation. It would therefore be inconsistent with the terms of the plan to assume that benefits are indexed based on one asset portfolio while discounting the resulting amount based on the expected return on a different portfolio. Consequently, if the benefit indexing is consistent with the discount rate, the present value will be sufficient to provide the benefits. If the benefit indexing is not consistent with the discount rate, the present value will be either insufficient or excessive for providing the benefits.

Indexing benefits based on one rate of assumed return and discounting the resulting payment stream using a different rate of assumed return is mathematically possible. However, the result would not represent the present value of the obligation (i.e., the amount of assets needed today to back the obligation based on an assumed asset return) but could, as discussed above, nevertheless be viewed simply as a prescribed calculation component. The implications of this view are fundamentally different for a pure variable annuity plan than for any other type of pension plan. For a plan where benefit amounts are independent of the return on plan assets, the liability is the amount that would be sufficient to back the benefits if all of the assumptions (including asset returns equal to the prescribed discount rate) are met. For a variable annuity plan that uses different rates to determine benefit indexing and to discount the payments, the calculated obligation is

guaranteed to be different from the amount needed to provide benefits because all assumptions cannot simultaneously be met.

Although few, if any, plans would be regarded as pure variable annuity plans, many plans deviate only modestly from the pure variable model. Accordingly, an appropriate starting point for valuing these plans may be the pure variable model, modified as necessary to capture the cost of the deviation from the pure variable design.

Financial Accounting in the Private Sector

Financial accounting standards for the U.S. private sector require benefit obligations to be discounted at the rate at which the benefit obligation could be effectively settled. This provides the actuary with two possible approaches for determining the benefit obligation for a variable annuity plan:

Method 1: The amount at which the obligation for a pure variable annuity can be settled can be determined by valuing a level annuity at the current nominal value of the benefit using a discount rate equal to the hurdle rate. Annuity quotes from insurers who provide immediate variable annuities could be used to support this methodology.

Some actuaries, preparers of financial statements, or auditors may be troubled by this method because disclosing a discount rate equal to the hurdle rate may seem inconsistent with the accounting standards' requirements for setting the discount rate. This concern can potentially be addressed by a disclosure that the value of the benefits is based on a settlement interest rate which is independent of current market rates because of the nature of the obligation.

Method 2: Future indexed benefits can be discounted at a rate consistent with high-quality fixed income investments at the measurement date. In this case, an assumption also needs to be made regarding the future indexation of the variable benefits.

Indexing Assumption Consistent With Discount Rate

To be consistent with the objective of determining the amount at which the benefit obligation could effectively be settled, the indexed benefits would be assumed to be indexed to the same high-quality fixed income investments as are used to determine the discount rate. The benefit stream would then increase (or decrease) based on the spread between the hurdle rate and the discount rate. This method is consistent with the basic presumption that a liability expressed as a present value of future obligations will grow at the rate at which the future obligation was discounted.

As demonstrated in the appendix, the amount needed to provide a pure variable benefit (that is, the present value of the future payments) is independent of the asset mix used to determine the adjustment to the benefit, because the benefit stream will be adjusted to reflect actual investment return. Valuing the obligation substituting any asset mix for the actual asset mix will not change the amount needed to provide the underlying benefit, so

long as the asset mix assumed for indexing purposes is consistent with that assumed for discounting purposes.

Assuming a discount rate based on high-quality fixed income assets, but a benefit adjustment based on a different asset mix, would produce a result that is inconsistent with the Accounting Standards Codification Topic 715 (ASC 715)[10] objective of determining the amount at which liabilities could effectively be settled and a present value that would be either inadequate or excessive to provide the benefits, regardless of the actual return.

Indexing Assumption Independent of Discount Rate

It is possible to develop an assumption for future indexing based on the expected return on the asset mix used to index the variable benefits and independent of the discount rate used to measure the benefit obligation. As noted, this result could be viewed as inconsistent with the principles underlying ASC 715, because the benefit obligation would not represent the amount for which the benefits could effectively be settled.

However, some sponsors and their auditors may view this approach as more consistent with the ASC 715 requirement that each significant assumption used reflect the best estimate solely with respect to that individual assumption.

The arguments for and against setting the indexing assumption independent of the discount rate, and whether these are truly independent assumptions, are explored in more detail in the *Single-Employer Private Sector Funding* section of this practice note, below.

Plans That Base Benefit Adjustments on an Outside Index

Basing variable benefit adjustments on an investment index (e.g., the S&P 500) without investing in that index introduces risk, but arguably does not change the obligation. Some actuaries believe that there is a meaningful distinction that can be drawn between plans that determine benefits based on their own internal rate of return and those that determine benefits based on an external index.

Under the approach described above (in which the indexing assumption is consistent with the discount rate), provided that benefit adjustments are based on plan assets, the offset to pension cost for expected return on assets could be calculated at the rate used to discount benefits, regardless of the method used to set the discount rate. If the plan assets equal the calculated obligation, the interest cost and the expected return on plan assets would offset.

The benefit attribution method required by ASC 715 is the projected unit credit method. There are two possible approaches to determining the obligation under this method. In the general case where the benefit to which an individual is entitled does not change based on

[10] The standard that prescribes the accounting for pension benefits under U.S. private sector accounting rules.

future compensation (i.e., a career average rather than final average design), it may be appropriate to set the projected benefit obligation (PBO) equal to the accumulated benefit obligation (ABO).

However, FASB has indicated that even a career average pay plan (perhaps more properly called career accumulation, because it need not calculate an average) needs to use the projected unit credit method with service prorate. The actuary should consider discussing this issue with the plan sponsor and auditor and reach a consensus interpretation.

To the extent that the attribution method results in a liability for benefits in excess of the amount currently accrued (generally, PBO greater than ABO), the valuation approach described above may need some modification. As established above, once a benefit is earned, its value is determined using the hurdle rate. Before a benefit is earned, there is no adjustment for the difference between actual and expected returns, and thus no guarantee that the obligation can be settled at the hurdle rate. The obligation relating to the portion of the benefit that is not yet earned (the excess of the PBO benefit over the ABO benefit, often called the effect of future salary increases but more accurately the effect of prorating the projected benefit) can be viewed as equivalent to the obligation to pay a lump sum on the date the benefit is earned equal to that benefit valued at the hurdle rate. The value of that obligation on the valuation date would then be that amount calculated at the date the benefit is earned, discounted back to the valuation date using an appropriate discount rate. The hurdle rate may not be the best rate to use for discounting during the period between the valuation date and the accrual date because there is no automatic connection between liabilities and assets that would cancel out the effect of returns above or below the hurdle rate.

For many plans, the excess of PBO over ABO may be relatively small, and the effect of discounting this piece of the obligation from accrual date back to valuation date at a different rate may not produce a significantly different result from simply using the hurdle rate as the discount rate.

Financial Accounting in the Public Sector

Governmental Accounting Standards Board (GASB) Statement No. 67 requires that benefit obligations be measured using the entry age normal (EAN) method and a discount rate equal to the expected rate of return on plan assets (EROA), or in some cases a blend of the EROA and the yield on 20-year AA/Aa or higher tax-exempt municipal bonds.

The requirement to use the EROA works well with pure variable benefit plans. The actuary can assume that benefits change each year based on the EROA and discount at this same rate. Liabilities for all inactives will be identical to valuing benefits at the hurdle rate.

As discussed above under *Financial Accounting in the Private Sector*, any time the actuary recognizes an obligation for benefits that have not yet been earned (as will typically be the case with the EAN method), there will be a period of time between the valuation date and the date the benefit is earned, during which there is no benefit escalation. During this period, for this portion of the benefit, a discount rate other than the hurdle rate may be appropriate. Applying the EAN method using a benefit escalation factor equal to the EROA/discount rate should yield an appropriate result, but one that will differ from discounting using the hurdle rate.

Single-Employer Private Sector Funding

The Pension Protection Act of 2006 (PPA)[11] requires the actuary to discount future benefit payments using the full yield curve (YC) or segment rates under Internal Revenue Code (Code) Section 430. The traditional method of valuing a level annuity at the hurdle rate assumes that the return on assets, discount rate, and benefit payments will all remain constant in future years. Using a full YC or segment rates is not consistent with the traditional method. Furthermore, as shown earlier, discounting a level annuity with the YC or segment rates would produce a present value different from the amount needed to fund the promised benefits. Therefore it is necessary to make an assumption regarding the future change in benefit amounts.

The final regulations for Code Section 430 provide some guidance to actuaries concerning the benefit change assumption. The regulations provide that assumptions other than prescribed assumptions "must be reasonable (taking into account the experience of the plan and reasonable expectations)." In addition, the non-prescribed assumptions "must, in combination, offer the plan's enrolled actuary's best estimate of anticipated experience under the plan based on information determined as of the valuation date."

Q&A #6 of the 2010 Enrolled Actuaries Meeting Gray Book is also pertinent. The question asks whether the actuary can use the hurdle rate to value a variable benefit or whether the actuary can assume that investment returns will equal those implied by the full yield curve. The answer states, "The actuary develops the best estimate of benefits using the actuary's best estimate of the return on plan assets. The simplifications described in this question are appropriate only if they represent the actuary's best estimate."

The actuary should use professional judgment and guidance from the actuarial standards of practice when setting assumptions under PPA for these plans. There are two theories regarding how to set this EROA assumption. Similar to the brief discussion above on *Financial Accounting in the Private Sector*, these theories are referred to here as 1)

[11] Pub. L. 109-280.

consistent with discount assumption, and 2) independent of discount assumption, and are discussed in greater depth below.

EROA Consistent With Discount Assumption

The consistent with discount assumption approach recognizes that the typical definition of a present value involves a discount rate and a return assumption that are the same. A present value is the current amount that will provide the future cash flows if the current amount consistently earns a return equal to the discount rate. If the discount rate and the return assumption are different, the amount will be either inadequate or excessive to provide the future cash flows and thus would not meet the typical definition of a present value.

In other words, to be consistent with the typical definition of a present value, the discount rate and the assumed return on assets are considered the same assumption. From this viewpoint, the EROA is actually a prescribed assumption, not an independent assumption subject to the actuary's best estimate.

This viewpoint is consistent with the fact that the amount needed to provide benefits under a pure variable plan is independent of how the plan assets are invested (as demonstrated in the appendix). The expected return is selected to be the same as the discount assumption, recognizing that plan assets could be invested in a variety of different ways without changing the result. This approach is consistent with the basic presumption that a liability grows at the discount rate used to calculate the liability. An EROA equal to the discount rate is the only rate that produces an obligation equivalent to what is needed to provide the benefits. Choosing an EROA in excess of the discount rate would result in the calculation of additional incremental liabilities already provided for by offsetting changes in the plan assets, and, if funded, would result in surplus assets. Choosing an EROA less than the discount rate would result in a funding target that would be insufficient to provide the benefits.

Due to the variable nature of the benefit and the inherent connection between the investment experience and the benefit adjustment in a pure variable annuity plan, the rate used to discount liabilities should also be used to determine the benefit adjustments in order for the present value to represent the amount needed to provide the benefits (i.e., the typical definition of a present value). In other words, when the discount rate is prescribed, liabilities should be calculated reflecting an assumed return consistent with that rate, regardless of the actual asset mix. The actual asset mix is irrelevant as demonstrated in the appendix, therefore there is no reason to use it as a basis for the EROA assumption. If the plan is funded at the appropriate level, any asset mix will provide the promised benefits.

The basic principle underlying the calculation of the PPA funding target is very similar to the calculation of the ASC 715 ABO. In both cases, the liability is intended to be a

settlement liability, generally calculated assuming investment in high-quality corporate bonds. As discussed above, assuming a discount rate based on these assets but an asset return (and resulting benefit adjustment) based on a different asset mix would produce a result that is inconsistent with the settlement liability objective.

Where the obligation is measured using segment rates (as opposed to the full YC) there is some smoothing introduced in the calculation, especially after reflecting the interest rate stabilization enacted in the Moving Ahead for Progress in the 21st Century Act (MAP-21),[12] the Highway and Transportation Funding Act of 2014 (HATFA),[13] and the Bipartisan Budget Act of 2015 (BBA 2015).[14] Nonetheless, the underlying theory still stands. If assets are set aside equal to the obligation and if returns on those assets are equal to the rate used to discount benefits, the benefit adjustment cancels out the effect of differences between the discount rate and the hurdle rate, producing the same result, regardless of discount rate. In this case, the return assumption is defined not as a single rate, or even as a single set of annual rates, but rather with reference to the discount curve. Thus, different underlying return scenarios would apply for measurements that use different discount curves (whether stabilized, non-stabilized, present value of vested benefits for PBGC premium purposes, or some other basis), yet each measurement would produce substantially the same result, exactly as should be expected for an obligation that is not interest rate sensitive.

This result can be demonstrated mathematically as follows:

An EROA that matches the return of the YC or segment rates would be an array of returns. This array can be expressed as

$$I_t = I_1, I_2, I_3, \ldots, I_n$$

where each element of the array reflects the annual effective return from the measurement date ($t = 0$) to the benefit payment date ($t = n$). Expressed alternatively, for every value of t from 0 to n,

$$I_t = (1 / v^t)^{1/t} - 1$$

where v^t is the effective discount factor of the YC or segment rate at time t.

The benefit array to be valued then can be seen to be

$$B_n = B_0, B_0 \times (1 + I_1) / (1 + h), B_0 \times (1 + I_2)^2 / (1 + h)^2, \ldots, B_0 \times (1 + I_n)^n / (1 + h)^n$$

[12] Pub. L. 112-141.
[13] Pub. L. 113-159.
[14] Pub. L. 114-74.

This array of benefits then is discounted based on the YC or segment rates. Because the EROA array is defined in terms of the YC or segment rates, the discount factor can be expressed in terms of the EROA as follows:

$$v^t = 1 / (1 + I_t)$$

Substituting the right side of this equation for v^t in the normal expression for the liability, the liability can be expressed as:

$$L_0 = B_0 \times \left(1 + \frac{1 + I_1}{1 + h} \times \frac{1}{1 + I_1} + \frac{(1 + I_2)^2}{(1 + h)^2} \times \frac{1}{(1 + I_2)^2} + \cdots + \frac{(1 + I_{n-1})^{n-1}}{(1 + h)^{n-1}} \times \frac{1}{(1 + I_{n-1})^{n-1}}\right)$$

This equation easily simplifies to a level annuity of B_0 evaluated at the hurdle rate, the same result as the traditional method. Thus, if the array of returns is consistent with the discount curve (full YC or segment rates), this method produces the same liability as the traditional method.

Note that the array is expressed as a series of compound annual returns through each year. These could be converted to an array of successive annual returns, but the resulting assumption may be a bit awkward to describe in this manner. For example, if the first segment rate is 3% and the second segment rate is 4%, the assumed compound annual return through year 4 is 3% and through year 5 is 4%. This implies that the "return" during year 4 is 8.09% ($1.04^5 / 1.03^4 - 1$). A similar discontinuity in the assumed return would occur at year 19. This anomaly results because the segment rates are not really market interest rates, but simplified representations of market rates. For this reason, it may be preferable to describe the expected returns as those implied by the yield curve, or as a series of compound annual returns. The year-to-year progression of assumed returns implied by the full YC would show less discontinuity, because the full YC is, but for the one-month averaging, a true market curve.

Actuaries supporting this method cite the regulations for Code Section 430 and take the view that there is only one assumption involved—i.e., the discount rate and the rate at which the present value grows are the same and are prescribed, an interpretation consistent with the typical definition of a present value calculation.

They also observe that:

- Prior to PPA, the discount rate and expected return on assets were always the same, and PPA does not change the fact that a present value grows at the rate at which it is discounted.
- The rate implied by the yield curve is a risk-adjusted expected return for any portfolio.

- The asset allocation of the portfolio is irrelevant to determining the amount needed to provide the benefits, thus the current asset mix is no more relevant than any other mix in determining the funding target.
- Liabilities and assets growing at the same rate precisely meet the actuary's best estimate of anticipated experience under the plan.

Finally, this interpretation is consistent with a generally accepted definition of a reasonable funding method. IRS regulations have long provided that "under a reasonable funding method, no experience gains or losses are produced" if each actuarial assumption is exactly realized (Section 1.412(c)(3)-1(c)(2), a pre-PPA regulation that remains in effect). An assumption of an asset return different from the discount rate will produce gains or losses each year and not be a reasonable funding method.

Actuaries choosing this method for determining future benefit indexing should be aware that there is no official guidance supporting this interpretation.

EROA Independent of Discount Assumption

Some actuaries have suggested an alternative method. They would determine an estimated return (ER) on plan assets based on the asset allocation of the fund and expected long term returns on asset classes. ER could be an array of rates or a single level return. This return would likely differ from the return implied by the segment rates or YC.

Under this method, the liability at time $t = 0$ would be expressed as:

$$L'_0 = B_0 \times \left\{1 + \frac{1+ER_1}{1+h} \times \frac{1}{1+I_1} + \frac{(1+ER_2)^2}{(1+h)^2} \times \frac{1}{(1+I_2)^2} + \cdots + \frac{(1+ER_{n-1})^{n-1}}{(1+h)^{n-1}} \times \frac{1}{(1+I_{n-1})^{n-1}}\right\}$$

L'_0 will not equal L_0 unless one of two conditions are met. Either 1) $ER_t = I_t$ for every possible value of t, or 2) the differences between ER_t and I_t are both positive and negative to the degree that they exactly offset. These cases would be extremely rare. Note that when L_0 does not equal L'_0, either amount could be greater. In other words, if Δ is defined as:

$$\Delta = L'_0 - L_0$$

Δ can be positive or negative. Furthermore, it can easily be demonstrated that if the initial asset is anything other than L_0, say $L_0 + \Delta$, and no further contributions are made, then at time n the assets will be

$$A_n = B_n + \Delta \times (1 + AR)^n$$

where AR is the effective periodic actual rate of return over the entire period. In other words, if Δ is positive there will be surplus assets after the last payment, and if Δ is negative there will be insufficient assets to make the last payment.

Actuaries supporting this method interpret the ER assumption as a different assumption than the discount rate and cite the regulations[15] under Code Section 430,[16] in particular the requirement that each non-prescribed assumption should be reasonable. An actuary choosing this method should recognize that the liability calculation is unlikely to produce the amount needed to provide the plan benefits and that gains or losses will be generated when the actual return equals the expected return. The actuary should also recognize that the estimated return selected by the actuary affects the liability determination. PPA generally eliminated the ability for single employer plans to determine the liability based on expected returns, though PPA did not explicitly address variable annuity plans.

Actuaries choosing this method may also want to explain some implications to plan sponsors. If the return on assets assumption is less than the discount assumption, the required contributions will result in inadequate assets to provide the benefits and any future investment gains will increase the amount of the deficiency. Actuaries using this method in these circumstances could consider recommending contributions above the minimum funding requirement. Conversely, if the return on assets assumption is greater than the discount rate, the funding target will exceed the amount needed to provide the benefits. The actuary could consider advising the sponsor concerning the degree of this excess and the implications for funding policy.

As with the method discussed in the preceding section, actuaries choosing this method for reflecting future benefit indexing should be aware that there is no official guidance supporting this interpretation.

MAP-21, HATFA, and BBA 2015 Issues

With the exception of plans using the full YC, MAP-21, HATFA, and BBA 2015 require the actuary to determine benefit obligations for various purposes using either stabilized or non-stabilized rates, while not changing other assumptions. If the EROA or benefit adjustment assumption is the same for the stabilized and non-stabilized calculations, the resulting reported liabilities will be different. This anomalous result is inconsistent with

[15] 1.430(d)-1(f)
[16] 26 U.S.C. §430.

our prior demonstration that the amount needed to satisfy the benefit obligation in a pure variable plan is independent of market interest rates.
This anomaly can be reconciled by changing the EROA when the discount rates are changed in order to achieve the correct theoretical result. Under this approach, in a pure variable plan, these rates are interdependent, and thus the EROA should be consistent with the discount rate. In other words, the EROA would not be defined as a rate (or set of rates) but rather as a function of the discount rate, or, as discussed earlier, simply the same assumption as the discount rate.

If the actuary chooses to set the EROA to be consistent with the discount rate, liabilities disclosed using stabilized and non-stabilized rates would be the same. The actuary may want to include a statement in the Schedule SB or accompanying description of assumptions and methods that the variable benefit liabilities are not sensitive to the discount rate used.

A possible theoretical interpretation of this outcome is that the legally mandated rates (or the settlement rate, in the case of an ASC 715 calculation) represent a "return scenario" that the actuary must follow. In effect, the liability is being calculated under an assumption that the plan actually earns the returns that are specified for the calculation. In the case of MAP-21, HATFA, and BBA 2015, this view would be consistent with one of the arguments put forth by proponents of the legislation—that a historical averaging of rates represents a reasonable expectation of what plans might earn in the future (that is, discount rates do not exist in a vacuum, but rather represent returns on some underlying investment).

Alternatively, the actuary may choose to calculate stabilized and non-stabilized obligations using the same EROA. In this case, the actuary should recognize that at least one of the reported obligations would be either inadequate or excessive to provide the benefits under any asset return scenario. This deficiency or excess cannot be eliminated by future investment gains or losses because those gains or losses adjust benefit amounts.

Multiemployer Private Sector Funding

Multiemployer plans use the actuary's reasonable estimate of EROA to value plan liabilities for funding. Because plan liabilities are independent of future returns, most actuaries use the hurdle rate for this purpose. Alternatively, the same result can be obtained using any EROA to adjust benefits and then discount benefits at the EROA. Either method of expressing the plan's benefit obligation produces the same result.

Multiemployer plans are able to select one of six actuarial cost methods to determine plan liabilities and normal cost. Funding 100% of the unit credit liability is the method that minimizes investment gains or losses, but the unit credit method can produce increasing contribution patterns for maturing plans. Some sponsors prefer the more level contribution requirements of other methods.

Multiemployer plans must also calculate a current liability. The discount rate used to calculate the current liability is mandated by legislation. The actuary may want to consider using the same methodology described in the EROA Consistent with Discount Assumption section under *Single-Employer Private Sector Funding* to determine an EROA consistent with the discount rate. The EROA for this purpose may be considered the same assumption as the discount rate used for determining the accrued liability.

Alternatively, the actuary may consider using the methodology described in the EROA Independent of Discount Assumption section under *Single-Employer Private Sector Funding*.

Public Sector Funding

Public sector pension plans do not have common funding requirements. The traditional method or any of the techniques described in other sections may be used for valuing liabilities. To the extent that local legislation may dictate a discount rate to be used, the analysis in the other sections may prove useful in determining how to approach calculation of the plan's benefit obligation.

Deviation From the Pure Variable Design

No variable annuity plan precisely fits the fully funded pure variable model. Some sources of deviation include:

- frequency of benefit adjustments that do not match the frequency of benefit payment;
- administrative delay in making a benefit adjustment beyond the end of the period for which asset performance is measured;
- demographic gains or losses that produce a mismatch between assets and liabilities;
- other more significant embedded options, such as floors or caps on benefit adjustments; and
- other plan features, such as a subsidized early retirement or disability benefit or the absence of an actuarial increase after normal retirement age.

The closer the design is to the pure variable model, the closer the liability should be to the pure variable liability. Plans with features that introduce a small increase or decrease in costs, but do not substantially affect liability behavior, may still be valued as pure variable plans, but with an appropriate load applied to capture the value of the feature.

Significant embedded options call for more substantial adjustments. Depending on the nature of the option, these features might be valued most appropriately by a) valuing all benefits as variable and adding a load to reflect the deviation, b) valuing all benefits as fixed and adding a load to reflect the variable features, or c) valuing the benefit directly with an options pricing model.

Benefits Indexed to a Portion of Plan Assets

Not all variable benefit plans index the benefit to the return on all plan assets. Qualified plans often have both fixed and variable benefits. Many of these plans split the total plan assets into two accounts, a fixed benefit account and a variable benefit account. Variable benefits are generally indexed to the return on the variable benefit account. This allows a plan sponsor to implement different investment policies for funding fixed and variable benefits. Fixed benefits are generally paid from the fixed account and variable benefits from the variable account, although all assets are available for the payment of any benefits. Final statutory hybrid plan regulations issued in 2014 make it clear that using a subset of plan assets is permissible provided the assets meet certain diversification requirements and the assets that generate the return on which the indexing is based approximately equal the liabilities for the variable benefits.

The indexing of the benefits to the return on part of the fund does not change any aspect of the liability calculation for variable benefits.

Benefits Indexed to an External Rate of Return

Some variable benefits are indexed to returns other than the plan return. Examples include an investment index (e.g., the S&P 500 index) or a specific mutual fund. In such a plan, the variable benefits will change based on the return of the investment index or mutual fund, which is referred to here as the external fund.

The plan sponsor can fully hedge the plan's liability by investing the assets to mimic the external fund. The amount needed to fully hedge the variable benefit obligation is L_0 (see the *Single-Employer Private Sector Funding* section) determined under either the traditional method or the alternative method where the assumed indexation is consistent with the discount rate (described in the *Financial Accounting in the Private Sector* section).

If the sponsor in fact invests to match the external fund, then the plan behaves like a pure variable plan. Specifically, the plan would avoid any funded status gain or loss due to a mismatch between the assets backing the obligation and those used to adjust benefits. Accordingly, it would be logical to value the obligation in the same manner.

If the plan sponsor chooses to invest in assets that do not mimic the external fund, asset/liability mismatch is introduced and the actuary should consider whether a value needs to be assigned to this mismatch. To illustrate, consider the following examples of three plans that are identical in all respects except for the indexing methods. The obligation of each plan determined using the hurdle rate is $1 million and each plan has $1 million in assets.

Plan A: Indexing is based on the actual return on plan assets compared to a hurdle rate of 5%.

Plan B: Indexing is based on an S&P 500 index fund and all assets are invested in an S&P 500 index fund.

Plan C: Indexing is based on an S&P 500 index fund and all assets are invested in fixed income securities.

Plan A's benefits are driven by the asset returns regardless of how assets are invested. Regardless of whether the assets are invested in equities or fixed income, the current assets will be sufficient to fund the benefits. There is no asset/liability mismatch.

Plan B's benefits are driven by the S&P 500 index fund and assets are invested in that same fund. There is no asset/liability mismatch and the assets will be sufficient to fund the benefits.

Plan C's benefits are also driven by the S&P 500 index fund and will grow exactly the same as Plan B's benefits, but there is an asset/liability mismatch and a potential for investment gains and losses.

Question: Should Plan C's funding target be different than Plan B's because of the additional risk of the asset/liability mismatch?

In Plan C, increases in benefits due to returns in excess of the hurdle rate (or decreases due to returns lower than the hurdle rate) are not automatically offset by corresponding increases or decreases in the plan assets.

Some actuaries suggest that the additional risk of Plan C should be quantified and added to the funding target. This adjustment might be accomplished by a load to the liabilities or by determining an expected return on the actual portfolio and indexing future benefits to the difference between that expected return and the hurdle rate. This approach is similar to the EROA Independent of Discount Assumption approach discussed under *Single-Employer Private Sector Funding*, and may produce a substantially different liability than valuing the obligations as a pure variable plan.

Other actuaries suggest the plan should be valued as a pure variable plan and point to the basic objective of accounting rules and PPA funding rules:[17] determining the amount required to secure or settle the obligation. The fact that a sponsor may choose to invest in a manner that introduces risk is irrelevant to the determination of the amount required to secure the benefit obligation, which is determined by valuing a fixed annuity at the hurdle rate. The obligation can only be secured by investing this amount in the index fund used to adjust benefits, but investing differently does not change the amount that would be needed. Investing differently is simply an investment choice made by the plan sponsor.

In essence, two main arguments support valuing this type of plan in the same manner as a pure variable annuity plan:

1) From both a participant and sponsor or insurer point of view, the obligations of this plan still behave like those of a pure variable annuity plan. The only difference is that there is only one portfolio that avoids introducing investment risk (the external fund that indexes the benefits), instead of an infinite choice of portfolios (when indexing is based on actual plan assets, any portfolio is possible). However, if the plan obligations are fundamentally equivalent to a pure variable plan, the plan should be valued as such.

[17] Some actuaries suggest that the MAP-21, HATFA, and BBA 2015 modifications to the funding rules fundamentally change the objective of PPA funding. Others point to the gradual phase-out of these rules and conclude that the objective is only temporarily, if at all, changed.

2) The rationale behind the PPA and accounting approach to discounting benefits using a fixed income yield curve is that bonds provide a good match to pension cash flows and thus the resulting liabilities represent a reasonable estimate of the amount needed to secure the pension obligation with low risk. In contrast to fixed benefits, fixed income investments cannot secure variable annuity benefits if the benefit adjustments are based on a non-fixed income index or return. Valuing the liability at the hurdle rate or projecting growth and discounting benefits at a consistent rate are the only approaches that are consistent with the PPA and accounting settlement liability rationale.

The relevant regulatory bodies have not issued any guidance on this specific issue. The actuary and plan sponsor should agree on the appropriate treatment.

Valuing Variable Annuity Plan Variations

When a variable annuity plan provides caps, floors, or other features that depart from the pure variable design, the cost of those features should be reflected in determining plan costs. Where a benefit is predominantly variable (i.e., the variable mechanism is likely to drive the benefit actually paid), it may be reasonable to value the benefit as a pure variable benefit, and then apply an appropriate load to adjust for the value of the other features. An example of this type of benefit might be a variable benefit with a current face amount of $100, adjusted based on a 5% hurdle rate, with a floor benefit level of $90. In this case, the benefit paid in any given year will most likely be the adjusted variable benefit, but the floor benefit has a non-trivial value.

Where a benefit is predominantly fixed (i.e., there is a variable mechanism, but it is not expected to drive the benefit ultimately paid in most years), it may be reasonable to value this benefit as a fixed benefit, with an appropriate load for the value of the variable feature. An example of this type of benefit might be a variable benefit with a current face amount of $100, adjusted based on a 5% hurdle rate, but where the floor benefit is $125. In this case, the floor benefit will drive payments, at least in the near-term, but in the longer term the variable feature may come into play.

Following is a discussion of how some caps, floors or other features may affect the valuation of a variable benefit promise.

Separate non-variable floor benefit formula: In the typical situation this plan is designed to be predominantly variable. The benefit may be valued as a pure variable benefit, with a load for the value of the fixed feature. The value of the fixed feature will vary depending on factors such as:

- The ratio of the variable benefit to the floor benefit
- The hurdle rate

- The asset mix underlying the variable adjustment
- The expected starting date of payments
- The annuity form
- The age of the participant (and beneficiary)

Stochastic modeling or other approaches may be used to estimate the likelihood of the floor benefit applying and the expected magnitude of the adjustment to the benefit (excess of floor benefit over variable benefit). Detailed discussion of these valuation approaches is beyond the scope of this practice note.

A grandfathered frozen benefit is an example of a fixed floor benefit. After a period of time, the likelihood of the fixed benefit applying may become *de minimis* as its value is worn away by additional variable accruals. At some point the value of the grandfathering may be disregarded. Until then, it may be taken into account as an adjustment to the variable benefit liability.

Where the benefit is predominantly fixed, the benefit may be valued in the same manner as a fixed promise, but with an adjustment for the expected value of the excess of the variable feature over the fixed promise. For example, this situation may arise after a period of poor asset returns that result in repeated downward adjustments to the variable benefit, leading the fixed benefit to prevail. Similar techniques may be used to estimate this value as are used to determine a fixed benefit adjustment to a predominantly variable benefit design.

Minimum or maximum benefits can be viewed as establishing bounds for the liability calculation. For example, if a plan provides a variable benefit that is subject to a minimum benefit, the plan liability would never be less than the liability of the minimum benefit evaluated as a fixed benefit. Similarly, if the plan provides that benefits cannot exceed a certain level, the liability should never exceed the liability of the maximum benefit evaluated as a fixed benefit.

Limit on the annual benefit adjustment: In some plans the full variable adjustment is not applied, but rather the upward or downward adjustment to the benefit is limited. For example, a plan might have a hurdle rate of 5%, but the variable adjustment in any given year is limited to +/- 5% (i.e., returns in excess of 10% or below 0% are disregarded). This type of plan would typically be valued as a variable benefit, but again, with an adjustment for the difference between the benefit adjustment that would apply in the pure variable situation and the benefit adjustment that applies based on plan terms. Stochastic modeling or similar techniques may be used to estimate the appropriate load to the pure variable liability.

In an extreme case, the variable adjustment may be so constrained that the benefit behaves more like a fixed promise, rather than a variable promise, in which case the benefit would be treated as predominantly fixed, with an appropriate load for the value of the variable feature.

Conversion from variable to fixed at retirement with appropriate charge for the cost of annuitization: A plan may offer the participant the option to convert some or all of the variable benefit to a fixed benefit at retirement. If this plan feature is designed to be cost-neutral, the conversion will vary with changes in market yields. If market yields are lower than the hurdle rate, the benefit will be adjusted downward to reflect the additional cost of settling a fixed obligation. If market yields exceed the hurdle rate, the benefit is adjusted upward at conversion. If the conversion is cost-neutral, then there is no need to reflect anticipated conversion in calculating obligations. Once benefits are converted, they would be valued in the same manner as any other fixed obligation. If the conversion is subsidized in some manner, or could be subsidized in certain interest rate environments, the expected cost of the subsidy (including the effect of anti-selection) and the portion of benefits expected to be converted should be reflected in the obligation.

Monthly benefit payments with annual adjustment: The analysis of the pure variable benefit assumes that each benefit payment is subject to adjustment (e.g., monthly benefit payments are subject to adjustment each month). If payments are made monthly but adjusted once per year, some investment gain or loss can be introduced even if the plan is precisely funded at 100% of the calculated liability.

In this case, if the actual return is higher than the hurdle rate, gains will generally occur. If the actual return is less than the hurdle rate, losses will generally occur. There can be exceptions to this general rule, for example if the return is less than the hurdle rate for 11 months, and then is positive enough in the 12th month to just exceed the hurdle rate. In theory, the plan could incorporate a mechanism to adjust participant benefits for these gains or losses, in which case the liabilities would behave in the same way as for a pure variable plan. In practice, variable annuity plans are not typically designed this way, and the plan sponsor bears the risk associated with these gains or losses.

The actuary should consider the degree to which these gains or losses are anticipated and make adjustments to the liability if, in the actuary's judgment, doing so is appropriate. This may be appropriate if there is a significant difference between the hurdle rate and the rate of return expected to be earned by the portfolio of assets.[18]

[18] Note that it is possible to invest the plan's assets in such a way as to completely immunize this risk. For example, suppose there are two funds, the "variable fund" and the "temporary fund." On each Jan. 1, the plan sponsor transfers sufficient funds from the variable fund to the temporary fund to cover benefit payments for that calendar year. The variable annuity is tied to the variable fund. The sponsor then invests the temporary fund in short-term fixed income investments, matching the duration of the 12 months of benefit payments.

Lump Sum Distributions

In general, lump sum distributions should be calculated in accordance with plan provisions. To avoid ambiguity and to ensure that benefits are definitely determinable and not subject to employer discretion, the plan should describe all elements of a lump sum calculation. If the plan calls for lump sums to be calculated as an actuarial equivalent value to the normal annuity form but does not give further guidance, the actuary and the plan administrator may need to make decisions regarding the actuarial assumptions and how they differ from the calculation of a lump sum for a fixed benefit. The plan document may need to be amended to reflect these decisions. The following discussion assumes the variable benefit is a pure variable benefit. To the extent the benefit varies from the pure form, the actuary and the plan administrator should consider how such variation should be reflected.

There are two general categories to consider:

Plans Not Subject to Code Section 417(e)

The lump sum may be determined using an appropriate mortality table and the hurdle rate of interest defined by the plan. This calculation yields the same present value as the sponsor's obligation.

Plans not subject to Code Section 417(e) may also consider the methods described for plans that are subject to that Code section.

Plans Subject to Code Section 417(e)

The minimum lump sum amount determined using the assumptions of Code Section 417(e) is an estimate of the present value of the periodic benefits determined on a basis generally consistent with the funding target of the plan without regard to assumptions other than mortality and interest and without regard to the stabilized rates of MAP-21, HATFA, and BBA 2015.

Plans subject to these requirements must determine the minimum lump sum using the applicable interest rates and applicable mortality table required by Code Section 417(e) and regulations thereunder to discount the periodic benefits expected to be paid in future years. An indexed benefit must use an additional assumption regarding future indexation. For example, a plan benefit subject to cost-of-living indexation must make a reasonable assumption regarding future inflation.

If the plan provisions provide a method for determining the estimated benefit indexation, those provisions should be followed. If the plan is silent regarding estimating future

indexation, the actuary and plan sponsor should agree on a reasonable method to estimate future indexation and amend the plan as needed to reflect the decisions.

The pertinent question is: How should future periodic benefits be estimated? In the absence of any official guidance on this question, this section considers three possible methods.

Method A: Future Indexation Consistent With Segment Rates

A variable annuity is an indexed benefit and the lump sum calculation can reflect a reasonable assumption concerning future indexation similar to a lump sum calculation for a non-variable annuity that is indexed for cost of living. The lump sum calculation for a cost-of-living indexed benefit will generally reflect an estimate of future inflation that is consistent with economic conditions at the time of the calculation. That estimate might vary as economic conditions change.

When considering various methods of estimating the future indexation, the actuary may choose to consider how the lump sum determinations are made for fixed benefits. When a fixed benefit is discounted at the segment rates, the resulting lump sum is generally consistent with the sponsor's funding target for that benefit (before considering the stabilized rates of MAP-21, HATFA, and BBA 2015).

A method that produces a lump sum value that is consistent with the sponsor's funding target might be considered a reasonable method. If the funding target is determined as described above in the EROA Consistent with Discount Assumption section under *Single-Employer Private Sector Funding*, this can be accomplished by assuming that the actual return on the assets for all years to which the benefit is indexed will be equal to:

1. the first segment rate for all payments discounted at the first segment rate,
2. the second segment rate for all payments discounted at the second segment rate, and
3. the third segment rate for all payments discounted at the third segment rate.

The resulting benefit stream is then discounted using the applicable interest rates and mortality table. This method will produce the same lump sum amount as would be determined by valuing the nominal benefit at the hurdle rate and applicable mortality table. As in the case of other liabilities discussed earlier in this practice note, once again the mandated basis (in this case, lump sum segment rates) would serve as the "return scenario" for the calculation under this approach.

Advocates of this method note the similarity to the typical meaning of a present value discussed earlier. The minimum lump sum amount is a present value of promised benefits. In order for the present value to provide these benefits, it must grow at a rate of return equal to the discount rate. They suggest that the return on assets is not a separate assumption, but by definition must be the same as the discount rate and therefore is a prescribed assumption.

Advocates of this method also note that the lump sum reflects the relative value of various hurdle rates. A plan with a 3% hurdle rate would pay a larger lump sum than a plan with a 7% hurdle rate (all other things being equal). They also note that the lump sum is comparable to the premium an insurance company would charge for a variable annuity with the same hurdle rate (and assuming the same mortality assumption). Advocates also note that all assumptions used are published and not subject to the discretion of the plan sponsor, thus meeting the definitely determinable rule. They further contend that the lump sum does not fluctuate as interest rates change and that this is consistent with the fact that variable annuities are generally not sensitive to interest rate changes. Finally, they observe that the lump sum is consistent with the economic value of the periodic benefits.

A participant electing a lump sum is not, in fact, giving up the right to future benefit indexing, and therefore does not need to be compensated for it by building differences between anticipated plan returns and fixed income returns into the present value calculation. The participant can invest in the same or similar manner as the plan assets were invested, and thereby achieve the same level of adjustment relative to the hurdle rate that they would have had if they had left their assets in the plan. To require payment of a premium for the anticipated difference between expected equity returns and expected fixed income returns effectively allows the participant to benefit twice from this potential difference, because the participant is still free to invest in equities and again earn the equity risk premium. It is worth noting that the equity risk premium has a market value of $0—that is, one dollar of equity assets has the same market value as one dollar of fixed income assets, despite the potential for higher returns on the equity investment.

Market-based cash balance plans, which are a form of variable benefit plan, are not required to build in a premium for potential future investment returns, but instead pay out the account balance if they meet the definition of a lump sum-based benefit formula under the final hybrid plan regulations issued in 2014. This is equivalent to Method A, which would pay out the market value of the variable annuity benefit.

Critics of this method contend that the segment rates may not reflect actual expected returns on the plan assets (or the applicable index) and that the theoretical basis behind the Code Section 417(e) rules is irrelevant to the application of those rules.

Method B: Future Indexation Based on Expected Return on Assets (or Index)
This method determines an estimated return on the actual assets based on the portfolio asset allocation (or the estimated return of the index in the case of a plan that bases changes on an index). The estimated return is used to calculate the future indexing of the benefit. The resulting benefit stream is then discounted with the applicable interest rates and mortality table.

Advocates of this method contend that it is the best estimate of the actual benefits expected to be paid in the future.

Critics of this method express several concerns:

- If the benefit indexation is not consistent with the discount rate, the lump sum value will be either fall short of or exceed the present value of the annuity benefits.
- The expected return on assets is subject to judgment and may not meet the requirement of being definitely determinable.
- Asset allocation is generally controlled by the plan sponsor. By changing asset allocation, the sponsor has influence over the amount of the lump sum that is paid.
- More aggressive portfolios are subject to higher risk, the cost of which is not reflected in the lump sum. Participants benefit from the riskier assets but receive the benefit immediately and are not subject to the risk. The price that financial markets would put on the risk would exactly offset the premium built into the lump sum calculations.
- Code Section 417(e) bases lump sum calculations on published interest rates, not estimates made by actuaries or plan sponsors.
- This method involves a degree of discretion and variation from plan to plan that mandated assumptions were intended to eliminate.

Method C: No Change in the Nominal Benefit
This method is actually a special case of Method B in which the expected return on assets is always equal to the hurdle rate. Therefore, indexation based on the difference between the return and the hurdle rate does not change the anticipated benefit.

Applying the applicable interest rates and mortality table to the nominal benefit and determining a lump sum value as if the nominal benefit was unchanged in future years will produce a result that is the same as a fixed benefit of the same nominal amount. However, the lump sum will not reflect the potential indexation of the benefit.

Advocates of this method note that the participant voluntarily elects a lump sum, and thereby elects to forgo the potential future indexation of the periodic benefits.

Critics of this method note that the indexation feature of a variable plan may have considerable value and that this value is not properly reflected in the lump sum under this method. Critics also note that this method would produce the same lump sum amount for a plan with a 3% hurdle rate as for a plan with a 7% hurdle rate despite the fact that future periodic benefits for the 3% hurdle rate plan would be significantly greater than for the plan with a 7% hurdle rate (assuming all other factors are the same) regardless of actual future returns on plan assets (or applicable index). Critics contend that the lump sum should reflect a reasonable assumption concerning future indexation and that assuming no change in benefits is generally not reasonable.

Finally, as noted above, participants electing a lump sum are still free to invest the proceeds and therefore have not, in fact, given up the potential for future benefit increases

(or decreases) that would result from investing those assets in a manner similar to the way the plan invests.

In the absence of regulatory guidance, the actuary and plan sponsor should examine this issue carefully and consult legal counsel in determining the most appropriate method to calculate lump sum benefits from variable annuity plans.

Issues Beyond the Current Scope of This Practice Note

This practice note addresses some basic issues regarding the valuation of pension benefits that include a variable benefit feature. There are many other aspects of variable benefits that may require treatment different from that for traditional fixed benefits, including some in areas other than the valuation. Future revisions to this practice note may address some of these issues. The IRS may provide future regulatory guidance relevant to the topics discussed in this practice note.

This section provides a partial list of issues that the actuary and plan sponsor may need to consider to determine whether a treatment different from that for traditional fixed benefits is appropriate.

Additional areas for consideration:

- Contributory plans
- Nondiscrimination testing
- Statutory hybrid plan regulations
- Minimum distribution regulations
- Code Section 415 limits
- Minimum benefit based on prior early retirement benefit
- Calculation of Pension Benefit Guaranty Corporation (PBGC) premiums
- Effect of gains and losses from noninvestment sources
- Relative value disclosures
- Actuarial equivalence for optional forms of benefit
- Treatment of expenses in determining investment return
- Unit versus dollar accounting
- Participant choice
- Qualified Domestic Relations Orders (QDROs)

Actuaries working with variable benefit plans are encouraged to contact the Pension Committee concerning these and other issues related to variable benefit plans.

Appendix

Consider a variable annuity plan that provides a series of benefit payments (not contingent on survival): $B_0, B_1, B_2, B_3, \ldots, B_n$.

The plan has a hurdle rate of h. This hurdle rate can be considered the periodic return required to keep the benefit payments equal to B_0. 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. The demonstration that follows applies regardless of the type of investments or the asset allocation because the returns, i_n, reflect the actual return on whatever portfolio actually exists. Payments are made at the beginning of each period. If $i_n = h$ then $B_n = B_{n-1}$.

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

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

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

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

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,

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

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

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

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

By repeating this procedure, it can be shown that:

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

$$A_n = B_n$$

A_0 is precisely sufficient to fund all benefit payments regardless of the actual return on assets. While this may seem surprising 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.

Furthermore, it can easily be demonstrated that if the initial asset is anything other than A_0, say $A_0 + \Delta$, then at time n the assets will be:

$$A_n = B_n + \Delta \times (1 + i)^n$$

where i is the effective periodic rate of return over the entire period. In other words, if Δ is positive there will be surplus assets after the last payment and if Δ is negative there will be insufficient assets to make all payments.

The important principle from this demonstration is that the assets needed to adequately fund a variable benefit obligation are independent of both market fixed income rates and the expected return on the portfolio of assets upon which the variability is based. This principle is the basis for the valuation techniques described in this practice note, which base assumed future indexation on the discount rate assumption when faced with regulatory requirements to use certain discount rates.