



### Key Points

- Two common measurements of pension obligations have significantly different meanings.
- Market-based methods use a discount rate based on observable data from the financial markets. Expected return-based methods use a discount rate based on the estimated return of the plan's investment portfolio.
- The *solvency value*, a market-based measurement, determines an amount that a pension plan needs to invest in default-free securities to provide the benefits with certainty.
- The *budget value*, an expected return-based measurement, determines an amount that will be sufficient to provide benefits if the portfolio earns the expected return on assets.
- The difference between the two represents the gain the sponsor anticipates by taking on risk in a diversified portfolio.
- Plans funded at the budget level and invested in a diversified portfolio are likely to experience either insufficient or surplus assets, and benefit security is affected by the plan sponsor's ability to make additional contributions if an adverse investment experience materializes.

## Measuring Pension Obligations

### Discount Rates Serve Various Purposes

Tens of millions of U.S. workers and retirees belong to pension plans that are the subject of heated debates surrounding the discount rate used to measure pension obligations. The American Academy of Actuaries' Pension Practice Council developed this issue brief to inform public policymakers and the general public about different measurements of the obligations of defined benefit pension plans.

Put simply, a pension is a series of payments made to retirees, usually for their lifetimes. An actuary estimates the payments that will be made for all potential retirees from the plan in each future year. Although an estimate, considering these payments as a certain stream of future cash flows is helpful to understand pension measurement.

Expressing the value of this future series of payments as a single amount on a specific date is required for several purposes, including financial statement preparation, funding decisions and regulatory compliance. This amount is an estimate of the *present value* of the obligation and is dependent on the discount rate, the interest rate used to bring future cash flows to the present to account for the time value of money. The intended use of the estimated present value influences how the measurement is determined. Although the estimate is useful for several purposes, the actual obligation remains the payment of the benefits when due.

This issue brief explores two approaches for selecting discount rates when measuring pension obligations, describes the meaning

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of each measurement, and characterizes the difference between them in terms of investment risk and potential gains and losses. Understanding the measurements of pension obligations requires recognizing the purpose and meaning of each one.

## Two Measurements

The two approaches for selecting discount rates used to determine the present value are the *market-based method* and the *expected return-based method*.

Using a market-based method, a discount rate is selected by looking at observable data in the financial markets at the measurement date. Market-based methods use fixed-income yield data because fixed-income securities are similar to the pension obligations – both make fixed payments in future years. Market-based methods vary in the amount of default risk recognized. For example, financial statement disclosures for private-sector employers use AA corporate bond rates, plan-termination measurements use insurance company premium quotes, and solvency measures (discussed further below) often use U.S. Treasury bond rates.

Using an expected return-based method, a discount rate is selected by looking at the asset allocation of the pension plan investment portfolio and estimating the average return the portfolio is expected to produce during the time period in which benefits are paid. State and local government plans, multiemployer plans,

and some private sector plans not subject to the Pension Protection Act<sup>1</sup> funding rules commonly use expected return-based methods. The expected return-on-assets estimate is based on the assumption that the asset allocation will be maintained in the future.

The two methods may produce the same result if a pension portfolio is invested entirely in the same type and duration of fixed-income securities used to select the market-based discount rate, but this is uncommon. Usually, the actual investment portfolio contains securities expected to generate returns greater than the fixed-income returns used by the market-based methods. Thus, the expected return-based discount rate will be higher and the resulting measurement will be lower than the market-based method.<sup>2</sup>

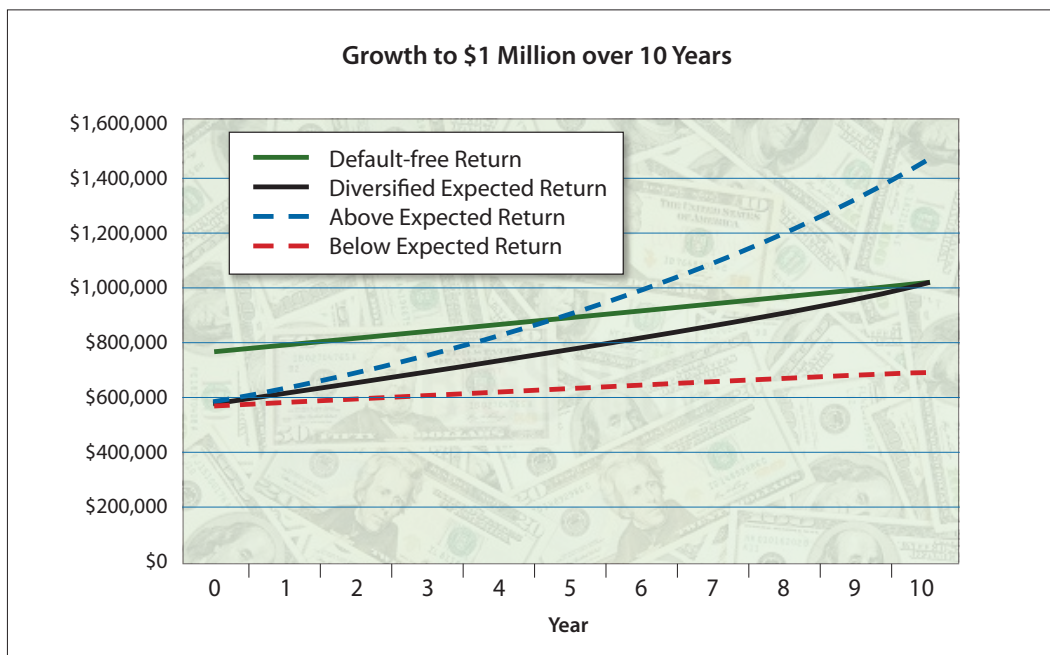
The two methods differ in the relative certainty (the confidence level or probability) that assets equal to the present value would grow as expected if invested as the method assumes. A simplified example is useful to illustrate the level of certainty associated with each.

Assume you promise to pay \$1 million to another party in 10 years and that you are deemed certain to pay your debt. You could fund this debt with a 10-year zero coupon Treasury note. If the note had an effective return of 3 percent, an investment of \$744,000 would be sufficient to fund the debt with 100 percent certainty. You might also fund the debt with a smaller amount invested in a diversified portfolio of assets. If you could reasonably expect the portfolio to return 6

<sup>1</sup>Public Law 109–280 (Aug. 17, 2006).

<sup>2</sup>In some periods of high interest rates such as the early 1980s, many pension plans used discount rates less than default-free rates.

Members of the Pension Practice Council include: Stephen Alpert, MAAA, FSA, FCA, MSPA, EA; Michael Bain, MAAA, ASA, EA; Janet Barr, MAAA, ASA, EA; Eli Greenblum, MAAA, FSA, EA – vice chairperson; William Hallmark, MAAA, ASA, FCA, EA; Kenneth Hohman, MAAA, FSA, FCA, EA; Evan Inglis, MAAA, FSA, EA; Ellen Kleinstuber, MAAA, FSA, FCA, MSPA, EA; Gordon Latter, MAAA, FSA; John Moore, MAAA, FSA, FCA, EA – chairperson; Tonya B. Manning, MAAA, FSA, FCA, EA; Andrew Peterson, MAAA, FSA, EA; Jeffrey Petertil, MAAA, ASA, FCA; Michael Pollack, MAAA, FSA, EA; David Sandberg, MAAA, FSA, CERA; Tamara Shelton, MAAA, FSA, FCA, EA; John Stokesbury, MAAA, FSA, FCA, EA; James Verlautz, MAAA, FSA, EA



percent, an investment of just \$558,000 would be expected to fund the debt, but the ability to meet the obligation with the invested assets would be less certain. The portfolio might earn more or less than 6 percent over the 10 years.

Your creditor would be willing to accept the \$744,000 Treasury note in settlement of the debt now, since both your debt and the note are certain to pay \$1 million in 10 years. But your creditor would not accept the \$558,000 diversified portfolio in lieu of the debt because there is no longer certainty that \$1 million will be available in 10 years and there is no compensation for the additional risk accepted.<sup>3</sup> The higher \$744,000 required using the Treasury investment can be considered the price of providing certainty and the \$186,000 reduction using the diversified investment is

the anticipated savings of the debtor that may result when the debtor accepts the additional investment risk.

### Solvency Value – A Market-Based Measurement

The *solvency value*<sup>4</sup> is the amount needed to fulfill all benefit obligations when invested in a portfolio of securities free of default risk whose cash flows match the future benefit payments.

An important characteristic of the solvency value is that it is intended to fulfill the benefit obligation without additional funds. This requires that the portfolio be free of default risk or else additional funds may be needed. Treasury securities are the only broadly available securities that are generally considered free of default risk. For the purposes of this brief, it is presumed

<sup>3</sup>A creditor willing to take risk could accept the \$744,000 Treasury note, sell the note and invest in a diversified portfolio.

<sup>4</sup>The terms “solvency” and “budget” (introduced in the next section) are used in the [Pension Actuary’s Guide to Financial Economics](#). The meaning in this paper is the same as in that guide. These terms may be used in other contexts with different meanings.

that a portfolio of Treasury securities that produces future cash flows with the same timing as the promised pension benefits would be certain to be capable of fulfilling the pension obligation.<sup>5</sup>

The discount rate used to calculate the solvency value is based on the Treasury yield curve or the return on the assets of the hypothetical Treasury portfolio. When expressed as the return of the hypothetical portfolio, the rate will vary depending on the timing of future benefit payments, or equivalently, based on the duration of the portfolio.

The solvency value, like any market-based value, will change when interest rates change but does not change merely because the asset allocation of the actual portfolio is changed. The solvency value is independent of the actual investments. In our example, the solvency value is \$744,000.

Valuing future pension benefits with a default-free discount rate such as the return on a hypothetical Treasury portfolio provides a reasonable measurement of the amount of assets needed today to provide the estimated benefits with no additional funds.

### Budget Value – An Expected Return-Based Measurement

The *budget value* is the amount that is expected to be sufficient to pay all benefits when due if that amount is invested and earns the anticipated return of the plan's investment portfolio. When the portfolio is diversified<sup>6</sup> and the return is uncertain, additional funds may be needed when returns are less, and surplus assets may develop when returns are greater than the expected return.

If the portfolio is diversified to include securities seeking greater returns, the anticipated

return will be higher and the budget value will be lower than the solvency value. Because of the risk aspects of the portfolio, insufficient or surplus assets may develop, and the budgeting process will have to be adjusted for this differential over time.

The budget value differs from the solvency value in that the selection of the discount rate is based on judgment of future market performance while the solvency discount rate is based on observable data in current markets. Selection of a reasonable rate is essential to the viability of the budget method. The expected return on assets often represents the median or the average of an array of estimated rates based on the potential variability of the return of the portfolio.

The diversified portfolio and the lower budget amount also result in greater uncertainty of the future contributions required of the plan sponsor. With a diversified portfolio and funding based on the budget measurement, the level of sponsor contributions are sensitive to total investment returns, which are affected by interest rates, defaults, and equity (including stock, real estate, hedge fund) price movements. Thus, returns in a diversified trust are expected to be variable, not consistently equal to the expected return. The inevitable result is that sponsor contributions to keep the plan funded at the budget value will be more volatile; or, if contributions are kept stable, unfunded or surplus amounts will develop. In practice, both volatile contributions and unfunded or surplus amounts are experienced by plans using the budget method.

The expected return on assets is often set as the median expected return of a wide range of possible outcomes. This means that perhaps 50 percent of the time the budgeted amount will be

<sup>5</sup>Constructing such a portfolio is not possible for most pension plans, partially due to the very long payment periods. Nevertheless, this hypothetical portfolio is useful for explaining solvency value and can be approximated in the markets with the use of derivatives.

<sup>6</sup>In this issue brief, diversified means any investments other than default-free assets that match the cash flow requirements of the benefit obligation.

insufficient and the sponsor will be called upon to make additional contributions. To the extent the plan sponsor cannot make additional contributions, the security of the benefits is at risk. The magnitude of the potential insufficiency is dependent on the actual return on investments compared to the expected return and can be significant.

Diversified portfolios are expected to have higher returns than Treasury securities. If the portfolio actually earns more than the solvency discount rate, benefits can be provided at a lesser cash cost than under the solvency model. In our example, the budget value is \$558,000, implying a targeted savings of \$186,000 compared to the solvency value. But this anticipated savings comes with added risk.

Valuing future pension benefits with the expected return on a diversified portfolio provides a reasonable measurement of the amount of assets needed today to provide the estimated benefits, but additional contributions may be required or surplus assets may develop.

## Risk and Reward

The difference between the solvency value and the budget value provides insight into the risk and potential reward of the diversified portfolio. If a plan sponsor does not invest in a matching portfolio of Treasury securities but instead uses return-seeking assets in a diversified portfolio, several changes occur. First, the expected return on the portfolio is likely to be higher. Therefore, the sponsor's target for funding is lower. At the same time, the magnitude of potential unfunded or surplus amounts increases. This increases the potential demand on the sponsor and the risk to benefit security.

Rational investors do not take risk without the opportunity for a commensurate gain. In

this case, the difference between the solvency value of the pension obligation and the budget value of that same obligation (\$186,000 in our example) can be thought of as a *target gain* for the plan sponsor. This target gain can also be viewed as the market value of the additional risk in the diversified portfolio.<sup>7</sup> Whether this potential gain is realized depends on the actual investment returns of the pension portfolio. The realized gains could be more or less than the target, and may be negative (i.e., the diversified portfolio may return less than the hypothetical Treasury portfolio). As in our example, the budget value would not be accepted as payment by another party to settle the pension obligation.

To reiterate, if the portfolio were invested as the solvency value anticipates, assets would accumulate to the amount needed to pay benefits since the return is certain. If the portfolio is diversified as the budget value anticipates, the asset accumulation is less certain and depends on the future return of the portfolio. Future returns less than the expected return will cause insufficiencies and additional contribution requirements. Future returns above the expected return will develop surplus assets and lower future contribution requirements.

Despite the uncertainties, several elements remain constant when risk is added to the portfolio – the benefit payments owed to the pension plan's participants and the sponsor's obligation to provide those benefits remain unchanged. The solvency value, which is independent of the actual investments, does not change. But the present value of the pension obligation as measured by the budget value decreases. This anomaly between the unchanged solvency value and decreasing budget value is reconciled by the sponsor's promise to fund additional amounts, if necessary. In effect, the plan then has a con-

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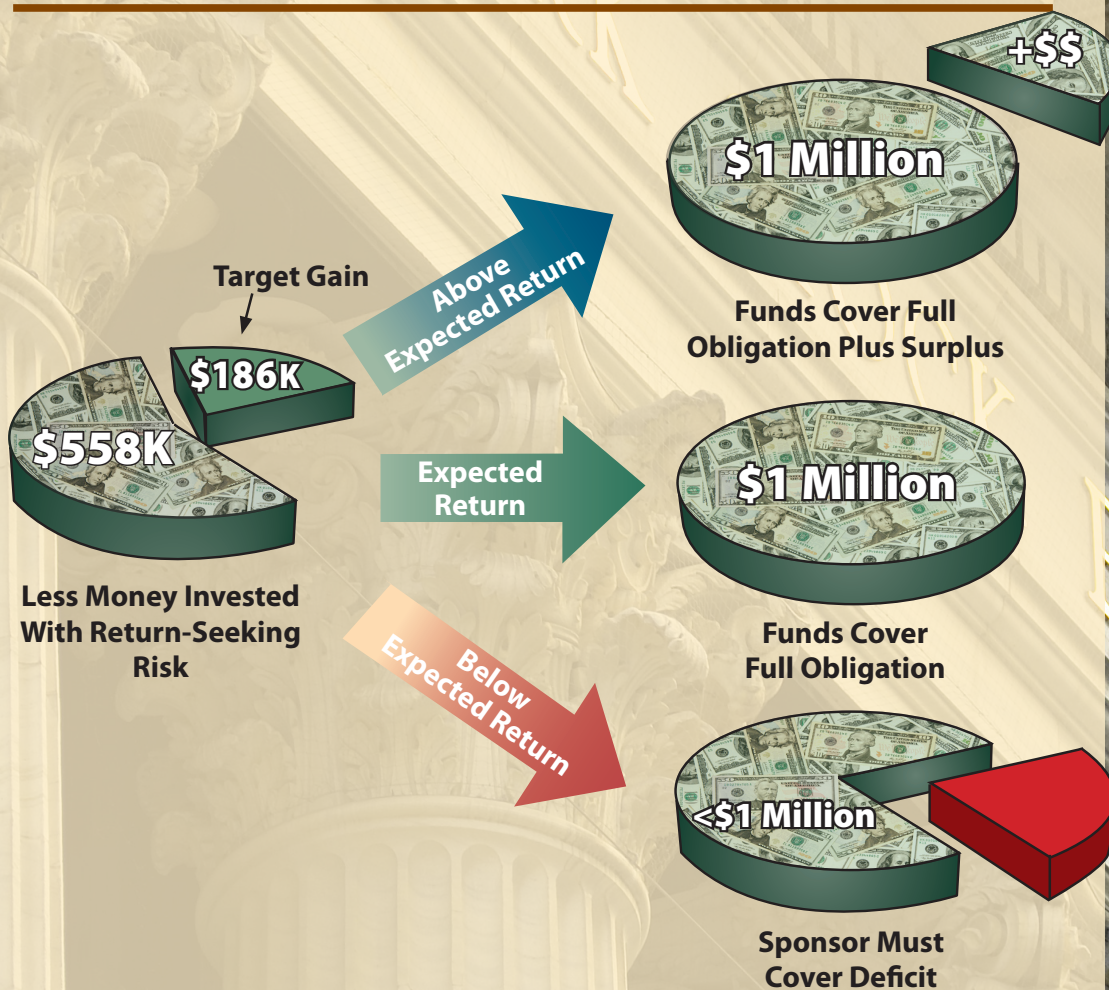
<sup>7</sup>In theory, the target gain is the price of a put on the portfolio to protect against deficiencies, less the price of a call to sell the potential surplus. In practice, no markets exist for such puts and calls.

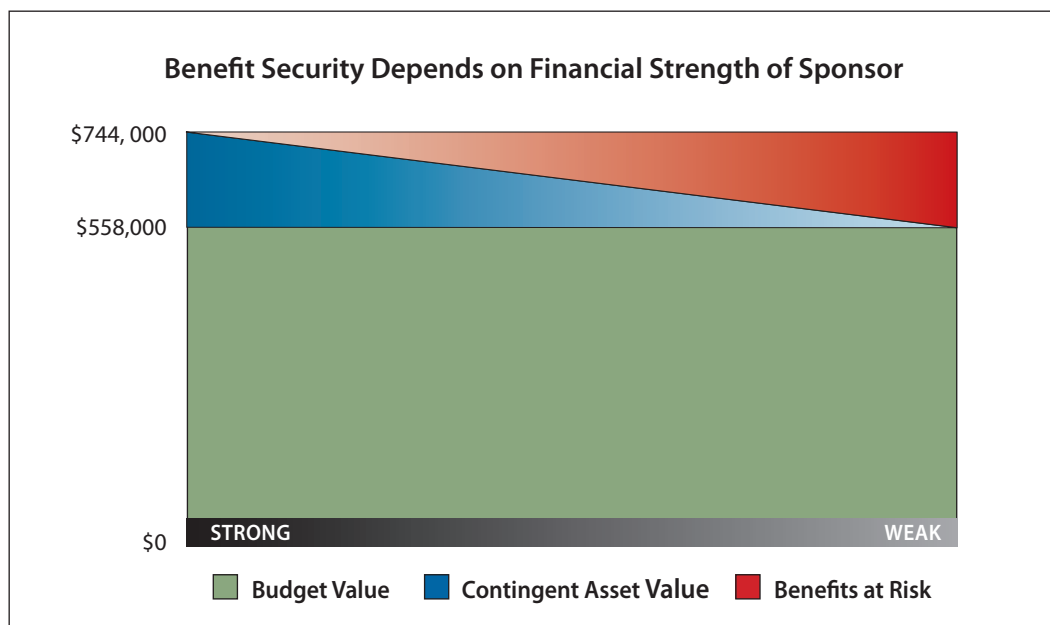
# PENSION MEASUREMENTS

## Solvency



## Budget





tingent asset, the equivalent of a call option on the sponsor's assets if the budget amount proves inadequate.

This contingent asset can provide significant benefit security for plan participants if the plan sponsor is financially strong and remains capable of making any necessary additional contributions. In such a case, the budget value plus the contingent asset value is essentially equal to the solvency value. However, if the plan sponsor is financially weak or not capable of making additional contributions, the benefit security of the participants may be materially reduced.<sup>8</sup>

## Summary

The market-based and expected return-based methods of measuring pension obligations both use a rate of return on assets to determine a present value of future pension benefits, but the assets of the portfolios differ. The solvency value uses a

hypothetical portfolio of default-free securities that is independent of actual investments, while the budget value uses the expected return of the actual portfolio. The solvency value, if invested in default-free cash flow matching securities, provides certainty that the assets will be adequate to provide the benefits. The budget value provides less certainty and depends on the ability of the plan sponsor to make additional contributions in the event adverse investment experience materializes. The difference between the solvency value and the budget value represents both the market value of the investment risk in the diversified portfolio and the target gain or reward that the plan sponsor anticipates. Each method is useful for its intended purpose although the measurements may differ significantly.

<sup>8</sup>To the extent the plan is funded at less than the budget value the contingent asset and the risk to benefit security further increase. For additional discussion about funded status and considerations about the health of the sponsor, see the Academy's issue brief [The 80% Pension Funding Standard Myth](#).