

RISK BUDGETING: A FOCUS ON A PENSION PLAN'S BIGGEST RISKS

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Introduction

With the widespread acceptance of modern portfolio theory by investors, asset-allocation decisions are often driven by the quest to select a portfolio that maximizes long-term risk-adjusted returns. The recent financial crisis, however, has intensified investors' focus on understanding the risks embedded in their portfolios.

Much as an enterprise allocates funds for capital investment through the process of capital budgeting, an investor can identify, analyze, and allocate risk exposures through risk budgeting. At NEPC, we see risk budgeting as a useful tool for helping our clients identify the risks in their portfolios with the greatest potential impact on their program, and whether the compensation for these risks is adequate. All investors can apply risk budgeting to a portfolio's *asset risk*; defined benefit pension plans can apply it specifically to the plan's *surplus risk*. Asset risk measures the volatility of a plan's asset value; surplus risk refers to the volatility of its funded status. This paper will discuss how risk budgeting can improve pension plans' ability to address both kinds of risk.

Asset Risk Budgeting

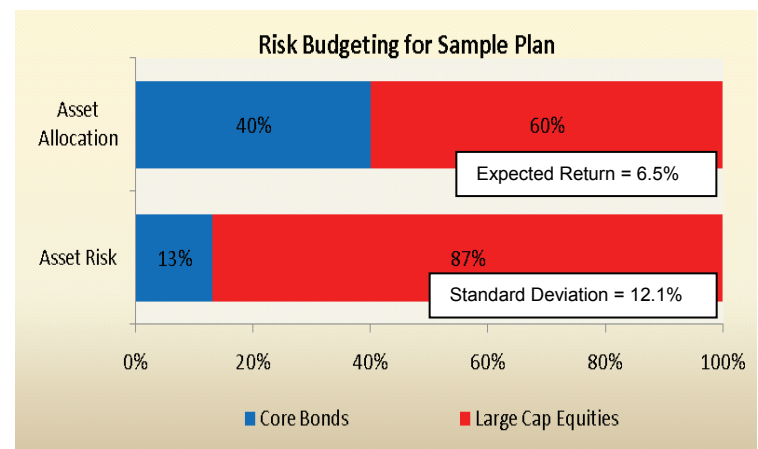
Asset risk is often estimated using standard deviation. The overall standard deviation of a portfolio is calculated from the individual standard deviation of each asset class and its correlation to every other asset class. To illustrate, assume a portfolio of 60% large-cap equities and 40% core bonds. Table 1 shows a sample asset-risk breakout for this portfolio.

Using NEPC's assumptions for risk and return over a five- to seven-year time frame formulated in early 2010, the expected return of this portfolio is 6.5% with a standard deviation of 12.1%. (For additional information on our asset class assumptions and forecasts, please contact your NEPC consultant). Of note, the asset-risk bar shows that the 60% of the portfolio invested in equities is responsible for 87% of portfolio volatility. Comparing the two bars makes it clear that even when a portfolio is diversified in terms of asset compo-

60% OF THE PORTFOLIO INVESTED IN EQUITIES IS RESPONSIBLE FOR 87% OF PORTFOLIO VOLATILITY.

sition, the sources of total volatility can be concentrated lopsidedly in asset categories with greater volatility and higher correlations to each other.

Table 1



Risk budgeting allows us to measure the contribution of each asset class to overall portfolio risk. The resulting breakout can then be examined in light of the investment program's stated objectives to see if allocation changes are warranted. As one example, an endowment with an equity-heavy portfolio may face risks to principal that are poorly matched to the timing of expected fluctuations in the endowment's spending needs.

The next step for pension plans, especially for corporate defined benefit plans with a marked-to-market discount rate, is to incorporate liabilities

PLAN SPONSORS' NEED TO MANAGE THE RISK TO A PLAN'S FUNDING STATUS...SETS PENSION PLANS APART FROM OTHER INSTITUTIONAL INVESTMENT PORTFOLIOS.

into the risk budgeting analysis. Such an addition shifts the focus to funding status or surplus risk.

Surplus-Risk Budgeting

The health of a pension plan is measured not only by the total value of assets in its overall portfolio, but also by the plan's funded status; that is, its assets relative to its liabilities. In addition to being required for funding and accounting purposes, a funding status measurement exists on an underlying economic basis as well. For example, the funded status of a corporate pension plan is reported annually under the terms of federal statutes – ERISA and the Pension Protection Act of 2006 – that guide calculation of the employer contributions required to adequately fund the plan. In addition, FAS 158 sets out rules by which the sponsoring company must report the pension plan's funded surplus or deficit on its balance sheet, which in turn affects shareholders' equity as reported by publicly traded companies. Plan sponsors' need to manage the risk to a plan's funding status, a need that exists regardless of how that status is calculated, sets pension plans apart from other institutional investment portfolios. The goal of most other institutional portfolios

is to earn the greatest return for a given level of asset risk. In contrast, the goal of many pension plans is to maintain or improve *funded status* in ways that pose the least amount of risk to that status.

When the value of plan assets exceed projected plan liabilities, the plan has a funding surplus; when assets are less than liabilities, the plan has a deficit. Surplus-risk budgeting addresses the volatility of this funding surplus or deficit. Surplus risk incorporates not only the asset risks discussed above, but also the risks inherent in liabilities, mainly their correlation to assets through their duration.

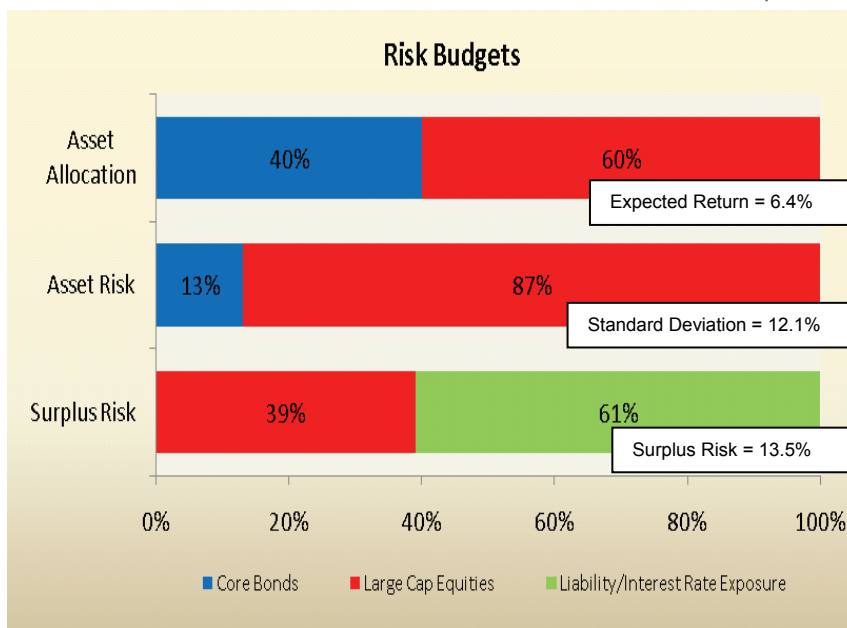
By definition, an asset or liability's duration is the sensitivity of its value to changes in interest rates. The greater the duration, the more sensitive to changes in interest rates. In risk budgeting, different asset classes are assumed to have varying levels of duration. For example, fixed-income assets have durations related to the weighted average term to maturity of their cash flows. In contrast, equities are assumed to have zero duration, or at least no reliable duration. That is because stocks historically have displayed wildly divergent responses to interest rates over various eras, ranging from decidedly negative to extremely elevated. Because equities may rise, fall, or remain steady after a shift in interest rates, we assign no duration to them.

Liabilities in a typical non-frozen pension plan have a duration of roughly 12–16 years. They are highly sensitive to interest-rate fluctuations, usually much more so than plan assets, giving rise to a significant duration mismatch between plan assets and liabilities. To illustrate, let us consider the previous example of a portfolio comprising 60% equities and 40% core bonds. In addition, let us assume a liability duration of 12 years and an 80% funded status for the plan. The resulting asset-risk and surplus-risk budgets are shown in the bottom two bars of Table 2.

Surplus risk in this example is 13.5%. This represents one standard deviation of the plan's potential funded status, meaning there is a two-thirds probability that funding status will vary up or down by as much as 13.5%. Table 2 also reveals that although equity exposure is the greatest con-



Table 2



tributor to asset risk, interest-rate exposure is the leading source of surplus risk because of the duration mismatch between assets and liabilities. The table shows that the plan’s two-year asset duration, supplied entirely by fixed-income assets (60% equities with zero duration, plus 40% core bonds with five-year average duration equals two years), is an inadequate hedge against the 12-year duration of the liabilities. In this example, the portion of surplus risk stemming from interest-rate exposure slightly exceeds that from equity exposure. The balance between the two will vary depending on assumptions made for liability duration and initial funded status.

Hedging Interest-Rate Risk

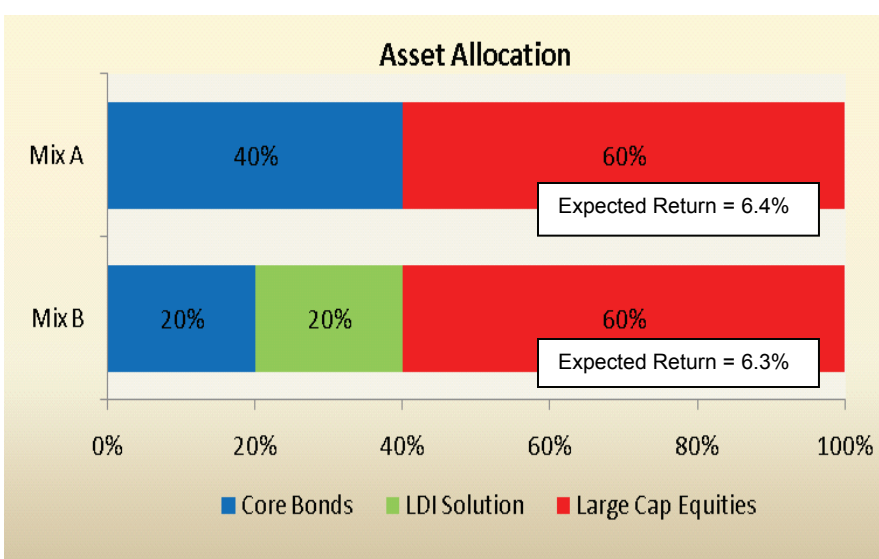
After analysis, a sponsor may wish to reduce the risks in its pension plan. We suggest that sponsors begin with their interest-rate exposure, often the greatest contributor to funded-status volatility. It is difficult to alter the discount rate, since it is market-based and governed by IRS and FASB guidelines. Thus, the most common way to reduce interest-rate risk is to increase the duration of assets so that it more closely matches that

of plan liabilities. Narrowing the duration gap causes plan assets and liabilities to move more closely in synch with each other as interest rates fluctuate, reducing the volatility of the plan’s funded status. This duration-matching technique has come to be called Liability Driven Investing (LDI).

LDI is discussed in more detail in two recent NEPC white papers, “*Understanding Duration Risk in Pension Plans: The “Case for LDI”*” and “*LDI Product Types and Implementation Strategies*”. Both papers are available at www.nepc.com.

To illustrate the effects of implementing an interest-rate hedging strategy, in the following tables we replace a portion of traditional fixed-income assets with an LDI solution of zero-coupon swaps carrying a duration of 45 years. Table 3 compares the different asset allocations.

Table 3



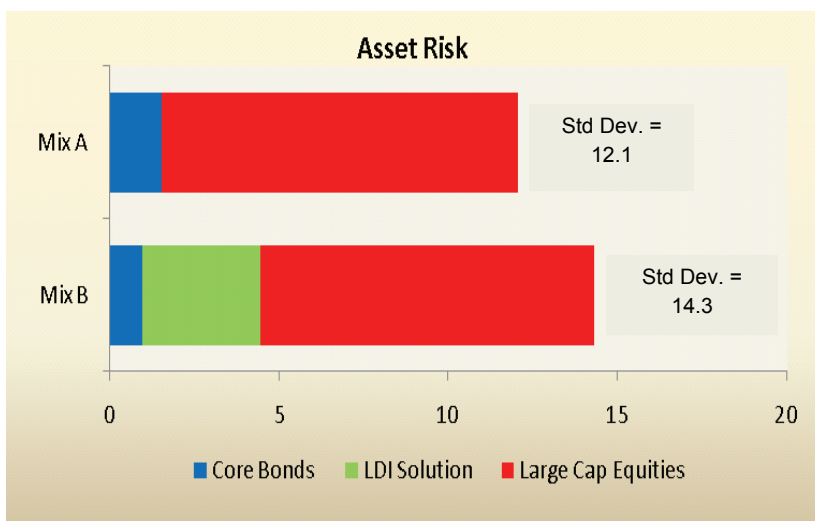
Although Mix B is more diversified, it has a slightly lower expected return than Mix A.

Table 4 compares the asset risk, or standard deviation, of the two allocations. Mix B, with an allocation to an LDI strategy, exhibits much greater volatility in asset returns than Mix A. This rise in



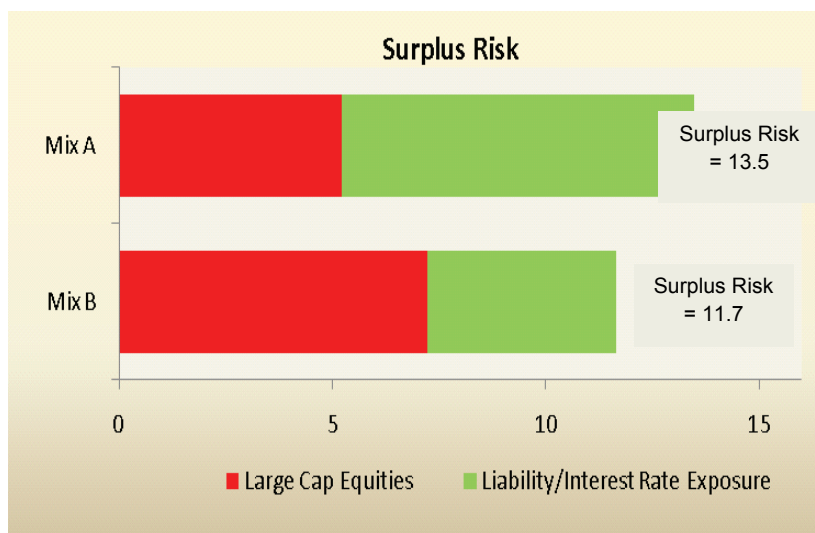
asset-return volatility, without a significant gain in expected portfolio return – indeed, in this example it is slightly lower – has deterred many investors from pursuing LDI strategies.

Table 4



The true benefit of implementing an LDI strategy is revealed in Table 5, which shows that the strategy has meaningfully lowered the volatility of the plan’s funded status.

Table 5



With the introduction of an LDI strategy to Mix B, surplus risk drops to 11.7% from the original 13.5%. This reduction stems from shrinking the duration mismatch between plan assets and liabilities. Equity risk now becomes the dominant risk to funded status.

Analyses of surplus risk reveal that plan sponsors usually face a tradeoff in considering LDI strategies: they lower surplus risk, but often boost asset risk at the same time. For this and other reasons addressed in depth in our papers on LDI, NEPC believes that sponsors should weigh several factors when deciding whether to adopt liability-driven investing. One essential step is to begin to compare asset performance to liability performance, versus peers or asset benchmarks.

To sum up, NEPC recommends that plan sponsors seeking to manage funded-status volatility prioritize their efforts. A sponsor should first address the greatest generator of surplus risk (typically the asset/liability duration mismatch), then secondary causes (usually equity

exposure).

Earnings Power: Risk Budgeting For The Rest Of The Portfolio

As seen above, implementing an LDI strategy can reduce the expected return of the portfolio.

Therefore, after interest-rate risk has been addressed, the next step for sponsors should be to ensure consistency of returns in the earnings-power portion of the portfolio. An asset-risk budget can be applied specifically to this segment, defined as plan assets that are not used to hedge interest-rate risk.

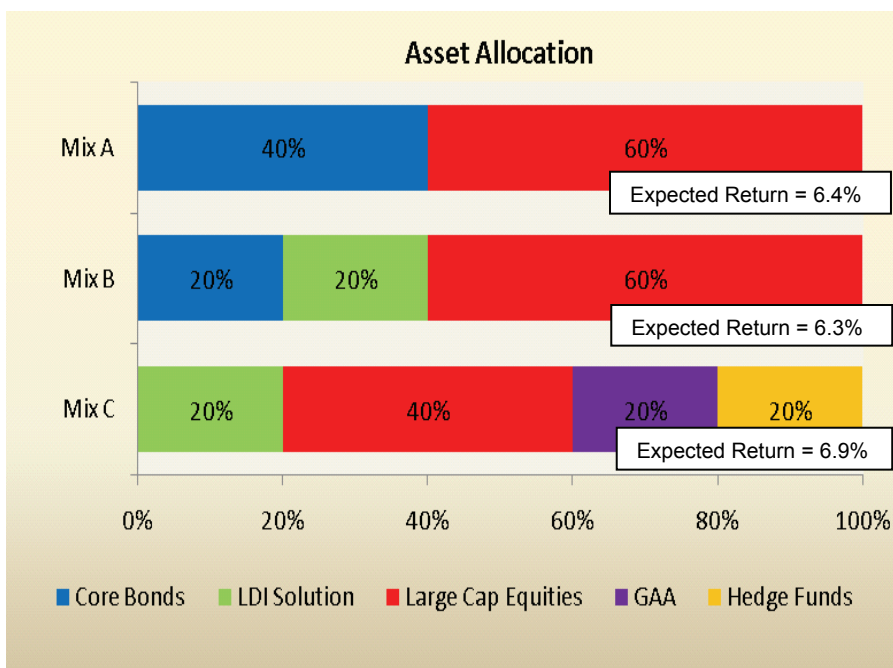
Historically, most pension plans have relied heavily on equities for earnings power, given their potential for high returns. Yet because of the volatility of equity markets

(recently witnessed in the “lost decade” of the 2000s, in which equities lost value), that reliance has led to wide swings in plan returns and funding status.

Risk budgeting can be used to gauge the contribution of equity investments to a plan’s overall risk. Recall that in Table 2, depicting a portfolio with a



Table 6



Lowering the equity allocation and adding other return-generating assets, as shown in Mix C, results in an expected return that is higher than that of Mix A. Thus we can create a portfolio with a component that hedges against interest-rate risk, without sacrificing return expectations from our original 60/40 portfolio. This addresses one of the key concerns in implementing interest-rate-hedging strategies.

In addition, the benefit of diversification can be seen in Mix C's lower level of asset risk compared to Mix B, stemming from Mix C's smaller allocation to equities and the

addition of asset classes with lower correlation to equities and to each other. Yet Mix C's LDI strategy continues to be a major contributor to asset volatility, causing it to exceed that of Mix A.

60/40 bond/equity allocation, equities represented the dominant risk from an asset-return perspective and the second-greatest risk from a funded-status perspective.

To address this risk, we recommend that sponsors consider reducing their plan's equity allocations, using the proceeds to build allocations to non-equity asset classes and strategies with significant return potential and low correlation to stocks. Possible candidates include global asset allocation, risk-parity strategies, private equity, real estate, absolute-return hedge funds, and commodities. This allocation shift diversifies the portfolio's sources of earnings power while potentially lowering both asset-risk and funding-status volatility.

Table 7

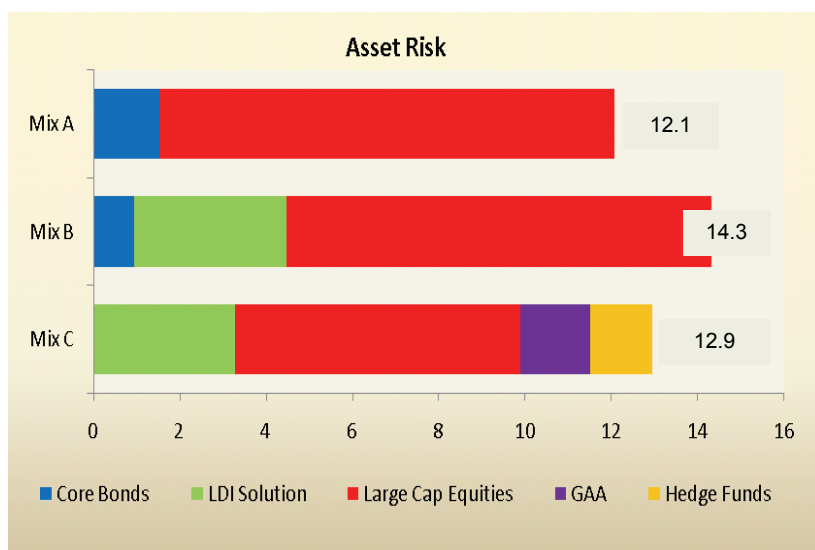
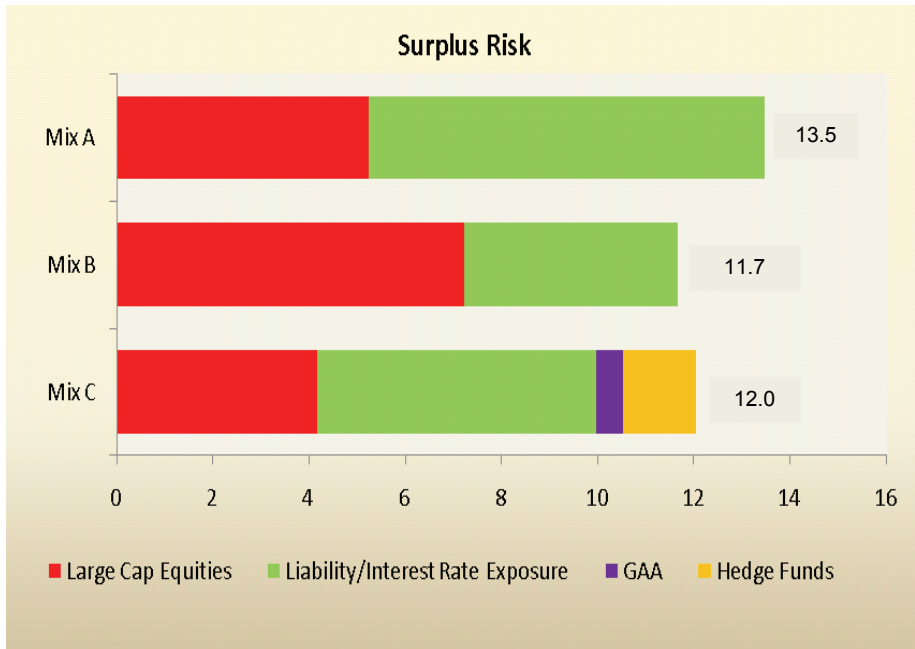


Table 6 displays the risk budgets of sample Mixes A and B, as well as that of a more diversified portfolio, Mix C. This third portfolio retains Mix B's 20% allocation to LDI strategies, but reduces the 60% equity allocation to 40% and eliminates the 20% allocation to core bonds while funding new allocations of 20% to global asset allocation and 20% to hedge funds.

An LDI strategy combined with broad equity-risk diversification, however, can lessen a plan's overall surplus volatility.



Table 8



measure those risks and to determine if they are being properly compensated. Risk budgeting in both asset and surplus terms is extremely useful in helping fiduciaries gain a detailed understanding of portfolio risks and the impact of allocation changes on those risks. NEPC recommends that all plans conduct asset risk budgeting analysis.

For most plans, the dominant source of asset risk is exposure to equities. For corporate pension plans, more focus can be placed on surplus-risk budgeting, which incorporates liability-side interest-rate risk. The

As can be seen in Table 8, it is possible to lower a portfolio’s surplus risk without sacrificing much asset-return potential. This can be done by diversifying a plan’s equity exposure into other return-generating asset classes, while placing some fixed-income assets into LDI strategies to hedge interest rate risk.

Decisions about whether to pursue an LDI solution and the appropriate components of such a solution, including bringing new asset classes into the portfolio – all these choices will be dictated by each program’s risk tolerance and the unique risk and return characteristics of any potential new asset classes. NEPC recommends that sponsors who opt not to pursue an LDI solution still consider lowering their allocation to equities and diversifying into other return-generating asset classes.

Conclusion

As assessments of a pension plan’s risks become increasingly vital in evaluating its design and performance, sponsors need improved methods to

two main drivers of surplus risk are usually the duration mismatch between assets and liabilities, and excessive concentration in equities. Both risks can be mitigated through a combination of LDI strategies and diversification from equities. NEPC has a proven record of working with clients, in the context of their risk tolerances and investment goals, to create customized solutions to address these challenges.

