American Academy of Actuaries

Issue Brief

The Actuary's Role in Public Pension ALM Studies

JUNE 2026

Key Points

- Public pension systems commission Asset Liability Management (ALM) studies to develop a holistic assessment of system funding and inform policy decisions.
- While ALM studies may serve various purposes, to be effective any such study requires careful consideration of both system assets and liabilities and—importantly—how to integrate these elements appropriately to examine key areas of interest.
- Actuaries and investment professionals have different expertise and perspectives, and collaboration between them is vital during ALM studies. Actuaries are critical to understanding how economic assumptions influence plan liabilities and tradeoffs involving plan funding.
- If an actuarial perspective is not present in the key policy discussions, the decision-makers may miss important information, which could lead to less effective policies that adversely impact the pension plan's future.

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Introduction

With public pension systems maturing and growing in size, more efforts are being made to improve risk management. One approach, an Asset Liability Management (ALM) study, is generally performed to aid policymakers with decisions that require an integrated view of plan assets and liabilities. These studies are generally initiated by the system's board, although other governing bodies or the plan sponsor may also commission them. Producing an ALM study typically requires the expertise of the system's investment staff or an external investment consulting firm, together with the system's actuary or other actuarial consultant. While the investment consultant's role may be more intuitive to the study's sponsor, the actuary also plays a vital role in ensuring that the study's objectives are achieved.

While ALM studies are commonly conducted for both private and public pension plans, this paper focuses exclusively on public pension plans. Public plans differ from those in the private sector. For example, they are typically administered by a board that is separate from the sponsor, are subject to different funding and financial reporting rules, and are mostly open plans rather than the closed or frozen plans that are common in the private sector. Consequently, the objectives and processes of public sector ALM studies can be quite different from those for private sector plans.

In some cases, ALM studies are completed by investment advisors with only minimal items being supplied by the plan's actuary, and little to no interaction between the investment advisors and the actuary. To maximize the value of an ALM study, it will generally make sense to work with an actuary specializing in public pension systems, who will collaborate with the investment professionals throughout the ALM process. The plan's own actuary often fills this role. While an independent actuary may bring a valuable perspective to the study, the plan's actuary typically has more knowledge of the key risks to the plan, including how investment risk affects the funding of the plan. Finally, some ALM studies may have objectives that focus solely on actuarial funding methods or demographics and require minimal input from investment professionals.

What Is an ALM Study?

An ALM study takes a holistic approach that integrates forecasts of assets and liabilities to inform policy decisions for managing a pension plan. It can be used to assess a pension plan's investment policy, contribution policy, or any other policies or measures that depend on the changes in assets and liabilities under various scenarios. Different purposes of ALM studies are discussed in the following section.

Often ALM studies use stochastic projections as the basis of their analysis, but stochastic projections are not the defining feature. Deterministic projections are also used for asset-liability management to explore potential scenarios or outcomes by evaluating both the assets and liabilities together. For example, in a deterministic high inflation scenario, projected assets may be adjusted for the expected impact of inflation on investment returns, while projected pension liabilities are simultaneously adjusted for the impact of inflation on cost-of-living adjustments and salary increases. A more complex version of the study may also consider the impact of high inflation on the selection of actuarial assumptions used to measure the liability, such as assumptions for future cost-of-living adjustments, salary increases, and expected investment returns. While this additional complexity provides a more complete view of the impact of the high inflation scenario, it may not be warranted depending on the purpose of the study.

Stochastic analyses involve using many randomized simulations to not only calculate an average result, but also a distribution of potential outcomes. One commonly simulated variable is the return on the plan's assets, although this is not the only variable that could be simulated. Deterministic analyses use a specific path of future experience designed to show one potential outcome of interest. This technique can be used to show expected results if all assumptions are met or to demonstrate specific stresses on the plan.

ALM Studies: Purposes and Applications

An ALM study is usually commissioned for a particular purpose, which will determine the inputs and assumptions as well as the metrics that will need to be evaluated in the study. Examples of such metrics could include future contribution levels, funded ratios, and unfunded liabilities. When possible, decision-makers are encouraged to establish clear objectives for the study in advance so that metrics can be selected that best evaluate the policy options against the pre-determined objectives.

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The Committee gratefully acknowledges the contributions of James Rizzo, MAAA, ASA, FCA.

Common purposes of ALM studies and examples of when they might be used include the following:

- Budget forecasting analysis: Illustrates the pattern and potential volatility of projected contributions. This can be used to plan for future contribution budgets under various scenarios, including, for example, alternative future return, payroll, and workforce forecasts.
- Contribution policy analysis: Compares forecasts of relevant metrics under different contribution policies. This can be used to evaluate the impact of alternate asset smoothing, amortization, or other contribution policy changes on managing the risks inherent in the plan.
- Surplus analysis: Illustrates the likelihood and magnitude of potential funded ratios greater than 100%. This can be used to help develop a surplus management strategy, as discussed in the American Academy of Actuaries issue brief *'Surplus' Considerations for Public Pension Plans*.[1]
- Asset allocation and investment risk analysis: Compares forecasts of relevant metrics under different asset allocations. This can be used to evaluate the desired balance between expected returns and the level of investment risk for the plan, as well as the investment return and discount rate assumptions.
- Variable benefit design and assumption analysis: Models potential outcomes for plan designs in which benefits vary based on funded status, investment returns, contribution levels, or other factors. This can be used to set design parameters and actuarial assumptions for plan provisions such as gain sharing, variable cost-of-living adjustments (COLAs), and variable benefit multipliers.
- Plan change analysis: Compares forecasts of relevant metrics under different plan provisions. This can be useful for examining the effect of changes in plan provisions, such as adding a new tier of members with different benefits or introducing new benefits applicable to current members.
- Liquidity analysis: Models the timing and magnitude of future net cash flow. This can be useful for assessing whether capital may need to be liquidated to pay benefits or meet private asset commitments. This type of analysis is especially important for plans with significantly negative cash flows and plans with significant allocations to illiquid investment classes.
- Asset-liability matching analysis: Studies the relationship between fixed income proceeds and benefit payment amounts for a designated member group or period of time. This may be used for investment policies or proposals that involve matching fixed income inflows with benefit outflows.

Input from actuaries with knowledge of the system is indispensable in many of the above examples.

1 See the Academy's issue brief, *'Surplus' Considerations for Public Pension Plans*.

An ALM study does not typically provide a single best option, but instead presents a set of options highlighting the tradeoffs between different objectives. For example, an ALM study can be used to better understand the tradeoffs between bearing more investment risk with the expectation of achieving higher investment returns compared to reducing investment risk and expecting lower investment returns. Without an ALM study, there is a risk of circularity in this analysis, with the actuary selecting the discount rate based on the expected return of the target asset allocation and the investment consultant selecting the target asset allocation based on the plan's discount rate.[2] In an ALM study, the impact of the risk-return tradeoffs can be explored in a more comprehensive way to allow decision-makers to select the appropriate balance for a given plan with the objectives that matter most to them.

In each funding valuation, actuaries are required to identify the key risks faced by the pension plan.[3] These identified risks can be used to determine the metrics on which to focus within the ALM study. For public pension plans, investment returns often represent the largest risk, leading many ALM studies to focus exclusively on investment returns, ignoring how the range of investment return scenarios may also affect liability experience and future assumptions used to measure liabilities. For example, if the actuary has identified inflation as a key risk, a high-inflation/high-interest-rate scenario may need to measure the effect on liabilities of those changes, including future changes to assumptions for future COLAs, salary increases, and the discount rate. While there is some value to an investment-return-only approach, the results can also be misleading if changes in the liability measure are not simultaneously considered.

Depending on the purpose of the study, the following are some of the metrics that are commonly evaluated. These metrics may be used for making decisions regarding strategies, alternatives, or proposals, or they may also be useful simply as an educational tool for plan fiduciaries to understand the direction and volatility of these metrics.

- Funding policy contributions (as a dollar amount or as a percent of pay)
- Unfunded actuarial liability (UAL, for funding purposes) or net pension liability (NPL, for accounting purposes on the employer's balance sheet)
- Funded ratios (e.g., funding, accounting, or solvency basis[4])
- Baseline benchmarks (e.g., normal cost plus interest on the UAL or, for fixed rate plans, an actuarially determined contribution)
- Cash-flow matching and liquidity needs

2 See the Academy's issue brief, *Asset Allocation and the Investment Return Assumption*, for a more detailed discussion of this dynamic.

3 See section 3.2 of Actuarial Standard of Practice No. 51: *Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions.*

4 Solvency basis examples could include calculations based on a "low-default-risk obligation measure" as defined in *Actuarial Standard of Practice No. 4: Measuring Pension Obligations and Determining Pension Plan Cost or Contributions* or an assessment of the sufficiency of plan assets to cover the estimated cost of settling the plan's benefit obligations.

Modeling the Asset Portion of ALM

Modeling the future experience of plan assets involves expectations for future investment returns and the volatility of those returns, as well as projected contributions and benefit payments. The plan's internal or external investment professionals typically provide expectations for future returns and volatilities of the asset classes in which the plan's assets are invested (capital market assumptions or CMAs), which may be used to estimate the portfolio's expected return and volatility. CMAs from different investment professionals may vary significantly, and decision-makers may want to consider a range of forecasts determined by different models when forecasting assets for their study.[5]

Projected future cash flows into the plan from employer contributions are developed from an integration of the asset projection and the liability projection discussed below. These amounts, along with projected employee contributions into the plan and benefit payments out of the plan are typically provided by the plan's actuary, as the actuary can produce the most reliable projections of these items, not only under a base scenario, but also under alternate scenarios. For many plans, the investment returns affect the contributions and may affect the benefit payments. Similarly, other variables such as inflation may also affect both contributions and benefit payments. Accurate cash flow projections are important to reflect the interconnected nature of the assets and liabilities.

Some investment classes may be fully liquid, while others may have an expected period of illiquidity or even the potential to require additional cash from the plan. The plan's investment professionals are best positioned to understand the economic conditions under which the plan's investments will be liquid, illiquid, or require additional cash. The actuary can illustrate when these economic conditions may also change contributions or benefit payments in a way that may alleviate or aggravate the liquidity needs.

Modeling the Liability Portion of ALM

When it comes to the liability component of an ALM study, the plan's actuary is typically best positioned to take primary responsibility for the modeling of plan benefit payments, liabilities, and projected contributions. If the plan's actuary is not responsible for this modeling, it likely will be helpful to receive their direction and input on the process, as they will be best positioned to ensure that the unique aspects of a plan's liability profile, assumptions, and funding policies are incorporated into the analysis properly. The plan's actuary is also likely in the best position to review the final output of any modeling of the plan's liabilities.

In developing or reviewing projected liabilities, the plan's actuary will be able to assess whether the implications of a given set of projected financial scenarios are considered, reflected, and communicated appropriately.

5 See the Academy's Practice Note, *Forecasting Investment Returns and Expected Return Assumptions for Pension Actuaries*, for additional information.

For example, areas of focus could include:

- Discount rate assumptions: The actuary typically will consider whether the current discount rate used for the valuation will be unchanged throughout the projection period, or if the modeling will incorporate potential changes consistent with the actuary's view of how the discount rate would change for different scenarios.
- Inflation impacts: The effect of inflation changes on projected cashflows and liabilities can vary significantly among plans depending on COLA provisions and assumptions regarding how directly future inflation experience will flow through the relevant salary and benefit amounts for a plan.
- Asset-related benefits: Benefits and cash flows may be directly affected by the return on plan assets (or a portion of plan assets) or the funded status of the system. This includes plans that have an account balance or variable component tied to investment returns or systems that may have a benefit or contribution policy triggered by funding thresholds.
- Demographic impacts: While plan populations are often assumed to be constant for purposes of a projection, there may be situations where the actuary and plan sponsor have determined it is appropriate to reflect projected changes in the population level, or to explore sensitivity around this assumption, such as modeling how plan outcomes would change if there was a decline in the covered group. The plan's actuary is going to be best positioned to make sure any such considerations are reflected consistently in the ALM study.

Integrating Assets and Liabilities

While plan assets and liabilities could be projected independently under various assumptions, coordinating these pieces more effectively models how the plan will behave over time. For example, as discussed above, investment or inflation experience may affect contributions, benefit payments, and the assets available to pay benefits.

Funding Status and Discount Rate

When interpreting any results involving the projected funded status, it is important to understand the implications of potential variations in the discount rate assumption. When the expected return on assets is used as the discount rate, an alternate investment portfolio with a higher or lower expected long-term return may necessitate a change in this assumption. For example, if an alternate investment portfolio necessitates increasing the discount rate, it would immediately increase the traditionally calculated funded status of a plan, even though the plan has the same level of assets and the same benefit obligations it did prior to the discount rate change.

The main funding objective of a public retirement system is to secure long-term benefit promises by systematically accumulating and maintaining an actuarially sufficient reserve. While maximizing future investment returns may enhance the plan's ability to pay future benefits,

there are other factors that influence the sustainability of a pension plan (perhaps even to a greater degree) such as future contribution volatility. Accurate modeling of such factors can only be achieved by integrating the projections of assets and liabilities under consistent sets of assumptions.

The desired outcomes of most ALM studies will include some type of modeling of future required contributions, funded status, unfunded actuarial liability, or cash flows. Producing these results requires consistent projections of both assets and liabilities, particularly regarding variables that affect both measures. Among these, inflation may be the most important, as it not only affects future investment returns, but also future member pay increases, and cost-of-living adjustments.

As an example, to appropriately model the impacts of inflation on the items mentioned above, the modeling will need to reflect the plan's benefit provisions and funding policies, including its cost method and amortization policies. These complexities are best addressed by the plan's actuary, who is equipped to ensure they are incorporated appropriately.

Presenting ALM Study Findings

As discussed above, it is best for the decision-makers commissioning the study to establish clear criteria early in the ALM study process to be used for evaluating the various options being studied. These criteria will involve different aspects of the asset portfolio and funding strategy and will likely involve metrics that move against one another. The outputs of the ALM analyses will demonstrate the inherent tradeoffs in the policy choices that the board is considering. This knowledge gives decision-makers a more complete picture of the risk and rewards on the metrics that are most relevant to the fund.

For example, it is generally preferred for contribution rates to be both low and stable. However, these metrics are in tension: Higher investment returns can reduce contribution rates, but the corresponding greater investment return volatility leads to less stable contribution rates. An ALM study should allow decision-makers to understand this tradeoff.

Deterministic projections are usually straightforward to understand, because they model one specific version of the future and can be used to illustrate asset/liability dynamics by isolating the impacts of a few key variables. They are also well-suited to stress test the system or examine the impacts of certain scenarios that are of most concern. For example, deterministic projections can illustrate the impact of repeated low investment returns or the level of return that would be required to reach a 100% funded ratio over a defined period with a given contribution rate. However, deterministic projections do not provide any information on the likelihood of such a scenario.

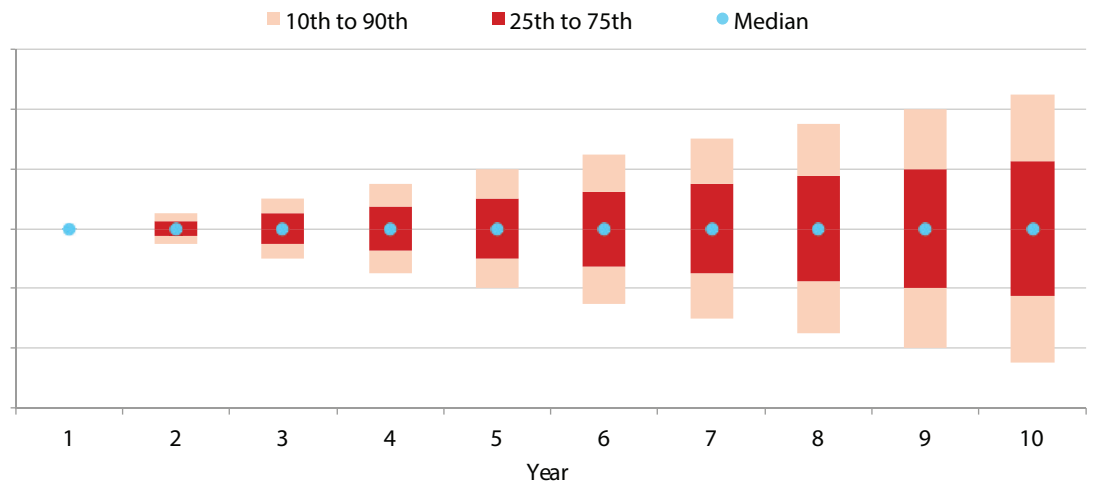
In contrast, stochastic projections produce results from numerous scenarios that are useful for exploring the range and likelihood of potential outcomes. For example, varying future investment returns in a stochastic projection is a common approach. As previously discussed,

the pre-determined key metrics can be computed and summarized in a variety of ways. Effective presentations of results may include:

- Projected results broken down by percentiles using bar charts, box-and-whiskers charts, stacked area graphs, etc.
- Estimated probabilities of certain events occurring (e.g., contribution rates exceeding a certain threshold, annual increase in contribution rates exceeding a certain threshold, funded status falling below a certain level).
- Scatter plot of two key metrics compared to each other, illustrating the tradeoffs between different desired objectives.
- Averages and standard deviations of items of interest.
- Heat map—results on a given metric organized and color-coded to draw out relationships (e.g., median funded status for each of the asset allocation options).

Chart 1 provides an example of how stochastic projection results for a plan's actuarially determined contribution could be displayed. For each year, the median result (for example, the middle contribution level calculated for that year out of the 10,000 modeled scenarios) is shown as a blue circle in the center of the distribution, the range of results from the 25th percentile to the 75th percentile are shown in the dark shaded region, and the 10th to the 90th percentile range shown in a lighter shade. By focusing on key percentiles and ranges, an effective illustration can help communicate patterns that may be less apparent in a non-graphical form. In this case, the increasing "cone of uncertainty" for the expected contribution level depending on future experience is clearly visible.

Chart 1: Projected Actuarially Determined Contribution as % of Pay



Comparing stochastic results for multiple policy alternatives can be difficult. One approach is shown in Chart 2, which illustrates the range of outcomes for the current contribution policy compared to four alternatives. The metric used for this chart is the Unfunded Actuarial Liability (UAL) at a point 10 years after the new policy is implemented. The bars represent the range from the 25th percentile to the 75th percentile out of the 10,000 modeled scenarios. Alternative Contribution Policy #1 produces the broadest range of projected UAL, and Alternative Contribution Policy #2 appears to be superior because it does not produce as broad a range. All modeled Alternative Contribution Policies produce a higher potential for UAL and a lower potential for surplus (below the white line) than the Current Policy. The Alternative Contribution Policies offer different trade-offs between the potential for surplus and the potential for UAL. Depending on the value of surplus, the affordability of the UAL, and other measures (e.g., contribution levels), one of the alternatives may nevertheless be preferable to the current contribution policy.

Chart 2: Projected UAL in 10 Years
25th to 75th Percentile

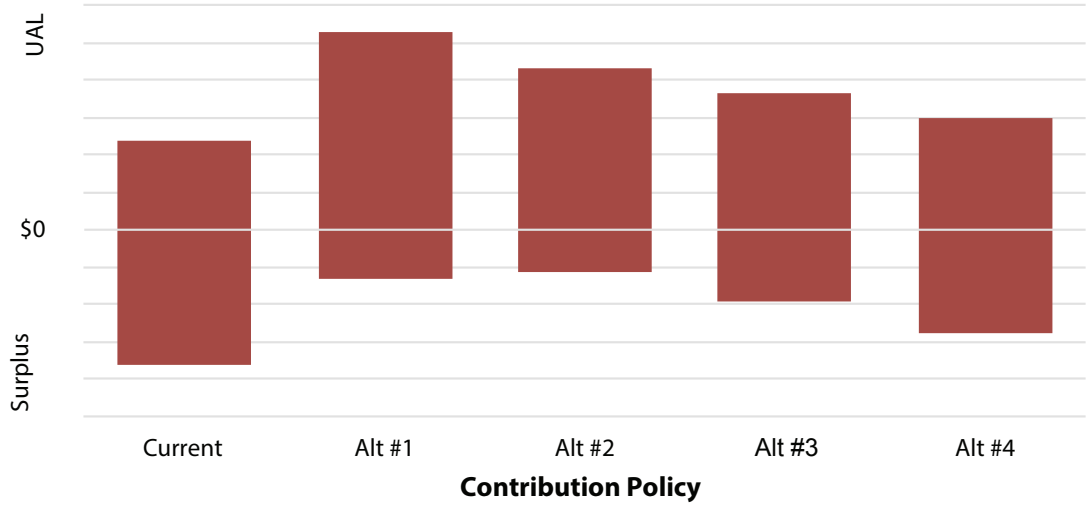
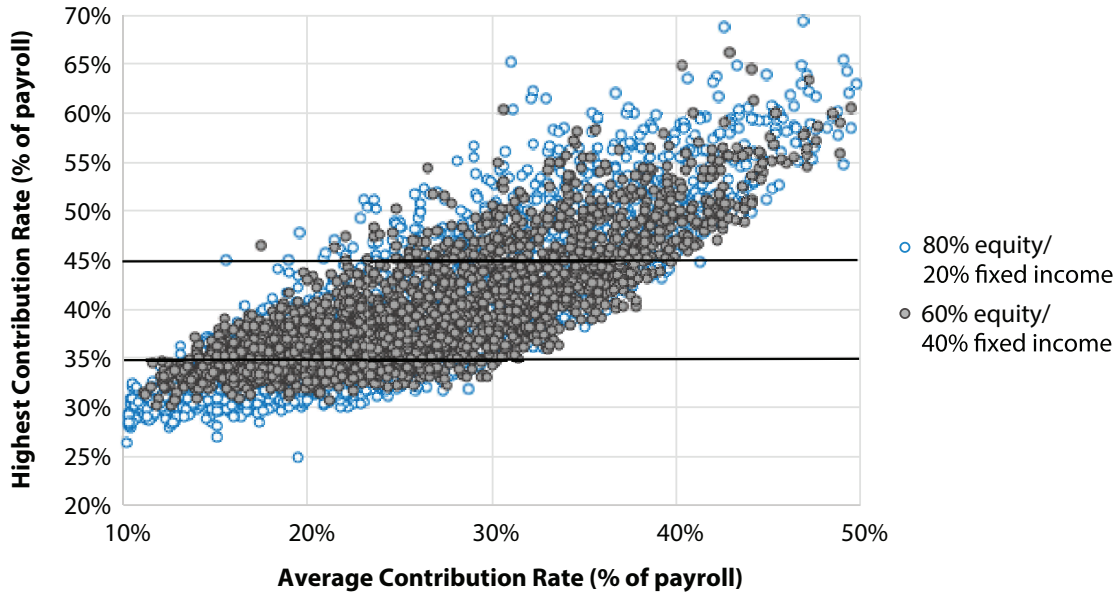


Chart 3 (a scatter chart) below provides an example illustrating the trade-off between an asset allocation with higher expected returns and an allocation with lower expected volatility by showing the full range of stochastic outcomes. The two metrics used are average contribution rate and highest contribution rate over a 20-year projection period. The individual scenarios associated with the "80% equity/20% fixed income" asset mix (blue circles) show a wider range of outcomes compared to the "60% equity/40% fixed income" asset mix (gray circles).

Chart 3: Investment Risk/Reward Trade-Off

Simulated 20-Year Projections of Employer Contribution Rates Under Two Alternate Investment Portfolios



Under the 80%/20% portfolio, 24% of the scenarios had a highest contribution rate in excess of 45% of pay, while this percentage was less than 19% for the 60%/40% portfolio. With the 80%/20% portfolio, 40% of scenarios had the highest contribution rate below 35% of pay, compared to 27% of scenarios for the 60%/40% portfolio.

A limitation of scatter charts is that they can be hard to read where scenarios closely overlap, such as those in the middle of the distribution in Chart 3. A discussion accompanying such a chart can help clarify the information shown.

Stochastic projections use many simulated future scenarios to illustrate the distribution of potential outcomes for key metrics or areas of interest. The simulated future scenarios typically depict a wide range of possible future experience over the course of the projection period. It is important to recognize that a plan will experience only one actual future, which becomes known only as it is realized over time. For example, a stochastic analysis may show the effects of very strong investment return scenarios along with scenarios with significant investment losses, which may incorrectly give the impression that good and bad experiences will offset each other. In the

event a plan experiences a period of significant investment losses similar to one of the depicted downside scenarios, the plan must have policies and practices in place that are robust enough to address the situation. Consequently, it is important for the analysis to focus on the likelihood and magnitude of downside scenarios where the implications may be severe and the decisions critical. The upside scenarios, in contrast, may provide limited utility.

When interpreting the results of an ALM study, it is particularly important to consider the limitations of the model that was used to perform the study. There are a wide range of assumptions used in an ALM study. There is uncertainty around each of these assumptions, so there are limitations to using any given model that should be considered when interpreting the results. It may be more useful to compare the results from a model between alternative policies or the trend in metrics over time rather than interpret the model as providing precise predictions.

Summary

Public pension systems need to consider their strategy and risk tolerance in funding the benefits that they are obligated to provide. To maximize the benefits from an ALM study, the analysis should go beyond investment performance to include a range of implications such as contribution requirements, funded status, and, when applicable, changes in benefits. Actuaries, with their expertise in liability measurement and funding methods, are critical to understanding tradeoffs involving plan funding. Investment professionals bring insight into the asset and operational risks of investment policies and portfolios. Ultimately, combining the expertise of actuaries and investment professionals may allow the system to better satisfy the fiduciary responsibilities of governing a public pension plan.

The future is impossible to predict with certainty, and no projection model will perfectly match actual outcomes. However, projection models can be helpful in contrasting choices relative to one another, as they highlight tradeoffs across key metrics and help decision-makers evaluate options despite the uncertainty.

While actuaries and investment professionals have different expertise and perspectives, collaboration between them is vital during ALM studies. If either perspective is not present in the key policy discussions, the decision-makers may miss important information, which could lead to less effective policies that adversely impact the pension plan's future. Actuaries and investment professionals may not agree on every point, but the ALM study can produce a more robust, relevant, and useful outcome by integrating the viewpoints and expertise of both parties.