

Charting the course:

A framework to evaluate pension
de-risking strategies

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working world

Our authors



Adam Berk
Partner, Ernst & Young LLP
Houston, TX
+1 713 750 4996
adam.berk@ey.com



Chris Raham
Principal, Ernst & Young LLP
New York, NY
+1 212 773 9064
christopher.raham@ey.com



Jennifer Haid
Manager, Ernst & Young LLP
New York, NY
+1 212 773 4624
jennifer.haid@ey.com



Phil Hur
Manager, Ernst & Young LLP
New York, NY
+1 212 773 7029
phil.hur@ey.com



Francisco Orduña
Senior, Ernst & Young LLP
New York, NY
+1 212 773 0145
francisco.orduna@ey.com

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A note on the organization: Section 1, the synopsis, provides an overview of our methodology and key findings. The remaining sections, the introduction through the closing remarks, develop, in further detail, each of the key themes of the synopsis.

1. Synopsis

In the five years since the financial crisis began, volatile market returns and depressed interest rates have combined to make defined benefit (DB) plan management particularly challenging. Volatility on the balance sheet, in net income and in cash contributions has caused DB plan management to be elevated to the finance agenda, and in response, plan sponsors, consultants and insurers are now increasingly focused on de-risking strategies for defined benefit plans.

Corporations experienced some relief in 2013, when market returns sky-rocketed and interest rates increased, increasing the funded status of many plans to pre-crisis levels. Many plan sponsors are back in the same funded position, facing the same type of decisions, as they were in early 2008. Back then, plan termination appeared to be affordable, yet because plan investments were not aligned to manage the risks in the liability portfolio, the opportunity to implement such forward-looking changes quickly vanished as the market plummeted.

Now, many plan sponsors are working with their advisors to develop their strategy for the next five to ten years: more plans have been frozen, and the discussion has turned to the effective management of the legacy liabilities. Differently than in 2008 when risk management options were limited to traditional Liability Driven Investment (LDI) investment strategies or terminal funding arrangements, plan sponsors now have more solutions available and, as a result of the increased focus on pension risk management, plan sponsors are better educated about their options.

Yet within the wide range of alternatives available, it can be difficult to settle on a course of action. Crucially, there is still a void with respect to the process that should be used to evaluate options against plan sponsor objectives instead of in their separate silos (design, financial, investment and insurance). The industry has not yet answered one of the most important questions: how can we examine the strategies available in today's market under a common framework?

We wrote this paper as part of an effort to fill that gap, laying out a framework and then taking the CFO of two midsize plans through our process to demonstrate how it can enable effective decision making tailored to the company and to the plan.

Building the decision-making framework

We believe there are three key tenets of a sound decision-making process:

- ▶ **The analysis must be objective.** We should be able to use the same framework regardless of the company or the plan under review.
- ▶ **The guidance should be unbiased.** Each solution – from plan design changes to the full buy-out of plan liabilities – should be evaluated against the same set of objective criteria.
- ▶ **The outcome must be well understood.** A solution's ability to achieve the identified objective must be measurable, as must be the costs or trade-offs of adopting the strategy.

The outcome of the process should be guidance that considers the objectives of the company and rejects solutions that expose the company to risks it is not willing, or prepared to take.

The framework is applied in five key work steps: define the objective; define the alternative strategies; analyze the alternatives, implement the strategy and monitor the outcomes. We will use the case study to walk through the first three steps of this process.

Applying the framework to our case study

Outlining the CFO's current state

The CFO has a common problem: the combination of low interest rates and volatile markets has significantly reduced the funded status of the company's defined benefit plans over the past five years. In fact, in the single year between 2008 and 2009, the funded status of the plans dropped 20%. As a result, while the company has made significant cash contributions, there has been no measurable improvement in funded status. Its investment policy – 60% return-seeking and 40% risk-protection assets – did not perform well in response to market volatility, but has allowed for partial recovery in recent quarters.

In those quarters, market returns and interest rates have improved. The CFO has made the strategic decision to take advantage of the resulting improvement in funded status to implement a strategy to terminate the plans within five years. She has taken the initial steps to close both plans and freeze benefit accruals; in addition, she has overseen the settlement of a portion of the existing liabilities using lump-sum payments. But how should assets be managed between now and full termination? What should her concerns be as they approach the 5th year?

How do we apply the framework to our case?

Define the objective: the answer to the CFO's question – how should assets be managed between now and full termination? – depends on varying factors: the risk tolerance of the company; the plan attributes; and the size of the plan liabilities when compared with the company's core business. While there may not be one 'best' solution, we will look to find the best options after we eliminate those strategies that do not meet the CFO's objectives. The CFO can then choose between the remaining strategies knowing that she's eliminated solutions that expose the business to undesirable outcomes.

We will walk through the case study under two scenarios:

- ▶ First, we will look at the CFO whose objective is to minimize the total expected cost of termination.
- ▶ Second, we will look at the CFO with no tolerance for termination cost in excess of what is budgeted -- \$45 million for the Salaried Plan; and \$12.5 million for the Hourly Plan. Should the economy improve, the improvement in funded status will allow the company to transact more quickly. However, should the economy deteriorate, this CFO expects the strategy to protect the plans' funded status from further deterioration.

Define the alternative strategies: The CFO is considering a set of four investment management strategies that are typically available to a midsize plan sponsor:

Static allocation	The current allocation of return-seeking and risk-protection assets is maintained throughout the projection period.
Graded allocation	The allocation to the current risk-protection asset is increased as certain milestones, based on the funding target, are reached. Re-risking, or increasing the allocation to return-seeking assets, is allowed if the funded status deteriorates.
Traditional LDI	The allocation to the current risk-protection asset is increased as certain milestones, based on the funding target, are reached. The risk-protection asset is defined as the combination of the Barclays Long Government Credit and the 30-year Treasury that matches the duration of the liabilities. Re-risking is allowed if the funded status deteriorates.

Insured solution

The allocation to the current risk-protection asset is increased as certain milestones, based on the funding target, are reached. The risk-protection asset is designed to transfer the economic risks to an insurance company. Re-risking is not allowed in this solution.

Analyze the alternatives: to demonstrate financial impacts, we demonstrate the performance of the strategies under a set of stochastic scenarios more like traditional Value at Risk (VaR) measures.

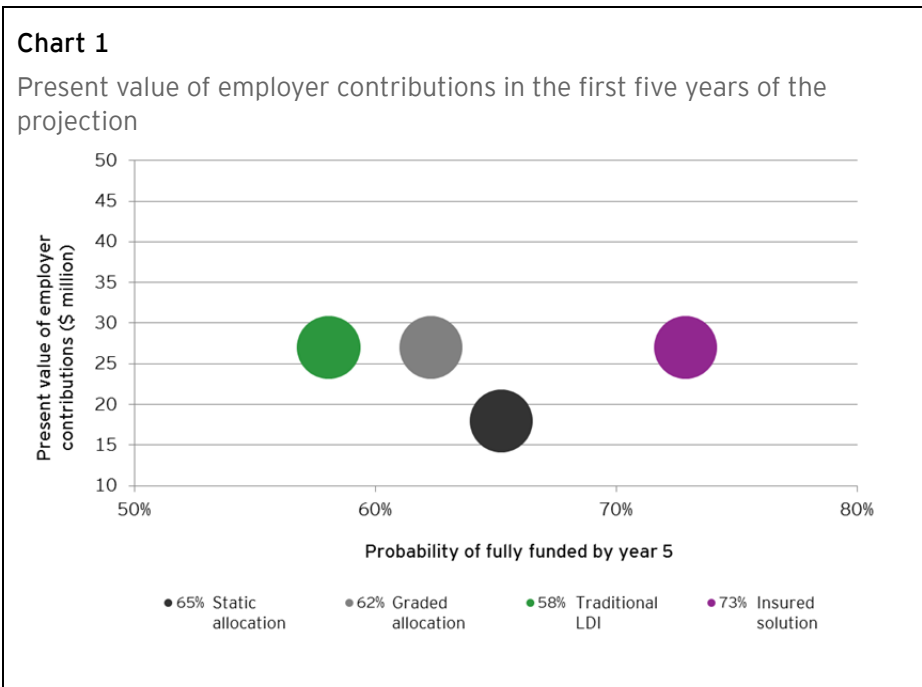
We will use the results of the stochastic analysis to rank the strategies by customized risk metrics. This will allow us to stress the performance of the strategies against the CFO's objectives over a wide variety of economic outcomes.

In this synopsis, we will focus our analysis on the Salaried Plan. In the body of the paper, we will extend our analysis to the Hourly Plan in situations where different plan attributes drive different results.

Minimizing the total expected cost of termination

The CFO is focused on minimizing the expected cost to terminate the plan over a five year horizon, subject to the condition that the strategy chosen shows a reasonable probability of achieving plan termination within the five year window. The plans will be terminated once available assets are sufficient to cover the termination premium.

The following chart shows the average total employer contributions remitted in the first five years of the projection against the probability of being fully funded by Year 5. Remitted contributions are less than budgeted when plan termination occurs before the end of the fifth year.



As we would expect, because the allocation to the return-seeking asset remains high under the static allocation, there is more opportunity to collect on market upswings, and the present value of the average cost of this strategy is the lowest. Since the static allocation also exhibits a reasonable probability of successful termination within the five year window (65%), the CFO is likely to choose this strategy.

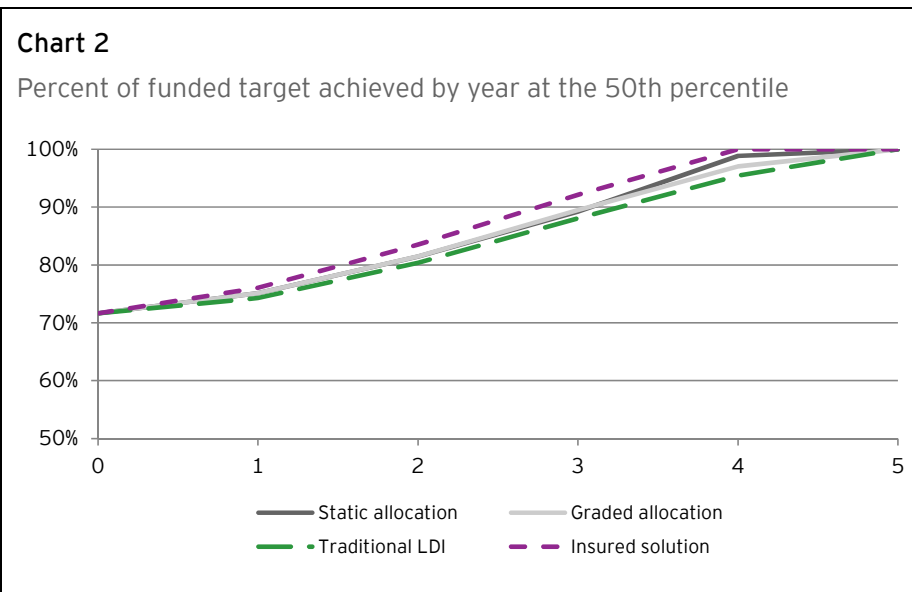
In this case, the order of the graded allocation, traditional LDI and insured solution is also important. Many economic forecasts anticipate an increasing interest rate environment, and the scenarios we've used do the same. Portfolios with shorter-duration fixed income will perform better in this environment than comparable strategies with longer-duration fixed income. Since we have modeled traditional LDI so that the dollar duration of the fixed income matches the liability, this portfolio uses longer-duration assets than the graded allocation and insured solution. Therefore, in this environment, traditional LDI does not have as high a return as those other strategies. In a decreasing interest rate environment, we would see the opposite effect.

Restricting the total cost of termination to budgeted contributions

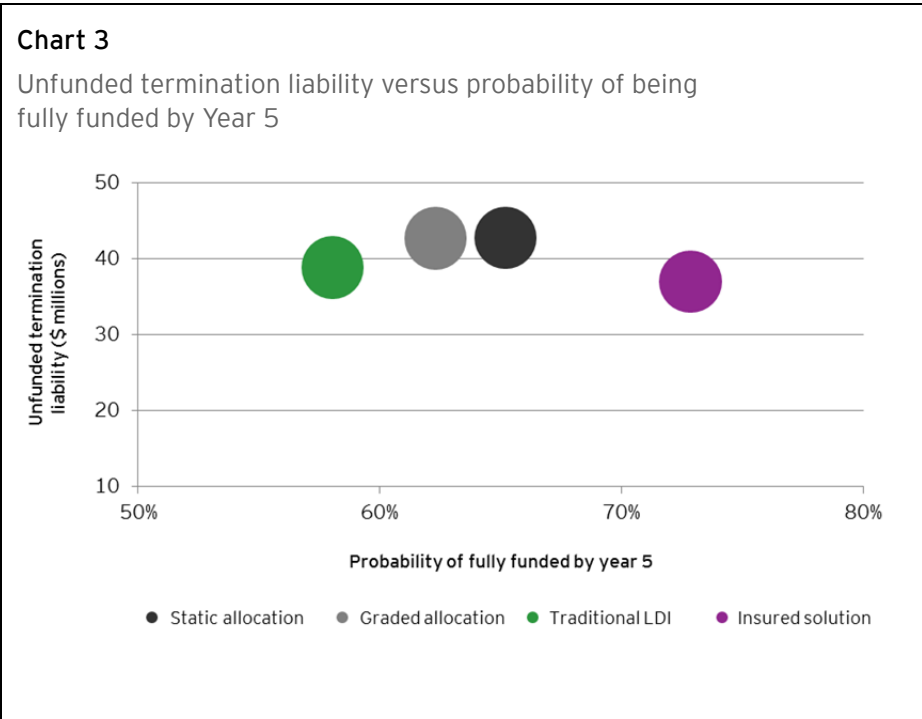
In this case, the CFO is focused on capping the total cost of termination to the budget. The plans will be terminated once available assets are sufficient to cover the termination premium.

In this case, better-than-expected performance that would allow termination before five years is a good outcome; however, it is less important than protecting against the risk of additional contributions.

If we look at the median result, the CFO's objective is satisfied under each strategy as all strategies achieve plan termination within the five year window.



However, by looking more deeply into the analysis, specifically at the adverse scenarios, critical differences between the strategies begin to appear. The following chart shows the probability of being fully funded by Year 5, against the unfunded termination liability at Year 5 in the scenario at the 95th percentile. By 95th percentile, we mean that if there were 100 cases ranked from the lowest cost of termination to the highest, this case would be the 95th least expensive – or 5th most expensive, scenario.



In this case, the traditional LDI and the insured solution have the lowest average unfunded termination liability at the end of five years. However, the insured solution appears to be the clear choice for the CFO as the probability of termination within the five year window is higher than for all other strategies.

In our example, we have chosen to model a simple version of the traditional LDI strategy where the bond portfolio is made up of a short duration asset and a long duration asset and the relative weighting is set to match the dollar duration of the liability. While there are more sophisticated LDI strategies available in the market, we have chosen to model the traditional LDI in this way because many companies with plan assets of a similar magnitude as those in the case study rely on a variant of this simple strategy.

Plans with a more sophisticated LDI strategy will see results that are more consistent with those plans that undertake an insured solution. In those cases, the traditional LDI strategy will show results more in line with the insured solution and may be a viable alternative for the CFO.

Summary analysis

It is clear from our examples that the strategy that best fulfills the objective of the plan sponsor is not the same for everyone. The strategy that best satisfies the corporate objective, constraints and priorities of the plan sponsor depends on the plan sponsor’s risk tolerance and the attributes of the plan. It also depends on which economic environment the CFO thinks is most likely over the projection time frame.

When markets perform well, static allocation strategies with a high allocation to equity perform well also; when interest rates are rising, but recovery is more sluggish, the strategies with higher allocations to shorter-duration risk-protection assets perform the best; and lastly, when interest rates are falling, the strategies with longer-duration risk-protection assets provide the lowest-cost solution.

Innovation has given CFOs a set of instruments that can be used to manage pension risk, and the tools to make effective risk management decisions have been created.

By using the disciplined framework we have presented here, the CFO can weigh each solution's benefits and costs against the company's constraints and other priorities.

As plans teeter on the brink of full funding, companies should harness the latest tools to select the strategy that best suits their needs. The alternative is to expose the company to a potential replay of the volatility they have experienced in the past five years.

2. Introduction

DB pension plan risk management is a topic frequently on the C-suite agenda. As such, many articles have been written to describe the unique challenges inherent in DB plan management, much media attention has been focused on those companies that are implementing risk management strategies, and many options are available to support transferring all or some of these risks to third parties.

One question that has not been answered is one of the most important: how can we examine the pension risk management strategies available in today's market under a common framework to assess which best meet the goals of the CFO, while considering the unique aspects of each company's situation?

Funded-status metrics are again at a level where de-risking solutions are affordable which presents an opportunity for companies to review their pension risk management strategy. Past experience shows us that the markets can move quickly to erode the hard-won gains in funded status, and those that have a strategy in place will be better positioned to handle unexpected market events.

If the ultimate goal is termination, there is also an advantage to being prepared: there are windows of time where de-risking strategies are more attractive and affordable. In order to be ready to take action, the CFO must have a strategy in place to take advantage of favorable market conditions. This means doing the legwork ahead of time to scrub the data, align the portfolio to an allocation that is appropriate both before and at plan termination, and perform proper due diligence on termination pricing relative to the demographics and plan provisions.

We wrote this paper to show how a company can work towards an effective pension risk management strategy. In particular, we will use a framework which allows a broad range of de-risking options to be evaluated in an objective and unbiased way against the company's objectives, constraints and other priorities.

In the sections below, you'll find the following information:

- ▶ In **Section 3**, we look at the market events that have led many plan sponsors to identify pension de-risking as a strategic objective.
- ▶ In **Section 4**, we lay out the key tenets of our framework for evaluating de-risking strategies.
- ▶ In **Section 5**, we describe the types of solutions that are available to plan sponsors.
- ▶ In **Section 6**, we illustrate how our framework can be used to set an effective pension risk management strategy through the use of a case study.

3. Why is pension plan de-risking such a hot topic?

Volatile market returns and depressed interest rates have combined in the early 2000s and again in more recent years to make defined benefit plan management particularly challenging. Plan sponsors have been required to contribute cash into their DB plans which otherwise would have been available for other purposes. Additionally, due to market fluctuations, they have had to explain volatility in their income and balance sheet to investors and analysts. This turbulence has elevated DB plan management to the finance agenda; in response, plan sponsors, consultants and insurers are now increasingly focused on de-risking strategies for DB plans.

Many plan sponsors have taken the initial step toward full termination and closed their DB plans to new entrants and have often taken the additional step to stop future accruals to existing plan members. As of June 30, 2012, only 11% of the Fortune 100 companies continued to offer traditional defined benefit plans to new salaried employees, down from 90% as recently as 1998.¹ Put a different way, of the approximately \$2.0 trillion of US DB assets under management by private plan sponsors, 56% relate to plans that are closed to new entrants and approximately half of those are frozen to future accruals.²

A Pyramis Global Advisors survey conducted in late 2013 showed that 15% of plan sponsors surveyed had instituted a formal glide path strategy with established triggers - i.e., a strategy that creates a more conservative asset allocation as certain triggers, like funded status level, are reached; a further 30% declared their intention to de-risk, but have not yet implemented a formal glide path.³

Pension plan management, traditionally the purview of the benefits department, is now also on the finance agenda, and financial risk management techniques are now becoming part of enterprise risk management strategy.

Why should we act now?

In 2013, market returns and interest rates increased. Consequently, the funded status of many plans increased to pre-crisis levels. While this has relieved some of the financial pressure on plan sponsors, significant challenges continue to exist:

- ▶ Legislative and accounting changes now require that pension liabilities be valued on a basis more in line with corporate debt.
- ▶ Updated mortality tables and improvement scales that reflect longer life expectancies have caused unanticipated increases in liabilities to reflect the additional expected payments to retirees.
- ▶ The costs of administering plans, including PBGC premiums, are rising.
- ▶ Lastly, analysts are taking a harder look at the ability of plan sponsors to meet their obligations, especially when the pension liabilities rival the plan sponsor's market capitalization.

MAP-21 temporarily increased PPA interest rates; however, the effects are likely to disappear by 2016. In addition, rates calculated in accordance with MAP-21 are not used to compute PBGC premiums and will not affect the interest rates used by insurers to determine buy-out liabilities. As a result, we have not included the effects of MAP-21 in our model.

Many plan sponsors find themselves in a similar funded position, facing similar decisions, as they were in early 2008: the plan's investments may not be aligned to mitigate the risks in the liability portfolio and therefore any slowdown or reversal of the economic recovery could cause a reversal in the gains in funded status as well. This is an outcome that plan sponsors understand well but would like to avoid.

Therefore, as asset values and interest rates continue to increase, and the cost of transferring the risk of the plan becomes more affordable, plan sponsors should consider this opportunity to act. There are many options: some will choose to defease the liability completely, others may choose

¹ "Fewer Employers Offering Defined Benefit Pension Plans to New Salaried Employees," *Workforce* magazine, www.workforce.com/articles/fewer-employers-offering-defined-benefit-pension-plans-to-new-salaried-employees, October 3, 2012.

² "The 2013 Cutwater Asset Management Defined Benefit Pension Plan Survey," Cutwater Asset Management, www.cutwater.com/pdf/research/2013_cutwater_survey_white_paper.pdf, 2013.

³ "2013 Pyramis Global Advisors US Corporate Mid-Market Pulse Poll," Pyramis Global Advisors, <http://www.pyramis.com/us/mid-market>, 2013.

to implement investment solutions with risk mitigation characteristics, and still others may choose to continue to manage their pension portfolio on a total return basis to take advantage of market upswings.

Regardless of the ultimate objective of the plan sponsor, the decision should be based on a framework that allows the performance of each strategy to be assessed in an unbiased way against the objectives, constraints and other priorities of the plan sponsor.

4. The tools available for pension risk management

In early 2008, plan termination appeared to be affordable for many plan sponsors, and many companies began to ask about de-risking strategies. At the time, there were fewer de-risking options available in the US, and we had not yet seen the level of customization that has been negotiated into recent transactions.

In 2014, that picture has changed, and there are significantly more options available across the spectrum of risk management activities, whether the end goal is to implement a liability-focused investment strategy, to partially de-risk the plan or to fully defease plan liabilities. Increasingly, as noted above, these options are customizable to the plan sponsor and plan attributes.

Many plan sponsors implement a de-risking strategy in a series of four major steps:

1. **Close the plan to new members and freeze benefits against future accruals.** This strategy reduces the company's exposure to future benefit accruals and will be driven by the company's overall benefits strategy.
2. **Offer lump-sum payouts to eligible deferred vested members and retirees.** Before a broader de-risking strategy is pursued for the existing plan population, this strategy should be evaluated as it may provide a cost-effective method to settle eligible benefits, depending on the current economic environment.
3. **Change the investment strategy such that the assets more closely mirror the liabilities.** To protect the funded status of the plan, the plan sponsor can invest in assets that will mirror changes in the underlying plan liability as interest rates and corporate bond spreads change.
4. **Transfer either or both the economic and longevity risks to an insurance carrier.** To insulate the plan against unfavorable changes in the interest rate environment, or against unexpected changes in plan experience, the company can purchase an insurance product.

For each of these steps, the right combination of risk management, or risk transfer techniques depends on a variety of factors, including the current and projected financial position of the DB plan, the company's expectations of the future economic environment, the company's overall benefit strategy and the relative cost of the strategies, just to name a few.

The following table provides a summary of some common risk management and risk transfer techniques available to DB plan sponsors.

Common risk management or risk transfer strategies	Description and representative actions
Design solutions	<p>Design solutions are usually applied in the first stages of a risk reduction exercise and are used to moderate or eliminate future increases in plan liabilities as a result of benefit accruals for current and future participants.</p> <p>These techniques can include:</p> <ul style="list-style-type: none"> ▶ Reducing future benefits ▶ Closing the plan to new entrants ▶ Eliminating future accruals for existing plan participants
Financial solutions	<p>Financial solutions are applied to reduce the liability or current shortfall in plan assets.</p> <p>Common techniques include:</p> <ul style="list-style-type: none"> ▶ Additional contributions in the form of cash, employer securities (the ability to use this approach is limited) or debt financing ▶ Lump-sum payouts
Investment solutions	<p>Investment solutions focus on the management of plan assets as a tool to either reduce any shortfall in plan assets or to reduce the volatility of the deficit or surplus.</p> <p>Common techniques include:</p> <ul style="list-style-type: none"> ▶ Portfolio diversification ▶ Investments in alternative asset classes; for example, private equity, derivative instruments or hedge funds ▶ Liability-driven investment (LDI) strategies ▶ Dynamic asset allocation
Insurance solutions	<p>Insurance solutions are used to protect the portfolio against unplanned changes in the liability; for example, an unexpected change in the pattern of retiree deaths or a mismatch between the liability discount rate and the return of the fixed income portfolio.</p> <p>Common products include:</p> <ul style="list-style-type: none"> ▶ Insured LDI ▶ Insured buy-in ▶ Insured buy-out ▶ Longevity insurance (more commonly sold in the UK)

Investment and insurance solutions available to plan sponsors

- ▶ **Traditional Liability Driven Investment (LDI):** the company seeks a closer correlation between the expected performance of current investments and future liabilities. An LDI approach seeks to build a portfolio capable of meeting all future DB liabilities on a best efforts basis. Similar to other investment products, fees are expressed as a percent of assets under management and collected at regular intervals.
- ▶ **Insured LDI:** a more rigorous example of the above, an insured LDI approach provides a guaranteed investment that exactly matches the economic basis of the liabilities. This strategy eliminates the basis risk that exists between a traditional LDI portfolio and the discount rate used to calculate plan liabilities. Similar to other investment products, fees are expressed as a percent of assets under management and collected at regular intervals.
- ▶ **Insured buy-out:** also referred to as an annuity purchase. A plan sponsor transfers the existing pension liabilities directly to an insurer in exchange for an up-front payment. This removes the liability from the plan sponsor's balance sheet. If a buy-out contract is purchased for the entire liability, the plan sponsor must immediately fund any gap between available assets and the buy-out premium. If a buy-out contract is purchased for a portion of the liabilities, the plan sponsor may be required to remit additional cash contributions should the plan become 'at-risk'. Typically, the premium for this product is due when the transaction is executed.
- ▶ **Insured buy-in:** these are similar to buy-outs, with one key exception: the fiduciary responsibility is not transferred to the insurer but rather remains with the plan sponsor. The plan sponsor purchases an asset that matches the existing pension obligations. This product allows the plan sponsor to i) avoid having to immediately fund any existing deficit and ii) avoid the settlement accounting that is required if the obligations are sold to an insurer in a buy-out. At the same time, future pension contributions and expenses become more predictable as the sponsor's deficit, with respect to the covered liabilities, becomes fixed. We note that the accounting treatment for buy-in contracts is complex and the issues related to measuring pension expense have been a consideration for employers evaluating this approach. Typically, the premium for this product is due when the transaction is executed.
- ▶ **Longevity insurance:** sometimes implemented as part of a broader Liability Driven Investment (LDI) strategy, actual longevity experience is swapped for a counterparty's expectations of future longevity experience, thereby locking-in the future longevity experience from the perspective of the plan sponsor. Fees are typically expressed as a percentage of the underlying benefit cash flows and may be collected up front, or at regular intervals.

Pension risk management is a complex exercise: in order to make an effective decision, the CFO needs a framework under which she can evaluate how successful each technique, or combination of techniques, might be related to her selection criteria.

5. Setting up a guidance framework

We believe there are three key tenets of a sound decision-making process:

- ▶ **The analysis must be objective:** We should be able to use the same framework regardless of the company or the plan under review. The criteria that a CFO prioritizes will fluctuate depending on the plan attributes and the company's risk tolerance, but the framework should remain constant while accommodating varying circumstances and facilitating the analysis.
- ▶ **The guidance should be unbiased:** each solution – from plan design changes to the full buy-out of plan liabilities – should be evaluated against the same set of objective criteria that has been prioritized based on the plan attributes and the company's risk tolerance.
- ▶ **The outcome must be well understood:** A solution's ability to achieve the identified objective must be measurable, as must the costs and risk/reward trade-offs of adopting the strategy.

The outcome of the process should reflect the company's objectives and reject solutions that expose the company to risks it is not willing, or prepared to take.

So how can we apply these tenets to the pension risk management exercise? Our pension risk management framework is set out in the table below.

Key work step	Key objectives
Define and prioritize the objectives and constraints	The company's objectives when defining its pension risk management policy should be stated in terms of its fiscal priorities; for example, the goal may be to minimize the volatility of cash contributions or net income, or to fully defease the liability for all or a part of plan participants in a set number of years. The company should prioritize competing objectives by its tolerance to the underlying risk.
Define the universe of alternatives to consider	The company should identify a finite number of strategies across the spectrum of alternatives that could be used to help achieve its objectives. Each alternative will then be subject to analytical review.
Analyze alternatives	Financial outcomes should be projected for the selected alternative strategies across a broad range of economic scenarios over the time horizon appropriate for the plan sponsor. Progress towards the defined objectives should be tracked and used to rank the strategies.
Implement the strategy	The company will work through the implementation of the strategy - for example, a lump sum offering, a change in investment strategy, or the purchase of an insurance product - with its team of advisors.
Monitor the strategy	Periodic monitoring allows the company to assess how the strategy is performing in a timely fashion and allows the plan sponsor time to react if adjustments need to be made. The frequency of monitoring will depend on the individual company and the size of the residual risk. Long-term forecasts should be reviewed at regular intervals to validate the strategies in terms of the company's current objectives.

The key tenets are important in each of the steps above. In this paper, we will show how they can be applied to analyze the alternative strategies. We will show how the application of an objective and unbiased framework and the choice of metrics that are focused on the objectives, constraints and other priorities of the CFO help to rank the strategies such that the solutions that expose the business to undesirable outcomes are eliminated, leaving only those that are best aligned with the company's goals.

Identifying the best strategy – setting objectives, analyzing the alternatives and selecting the ultimate strategy – takes time. Therefore, the earlier that the company works through this decision-making process, the sooner it can take action. In addition, implementation will also take some time and effort. Many of these actions demand significant planning. For example:

- ▶ Changes in a plan's benefit structure require plan amendments that must be communicated to and approved by various parties.
- ▶ Opening a lump-sum window requires a plan amendment and, in certain cases, approval from the Department of Labor.
- ▶ Data must be of sufficient quality to support the implementation of a lump-sum program or full termination through a buy-in or buy-out to an insurer.

Finally, acting early allows the company to be prepared and proactive to the economic environment before implementing a de-risking strategy. Timing is particularly important when the de-risking strategy requires changes to the portfolio's investment mix, which is likely required when implementing investment solutions and insurance products.

6. A case in point

To demonstrate our framework, we look at how the process would work for a hypothetical company: a mid-sized manufacturer with a current market capitalization of approximately \$500 million.

6.1 Background

The company sponsors two defined benefit pension plans: the Salaried Plan and the Hourly Plan. The combined liabilities of the two plans on a funding basis (as dictated by the Pension Protection Act of 2006) are approximately \$175 million.

The Salaried Plan is a final average pay plan with relatively rich benefits. It has been closed to new entrants for 10 years, which means the majority of the participants (80%) are already in receipt of benefits; the benefits are not linked to inflation. The plan is 85% funded on a PPA basis and has an existing asset allocation that is invested 60% in return-seeking assets (i.e., equities) and 40% in risk-protection assets (i.e., fixed income securities).

By contrast, the Hourly Plan is a flat benefit plan that has remained open to new entrants. Approximately half of the plan participants are receiving monthly benefits, with the remainder either still accruing benefits or terminated with a vested benefit; benefits are not linked to inflation. The plan is 95% funded on a PPA basis and has an existing asset allocation similar to the Salaried Plan: 60% invested in return-seeking assets and 40% in risk-protection assets. The duration of the Hourly Plan liabilities is longer than that of the Salaried Plan; this means that the cash flows are paid out over a longer period of time.

Further information on plan demographics can be found in Appendix A and further information on the liability valuation parameters can be found in Appendix B.

The Company's business is cyclical in nature: when the economy goes through a downturn, it experiences a reduction in sales and has less cash available to run its business. Unfortunately, this is also the time at which more cash must be contributed to the plans. In the more recent past, the combination of low interest rates and volatile markets had significantly reduced the funded status of the plans. The company has been required to make significant cash contributions. While market returns and interest rates have increased in the past year, the CFO wants to eliminate the volatility in required cash contributions and the resulting impact on the Company's financials.

Certain risk management actions have already been taken

The management team has evaluated its options and has decided that the retirement benefits that the company offers will be converted from a defined benefit arrangement to a defined contribution-style plan. The plan conversion is outside the scope of this case study: we will focus on the path the CFO follows to fully defease the risk of the existing DB plans.

The CFO consults with the plans' actuaries on the most effective way to manage the risks associated with the remaining DB plan liabilities; it is decided that the plans will be fully terminated: the target time frame is five years.

A number of steps are taken immediately:

- ▶ The Hourly Plan is closed to new entrants to mitigate the risk of any increase in liabilities due to new participant accruals. This action is not required for the Salaried Plan which is already closed.
- ▶ All existing accruals are frozen, i.e., current plan participants are no longer eligible to accrue benefits related to future service within either of the DB plans.
- ▶ Lump-sums payouts are offered to eligible participants, reducing the liability related to the ultimate buy-out transaction.

Offering lump-sum payouts for relatively small accrued benefits is an economical way to reduce the liability for many pension plans. While the actual cash payouts relative to the liability will vary depending on the economic conditions and assumptions for determining the liability, there are other savings to be considered. PBGC fixed premiums are paid annually on a per participant basis, regardless of funding level, and are set to rise from \$42 for the 2013 plan year to at least \$64 for the 2016 plan year, a more than 50% increase. In addition, reducing the number of plan participants can lessen various administrative burdens such as annual notices and census recordkeeping.

The remaining shortfall between available assets and the full termination premium is too large for the company to contribute in a single year; the CFO has set the funding policy such that, at current interest rates, the plans will be funded at the end of five years. For the Salaried Plan, the annual contribution is budgeted at \$9 million (for a cumulative total of \$45 million); \$2.5 million for the Hourly Plan (for a cumulative total of \$12.5 million).

The plans will be terminated once available assets are sufficient to cover the termination premium; or at the end of 10 years, whichever happens first.

The CFO must set the investment policy for plan assets from now until the date of termination.

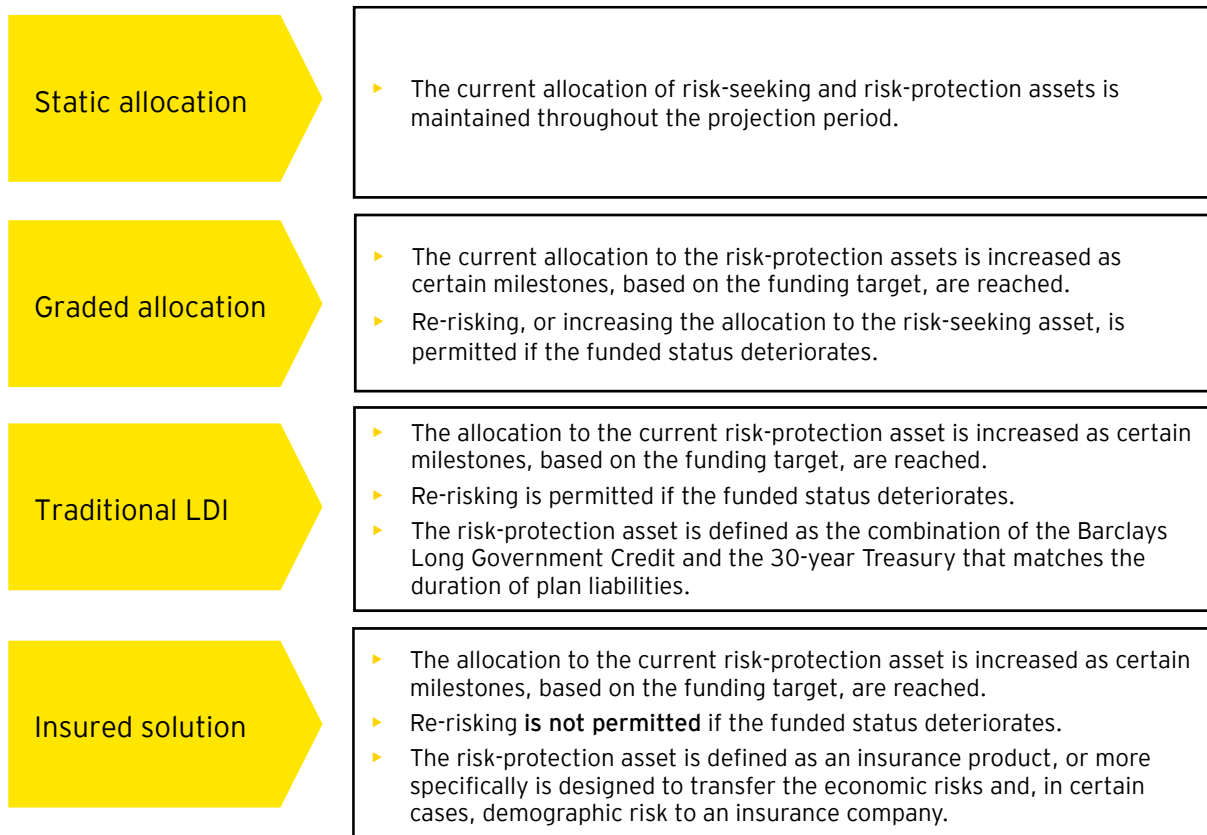
6.2 Defining the corporate objective

We will walk through the case study under two scenarios:

- ▶ Objective 1: The CFO's objective is to minimize the expected total cost of termination.
- ▶ Objective 2: The CFO has low tolerance for termination costs in excess of what is budgeted -- \$45 million for the Salaried Plan; and \$12.5 million for the Hourly Plan. Should the economy improve, the improvement in funded status will allow the company to transact more quickly. However, should the economy deteriorate, this CFO expects the strategy to protect the plans' funded status from further deterioration.

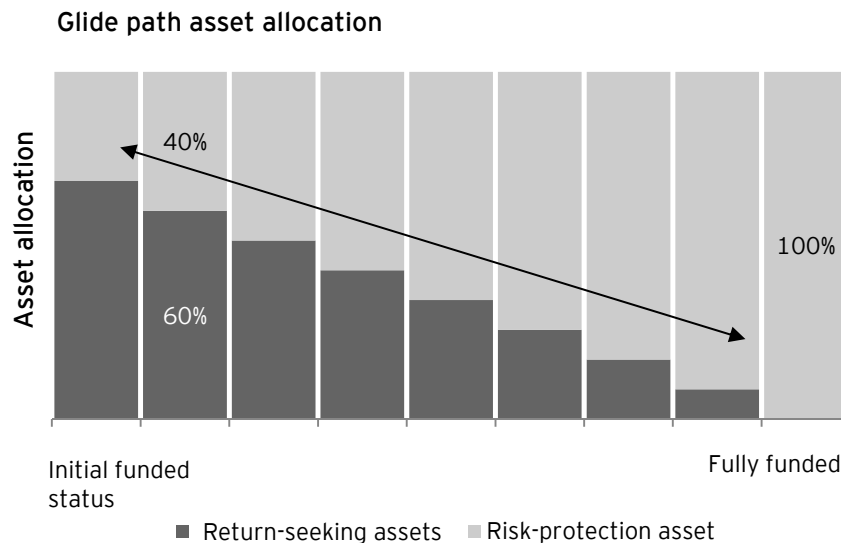
6.3 Identifying the strategies that will be considered

As a first step, the CFO works with the plans' advisors to develop the list of investment and insurance strategies to be considered. The following strategies, which represent a cross section of those typically available to a mid-size sponsor, were selected for analysis.



Setting up the glide path

In strategies that use a glide path, the asset allocation is reset based on the funded status of the plan at the end of each year. If the funded status improves, more assets are allocated to the risk-protection assets. On the other hand, if the funded status deteriorates, more assets are allocated to the risk-seeking assets. The following figure illustrates the linear rebalancing path followed by the strategies that use a glide path.



6.4 Analyzing the results

6.4.1 Modeling the selected strategies

In this section, we provide an overview of our modeling approach. Further detail can be found in the Appendices.

In section 6.4.2, we will explore the relative performance of each strategy using a set of management scenarios the CFO has selected. These strategies represent both the baseline economic outcomes which the CFO believes are most likely and alternatives the CFO believes are possible and would have a negative impact on the plan.

In section 6.4.3, we will use a set of stochastic scenarios to analyze the strategies by customized risk metrics. This will allow us to stress the performance of the strategies against the CFO's objectives over a wide variety of economic outcomes.

Defining the strategies

Static allocation: In this strategy, the target asset allocation is unchanged throughout the strategy at the current mix: 60% return-seeking assets and 40% risk-protection assets. When the portfolio is more than 5% outside the target allocation at any December 31, the portfolio is rebalanced to 60/40 the following January 1. For simplicity, rebalancing occurs once annually for all strategies. The risk-protection asset is the Barclays Long GC (Barclays Long Government/Credit Index).

Graded allocation: In this strategy, the target asset allocation is set throughout the projection period based on the funded status (defined on a PPA basis) at the end of the current year. As the plan's funded status improves, the allocation to the risk-protection asset increases; conversely, if the plan's funded status deteriorates, the allocation to the risk-protection asset decreases. The portfolio is rebalanced once annually on January 1. The risk-protection asset is the same as that in the static allocation strategy: the Barclays Long GC.

Traditional LDI: Similar to the graded allocation strategy, the target asset allocation is determined using a glide-path. The difference is that the risk-protection asset is composed of two assets: the 30-year Treasury bill and the Barclays Long GC. The relative weighting is set to match the dollar duration of the liability; with the restriction that short selling is not permitted.

While there are more sophisticated LDI strategies available in the market, we have chosen to model the traditional LDI in this way because many companies with plan assets of a similar magnitude as those in the case study rely on a variant of the simple strategy described above. Plans with a more sophisticated LDI strategy will see results that are more consistent with those plans that undertake an insured solution as described below.

Insured solution: Similar to the graded allocation and traditional LDI strategies, the target asset allocation is determined using a glide-path. The distinction is that in this strategy, the risk-protection asset is defined as an insurance product where the liability is "insured" – or held in the risk-protection asset – is fully hedged against changes in the economic environment. Certain products that fit into this category also hedge the liabilities against unexpected changes in the plan's expected mortality. In our projections, we have assumed that the product does not hedge longevity risk.

In all strategies, the return-seeking asset is allocated to a basket of indices representative of the portfolio of a mid-size plan sponsor. The initial allocation is 40% large cap equities; 15% international equities and 5% alternative assets; the relative weight of each class is maintained as the allocation to the return-seeking portfolio increases and decreases.

Each of the strategies discussed above has associated investment management costs. For the static allocation, graded allocation and traditional LDI strategies, the cost of investing in each asset class is based on current market expectations. The cost for the insurance solution is linked to the economy at the time of purchase and other factors: therefore, we have used indicative pricing data and created a simplified pricing algorithm such that the cost varies depending on the underlying liability duration and the economic environment at the time of purchase.

Further detail with respect to the parameterization of the strategies under consideration can be found in Appendix D.

Estimating the cost of plan termination

The cost of plan termination can be expressed as a multiple of the liabilities on either a PPA basis or a GAAP accounting basis – and this multiple can be used as the funding target when constructing the glide-path. In our example, the company is most concerned about the volatility of cash contributions

that are driven by the liabilities calculated on a PPA basis; therefore, we will express our target in those terms.

Indicative pricing for the company's two plans showed that, in today's environment, the termination multiples are approximately 120% of the PPA liabilities. We have used the termination multiple to set the Funding Target for plan termination.

It is important to adjust this metric over time to account for changes in the economic environment. To accomplish this, we use an algorithm that measures changes in the US Treasury curve and the S&P 500 to forecast their effects on these prices and have applied this during our projections.

6.4.2 How do the candidate strategies perform in the management scenarios?

For strategic planning purposes the Company has developed management scenarios. The management scenarios are used to explain how the strategies perform in response to changes in interest rates, corporate spreads and equity returns that are of top concern to management.

We will focus on four scenarios:

- ▶ **The baseline scenario:** equity returns are in line with historical averages and interest rates rise to their long term average over three years
- ▶ **The slow recovery:** equity returns are in line with historical averages and interest rates rise to their long term average over five years
- ▶ **The volatile equity scenario:** equity returns drop in the second year of the projection; and there is an initial period of high inflation
- ▶ **The Japan scenario:** interest rates remain low and equity returns are depressed

The charts for the Salaried and Hourly Plans are similar in each of the scenarios described above; therefore, only the results for the Salaried Plan are presented.

The baseline scenario

We first look at how the strategies perform in our base scenario: interest rates rise to the long term average over a 3 year period, and equity market returns are in line with historical averages.

The baseline scenario assumes that the 10-year Treasury rate increases from current levels to its expected long-term average of 4.85% over four years. (A forecast similar to that published by Moody's Analytics.⁴) For illustration, to create the full yield curve, we have assumed that the shape of the curve is the same as that at the beginning of the projection period, and that any credit spread from the Treasury rate is fixed over the full yield curve. We will stress both of these assumptions later in the analysis. Finally, we have assumed that return-seeking assets return 7.5% annually, which is the average historical return of the S&P 500 (including dividends) over the past 10 years. We will stress this assumption as well in later analyses.

⁴ "U.S. Macroeconomic Outlook Alternative Scenarios," Moody's Analytics, <https://www.economy.com/home/products/samples/Moodys-Analytics-US-Alternative-Scenarios.pdf>, September 2013.

The results for the Salaried Plan are shown in Chart 4 below.



In this scenario, the combination of increasing interest rates and moderate equity returns means that all strategies achieve the funding target -the termination premium - within the five-year window. As expected in this environment, those strategies that maintain a higher allocation to equity reach the funding target more quickly. While the static allocation strategy is the quickest to achieve the funding target, all strategies accomplish this by the end of Year 4.

The outlier in this chart is the traditional LDI portfolio. Because this strategy is heavily invested in long duration Treasuries, portfolio returns are lower than those invested in shorter duration securities. In a decreasing interest rate environment we would expect traditional LDI to outperform the graded allocation and insured solution, all else being equal.

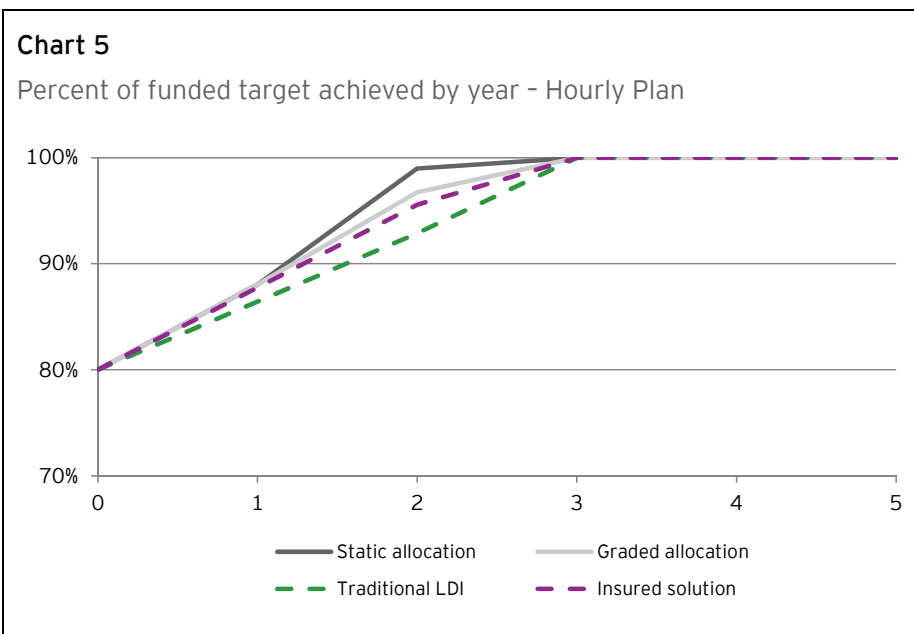
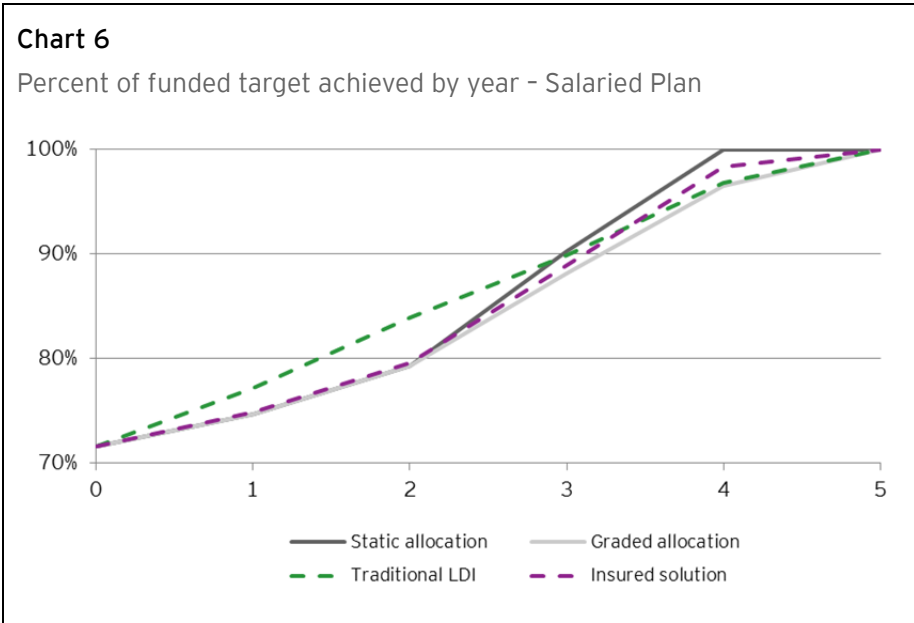


Chart 5 shows the results for the Hourly Plan where the funded status on a PPA basis was already 95%. The results are consistent with those of the Salaried Plan, save that the funding target is achieved even more quickly (i.e., by the end of Year 3).

What if the economy is slow to recover?

In this scenario, the increase in interest rates happens over a five year period instead of the three year period in the baseline scenario; equity returns are in line with historical levels which is unchanged from the baseline scenario. Chart 6 illustrates the results for the Salaried Plan.

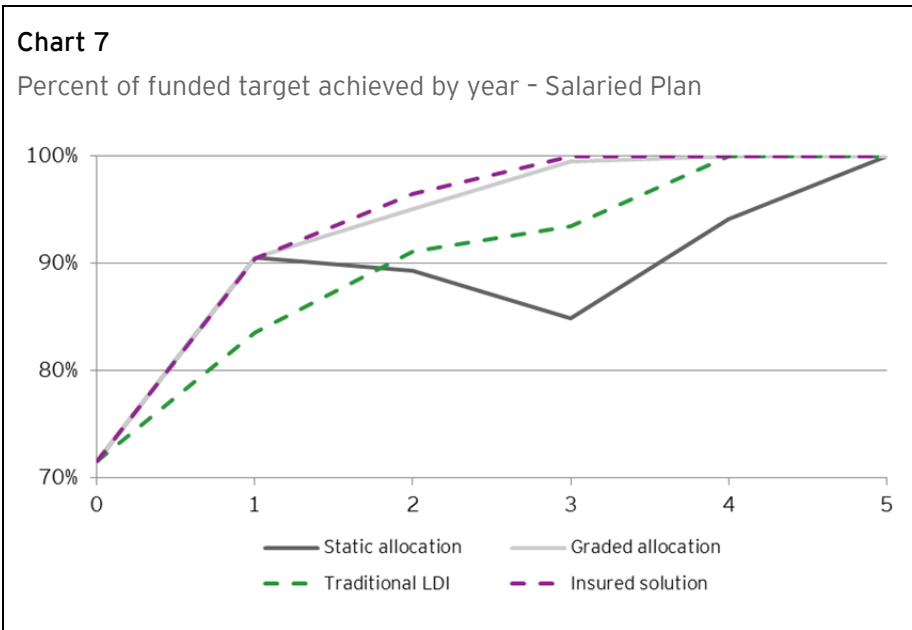


Similar to the baseline scenario, the combination of increasing interest rates and moderate equity returns means that all strategies achieve the funding target within five years.

In this scenario we see an example of the traditional LDI strategy outperforming the other strategies in the first few years while interest rates remain low.

What if there is a sharp drop in equities, and we experienced a period of high inflation?

In this scenario, there is a one-time deviation from the historical average as equity returns drop by 20% in the second year. In addition, interest rates spike in Year 1 and then return to the pattern described in the previous scenario - traveling from current levels to the long term average over five years. Chart 7 shows the results of this scenario for the Salaried Plan.



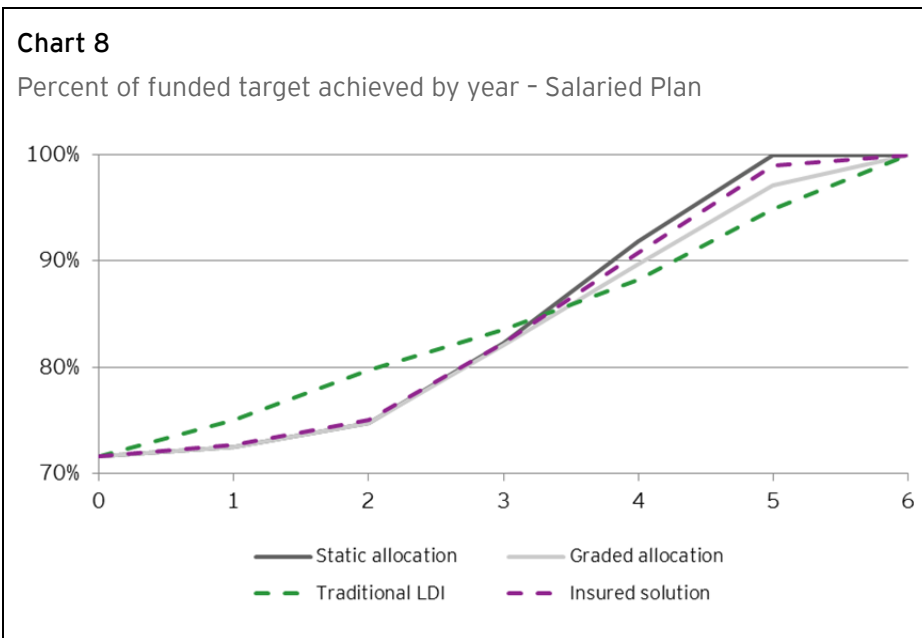
All strategies continue to achieve termination with the five-year window; however, the static allocation strategy is an outlier. In this strategy, gains are not “locked in” by increasing the allocation to the risk-protection asset; therefore, a higher proportion of the portfolio is affected by the drop in equities in Year 2.

In this scenario, we are assuming only one year of negative equity returns; it is easy to see that if equities continued to underperform the historical average for another year that the static allocation strategy may not achieve the funding target within five years.

In addition, those strategies with shorter fixed income duration - i.e., the graded allocation and the insured solution - reach the funding target more quickly than those with longer fixed income duration - i.e., traditional LDI. These strategies lock in the gains from the increase in interest rates and equity returns in Year 1, and in Year 2 they are less sensitive to the sharp downturn in rates brought on by the dollar crash than the longer-duration portfolio.

Finally, what happens if interest rates increase slowly and equity returns are depressed?

In this scenario, equity returns are in line with inflation over the entire projection period. In addition, interest rates increase from current levels to the long-term average over five years. Chart 8 presents the results for the Salaried Plan.



Initially, the traditional LDI strategy outperforms the other strategies as longer duration assets outperform shorter duration assets. As interest rates slowly increase, all strategies achieve the funding target within six years.

The performance of the strategies depends heavily on the economic environment between now and the date of termination. The table below shows the year in which the strategy achieves full termination for the Salaried Plan. Because contributions are the same across all of the scenarios, the lowest cost strategies are those where the funding target is reached in the shortest number of years.

Scenario	Static allocation	Graded allocation	Traditional LDI	Insured solution
Baseline	3	4	4	4
Economy is slow to recover	4	5	5	5
Drop in equities; period of high inflation	5	3	4	3
Low equity returns, low interest rates	5	6	6	6

We can draw a few conclusions from these results. When equity markets perform well, static allocation strategies with a high allocation to equity achieve the funding target more quickly. When interest rates rise at a slower rate, and equity markets perform modestly, the strategies with higher allocation to shorter duration risk-protection assets reach the termination target faster. And finally, when interest rates are falling, the strategies with longer duration risk-protection assets provide the quickest time to termination.

6.4.3 How do the candidate strategies perform under stochastic scenarios?

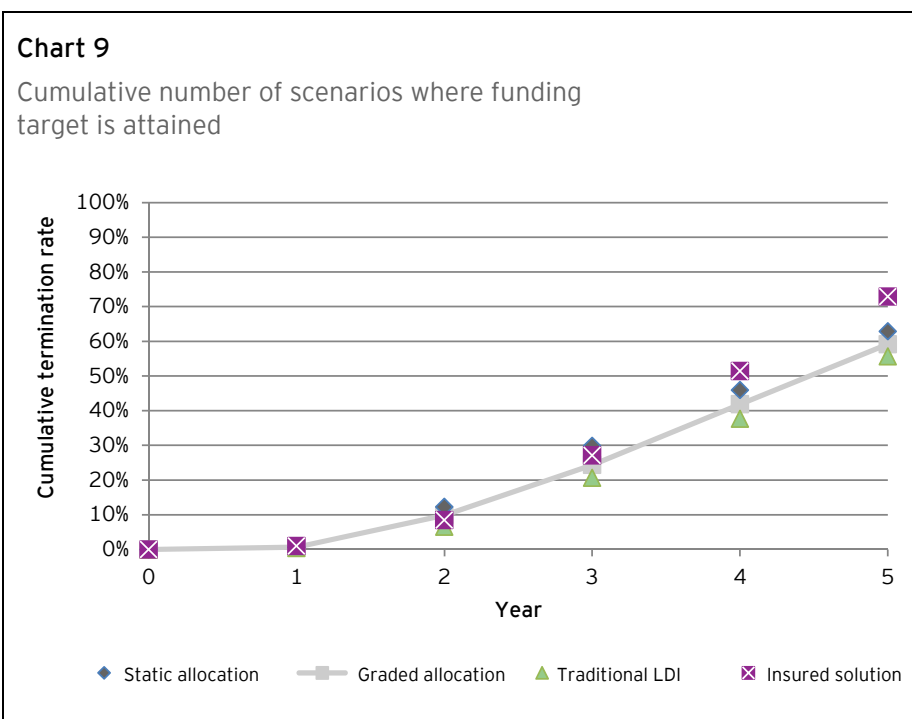
In this section, we'll shift the focus to look at the aggregate results of 2,000 randomly generated scenarios. The scenarios have been calibrated to reflect management's general expectations of future market returns, the risk free rate, and credit spreads. Further detail with respect to the development of the interest rate, corporate spread and equity market assumptions can be found in Appendix C.

We will use the results of the stochastic analysis to evaluate the strategies by customized risk metrics. This will allow us to stress the performance of the strategies against the CFO's objectives over a wide variety of economic outcomes.

Objective 1: Minimizing the expected total cost of termination

The CFO is focused on minimizing the expected cost to terminate the plan over a five year horizon, subject to the condition that the strategy chosen shows a reasonable probability of achieving plan termination within the five year window. The plans will be terminated once available assets are sufficient to cover the termination premium.

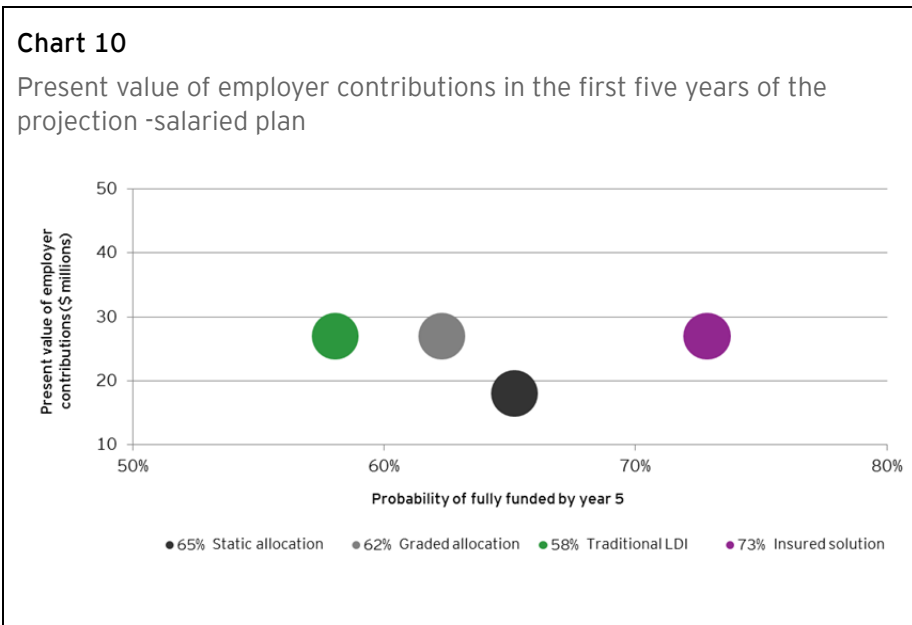
Chart 9 shows the cumulative probability of termination in each year across all scenarios for the Salaried Plan.



The static allocation has a slightly higher probability of achieving the funding target and; therefore, plan termination in the first three years of the projection. This is a function of the higher allocation to return-seeking assets. As above, by Year 4 and Year 5, the downside protection offered by the insured solution allows more scenarios to achieve termination.

Based on the chart above, it is unclear which strategy has the lowest cost over the five year period since the ranking of the scenarios changes over time.

Chart 10 shows the average total employer contributions remitted in the first five years of the projection against the probability of being fully funded by Year 5. Remitted contributions are less than budgeted contributions when plan termination occurs before the end of the fifth year.



The static allocation appears to have the lowest expected cost in this case. Because the allocation to the return-seeking asset remains high under the static allocation, there is more opportunity to collect on market upswings and the average cost over the initial five years is the lowest.

We also see that the insured solution has the highest probability of achieving termination at Year 5. This is a result of the downside protection this strategy provides in the worst scenarios.

It is important to put the ranking of the glide path strategies - graded allocation, traditional LDI and insured solution - in context.

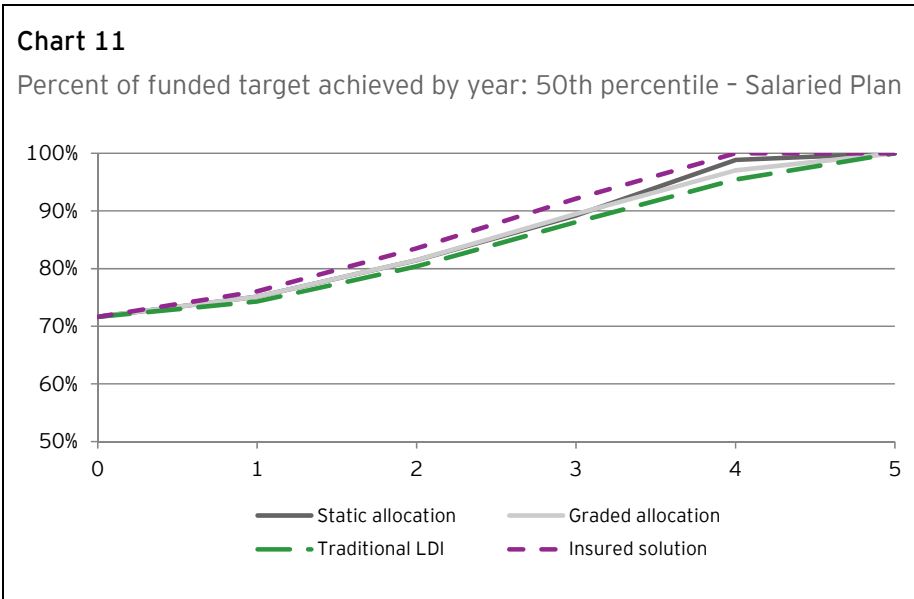
Many economic forecasts anticipate an increasing interest rate environment, and the scenarios used in this analysis similarly reflect an upward bias. Portfolios with shorter duration fixed income investments will have higher returns in this environment than comparable strategies with longer duration fixed income assets. Since the traditional LDI strategy targets the dollar duration of the liability, this portfolio uses longer duration assets than the graded and insured solutions which target modified duration. This explains the relative underperformance of this strategy in our analysis. In a decreasing interest rate environment, we would see the opposite effect.

Objective 2: Restricting the total cost of termination to budgeted contributions

The CFO is focused on minimizing the probability that the total cost of termination will be greater than what has been budgeted -- \$45 million for the Salaried Plan; and \$12.5 million for the Hourly Plan. The plans will be terminated once available assets are sufficient to cover the termination premium.

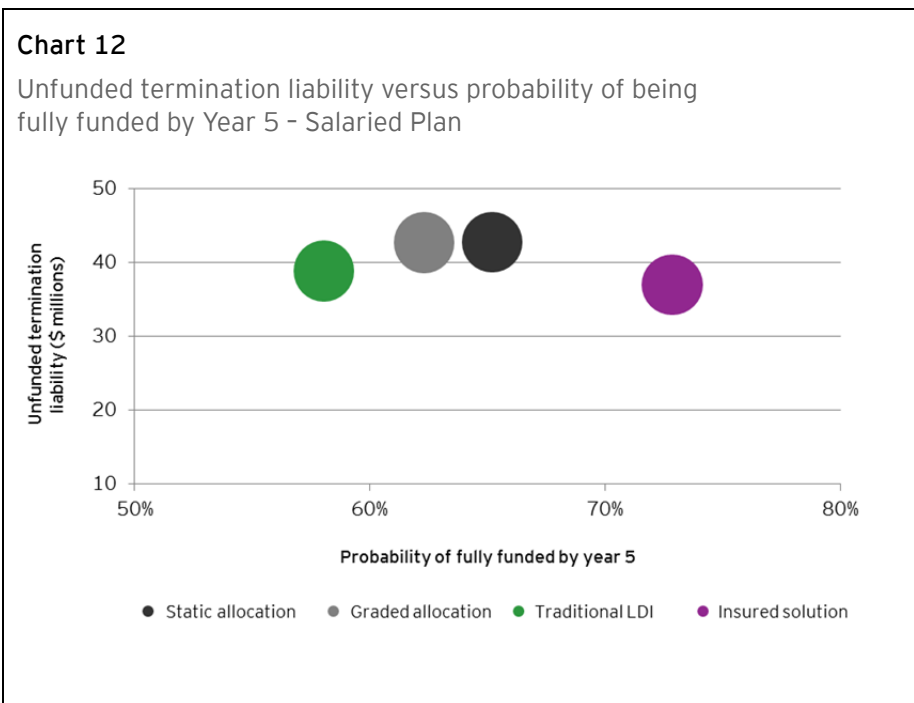
In this case, better than expected performance that would allow termination before five years is a good outcome; however, this must be weighed against the risk of additional contributions.

Chart 11 below shows the time to termination in the baseline scenario. If we relied only on this chart, we could assume that there is minimal differentiation between the strategies since in all cases plan termination is achieved within five years and; therefore, contributions are in line with budgeted amounts.



However, to properly assess the risk that contributions will exceed budgeted amounts, we need to look at more adverse scenarios.

Chart 12 shows the probability of being fully funded by Year 5, charted against the unfunded termination liability at the end of Year 5 for those scenarios in which available assets are insufficient to pay the termination premium.

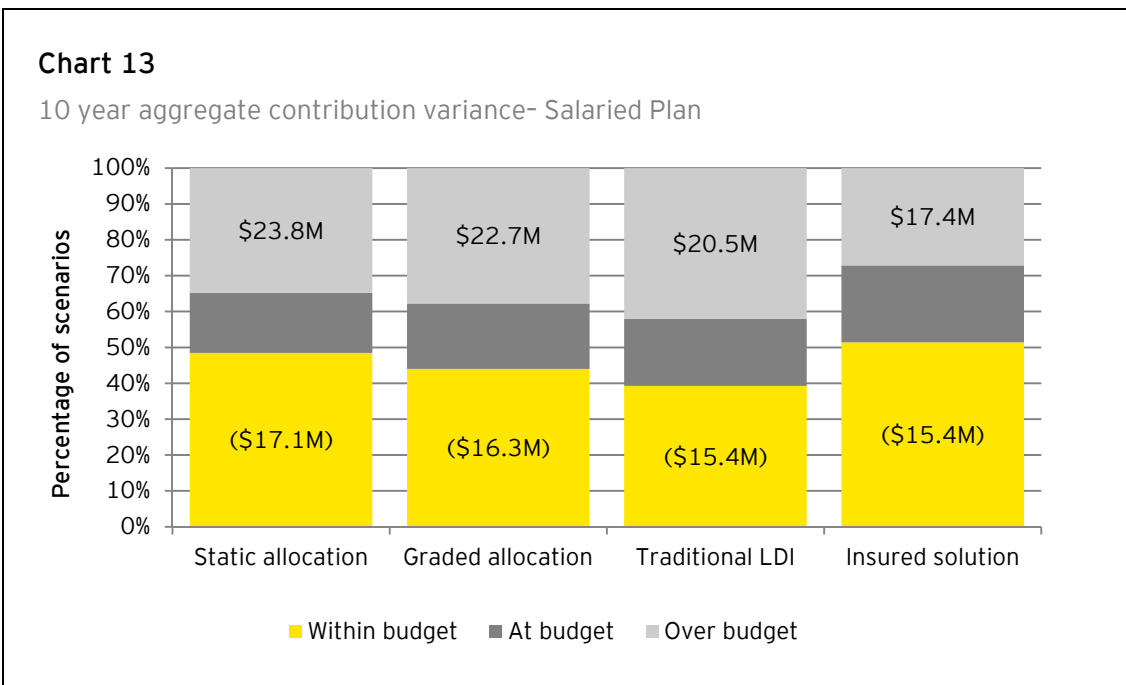


We can read the data for the static allocation strategy in the following way:

- ▶ In approximately 65% of the 2,000 scenarios, the strategy achieved the funding target by Year 5.
- ▶ In those scenarios for which the funding target was not achieved by Year 5 – the remaining cost to fully terminate the plan is approximately \$43 million for the case in the 95th percentile. By 95th percentile, we mean that, if there were 100 cases ranked from the lowest termination cost to the highest termination cost, this case would be the 95th least expensive– or 5th most expensive scenario.

Based on this information, it appears that the strategy with the lowest expected cost in excess of the budget is the insured solution.

Let's also look at the total cost of plan termination. In the following charts, we assume that the plans will be terminated once available assets are sufficient to cover the termination premium, but that the CFO will contribute any shortfall in plan assets at the end of year 10. Chart 13 illustrates the percentage of plans that, after 10 years, have spent more or less than the original budgeted contributions. Negative numbers indicate that the ultimate cost of termination is less than budgeted; and positive numbers show the average additional cost to terminate the plan over the budgeted amount at the end of the 10th year.

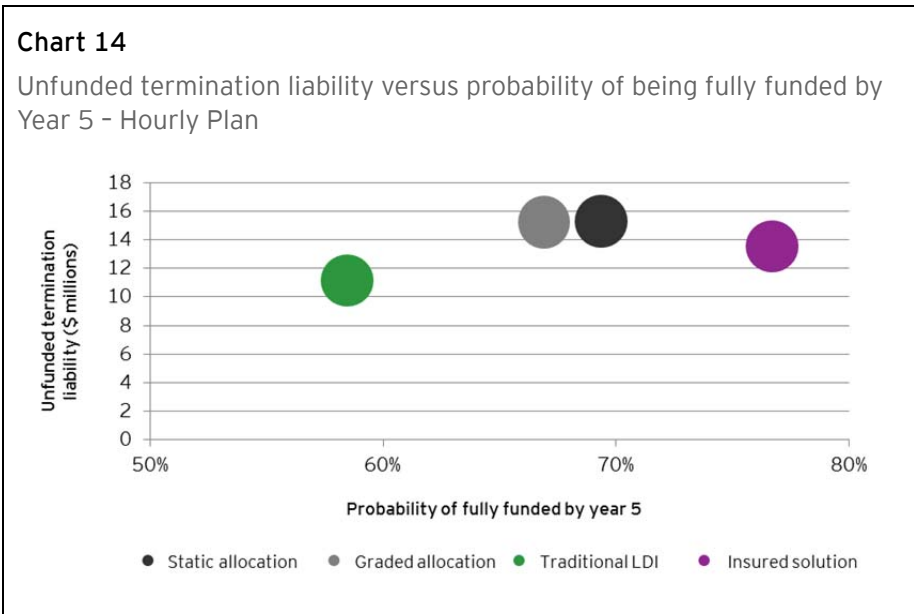


Based on this chart, the CFO's decision becomes clearer: traditional LDI and the insured solution have a lower average shortfall than the static and graded allocation strategies. In addition, the insured solution shows a higher probability of plan termination within the five year window. In this case, the CFO is likely to choose in the insured solution for the Salaried Plan.

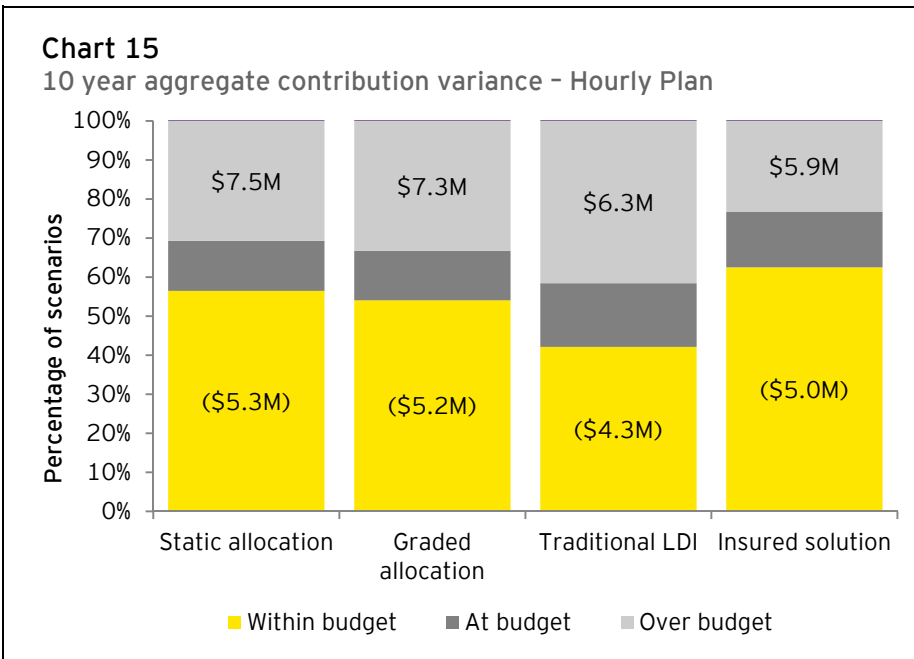
In our example, we have chosen to model a simple version of the traditional LDI strategy; however, plans with a more sophisticated LDI strategy will see results that are more consistent with those plans that undertake an insured solution. In those cases, the traditional LDI strategy show results more in line with the insured solution and may be viable alternative for the CFO.

The last question that we will look at is whether the relative performance of the strategies is different if we start with a plan that is better funded. To answer this question, we can look at the analysis for the Hourly Plan.

Chart 14 below shows the unfunded liability at the end of Year 5 at the 95th percentile, or the 100th most expensive outcome out of the 2,000 scenarios. When we look at this chart we see that the distribution of outcomes is much smaller than what we saw for the Salaried Plan. Since the distribution is smaller, the CFO may conclude that the potential upside in the static allocation strategy outweighs the potential cost of de-risking in the worst scenarios and may choose the static or graded allocation strategies.



We can test this by looking to the total cost of termination over the 10 year projection period, as shown in Chart 15 below.



We can see that the average savings for those scenarios where the cost of plan termination is less than that budgeted is highest in the static and graded allocation strategies.

The narrow distribution of results means that the right choice isn't obvious. The insured solution may also be a good choice: in this strategy, the probability of termination within five years is higher. In addition, for the scenarios where available assets are insufficient to fund the termination premium after five years, the average additional cost is smaller than that for the other strategies.

The CFO's decision will be based on her risk tolerance. Strictly speaking, the expected cost savings related to the static and graded allocation strategies is higher than in the other strategies. However, given the narrow distribution of the total costs, if she is more risk averse, she may choose the insured solution based on the higher probability of termination.

The work that we have presented here has shown that the relative performance of the strategies depends on the funded status of the plans and the constraints of the company. And it's safe to say that these are not the only factors: for example, the starting funded status of the plan, the proportion of participants that are receiving monthly benefits at the start of the projection period, and the size of the termination premium relative to the liabilities all play a part in the relative performance of the strategies.

That is what makes the use of a framework like this so effective: the Company's objectives, constraints, and the plan attributes can all be considered under an objective and unbiased lens. Because we've taken a holistic view- we have given the CFO the confidence to act on her decisions.

7. Closing remarks

Plan sponsors have experienced a reprieve as financial pressures on DB pension plans have eased in recent years. As a result, pension risk management strategies once again appear affordable.

In addition, there are more options available. Across the four types of solutions -- design, financial, investment and insurance - plan advisors, investment managers and insurers have created a variety of tools and techniques focused on the challenges US plan sponsors face.

There are still challenges that can't be ignored: the underlying issues that have driven up the costs of DB plan management have not gone away: administrative expenses, including PBGC premiums, are climbing; increases in plan liabilities are imminent as updated population mortality rates are adopted; the threat of changing reporting requirements remains; and the capacity of insurers to take on corporate plan liabilities may change, or grow more expensive, over time.

Given where we stand today, we are encouraging our clients to determine their objectives, constraints and priorities; to evaluate the alternative strategies that exist to help accomplish those objectives; and to implement a pension risk management strategy that is aligned to corporate strategy.

We acknowledge that within the wide range of alternatives available, it can be difficult to settle on a course of action. Crucially, there has been a void with respect to the process that should be used to evaluate options against CFO objectives in a holistic way.

Through the demonstration of our framework, we hope to empower plan sponsors with the tools to take informed action while these risk management solutions are affordable - and before the window for change closes once again.

There are tangible benefits to starting early:

- ▶ De-risking – and re-risking – steps can be timed to take advantage of market movements.
- ▶ Liabilities can be valued on an economic basis (both interest rate and demographic assumptions) so that the transparency of the transaction cost is clearer to senior management.
- ▶ If the ultimate goal is to fully terminate the plan, plan data must exist at a level to support insurer pricing. The process to collect and clean plan data can be long and should be started 12 to 18 months before any possible transaction.
- ▶ Again, if the ultimate goal is full termination, extra lead time allows the asset portfolio to be fine-tuned such that the cost of buying and selling assets either to refine the investment allocation or purchase an insurance product is not punitive.
- ▶ Finally, the company can begin to build relationships with potential transaction partners now to better understand and discuss how to make the terms of a transaction more cost effective.

As plans inch closer to full funding, companies should harness the latest tools and proactively select the strategy that best suits their needs. Plan sponsors should work with their advisors to identify the strategy that will carry them through the next five to ten years. The alternative may be to lose the opportunity to act and expose the company to unnecessary risk and volatility.

Appendix A Census data specifications

The census for both the salaried and hourly plans has been created to be representative of the demographic profile of plans with similar attributes to those described below. Figure 1 below provides the key characteristics of the three plans.

Figure 1: key characteristics of plans

	Salaried Plan	Hourly Plan																								
General description	<ul style="list-style-type: none"> ▶ Salaried plan with relatively rich benefits ▶ Plan has been closed for ten years; therefore, members are relatively older than the Hourly Plan 	<ul style="list-style-type: none"> ▶ Hourly plan 																								
Plan assets (initial)																										
<ul style="list-style-type: none"> ▶ Plan assets ▶ Funding target (plan termination basis) ▶ Funded ratio (plan termination basis) 	<ul style="list-style-type: none"> ▶ \$107 million ▶ \$150 million ▶ \$43 million ▶ 72% 	<ul style="list-style-type: none"> ▶ \$41 million ▶ \$52 million ▶ \$11 million ▶ 80% 																								
Participant information	<table border="1"> <thead> <tr> <th></th> <th><u>In pay</u></th> <th><u>Not in pay</u></th> </tr> </thead> <tbody> <tr> <td>80%</td> <td>20%</td> <td></td> </tr> <tr> <td>70</td> <td>53</td> <td></td> </tr> <tr> <td>\$1,500</td> <td>\$1,000</td> <td></td> </tr> </tbody> </table>		<u>In pay</u>	<u>Not in pay</u>	80%	20%		70	53		\$1,500	\$1,000		<table border="1"> <thead> <tr> <th></th> <th><u>In pay</u></th> <th><u>Not in pay</u></th> </tr> </thead> <tbody> <tr> <td>55%</td> <td>45%</td> <td></td> </tr> <tr> <td>70</td> <td>43</td> <td></td> </tr> <tr> <td>\$500</td> <td>\$250</td> <td></td> </tr> </tbody> </table>		<u>In pay</u>	<u>Not in pay</u>	55%	45%		70	43		\$500	\$250	
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55%	45%																									
70	43																									
\$500	\$250																									
Benefit type	<ul style="list-style-type: none"> ▶ Final average pay 	<ul style="list-style-type: none"> ▶ Flat dollar plan 																								

The distribution of gender, age, and monthly benefits of the generated plans are displayed in Figure 2 below.

Figure 2: in pay distribution - gender, age and monthly benefits

	In pay		Not in pay	
	Salaried Plan	Hourly Plan	Salaried Plan	Hourly Plan
Gender				
Female	23%	10%	21%	17%
Male	77%	90%	79%	83%
Total	100%	100%	100%	100%
Age				
93-88	1%	0%	-	-
88-83	5%	2%	-	-
83-78	9%	13%	-	-
78-73	17%	19%	-	-
73-68	28%	27%	1%	0%
68-63	26%	21%	8%	1%
63-58	12%	15%	16%	2%
58-53	2%	3%	29%	6%
53-48	-	-	23%	20%
48-43	-	-	12%	25%
43-38	-	-	8%	21%
38-33	-	-	3%	12%
33-28	-	-	0%	10%
28-23	-	-	0%	3%
Total	100%	100%	100%	100%
Monthly benefit (\$)				
0-200	24%	71%	18%	69%
200-400	19%	8%	14%	13%
400-600	15%	1%	21%	6%
600-800	11%	2%	8%	5%
800-1000	5%	3%	5%	2%
1000-2000	16%	6%	17%	5%
2000-3000	2%	5%	14%	1%
3000-4000	3%	5%	3%	0%
4000-100000	4%	0%	1%	0%
Total	100%	100%	100%	100%

Appendix B Actuarial valuation assumptions and methods

Figure 3: summary of valuation assumptions and methods for all pension plans

Attribute	Description
Funding basis	Pension Protection Act (PPA), as amended
Life events applicable to participants	Termination, retirement, and death
Mortality	IRS 2008 Generational Mortality Table
Retirement age	<ul style="list-style-type: none"> ▶ 100% at age 65 ▶ No early retirement
Termination	T-8 Less 51 GAT-M
Alternate mortality used for experience projections	<ul style="list-style-type: none"> ▶ Mortality table: RP-2000 ▶ Mortality improvement : Scale BB ▶ Early retirement incidence: None
Benefit definition - Normal payment form:	
<ul style="list-style-type: none"> ▶ Single participants ▶ Married participants 	<ul style="list-style-type: none"> ▶ Deferred to age 65 single life annuity ▶ Deferred to age 65 50% joint and contingent survivor life annuity
Retirement eligibility	Age 65 and 5 years of service
Disability benefits	None
Valuation interest rates	<p>At valuation date:</p> <ul style="list-style-type: none"> ▶ 30 September 2013 PPA Full Yield Curve <p>Future years:</p> <ul style="list-style-type: none"> ▶ Projected full yield curves are constructed using stochastic simulation of treasury yields and corporate bonds spreads. Please refer to Appendix C for further details.
Employer contributions	<ul style="list-style-type: none"> ▶ MAP-21 provisions were not applied. ▶ Target yearly contributions were set to achieve fully funded status at the end of Year 5 on a termination basis - \$45 million for the Salaried Plan; and \$12.5 million for the Hourly Plan. Regulatory contribution caps and floors are applied throughout the projection.
Salary inflation	0%
Cost of living adjustments	0%
Lump sum and other payment forms	Not applicable
PBGC variable premium liability	Premiums paid out of plan assets; the Budget Reconciliation Act of December 2013 is not reflected
ERISA asset valuation method	Market value
Administrative expenses	0.5%, included in funding cost

Appendix C Capital market scenario generation

Capital market scenario files were generated for a ten-year projection period using an EY Economic Scenario Engine (ESE).

The engine uses advanced “real-world” stochastic processes, including:

- ▶ Interest rate processing (Rendleman and Bartter) that includes mean reversion (Vasicek)
- ▶ Correlated return with yield curve movements
- ▶ Spline interpolation functionality for full yield curve extrapolation
- ▶ Geometric Brownian motion processing
- ▶ Capital Asset Pricing Model (CAPM) methodology
- ▶ “Rational Expectation” economic theory

To generate the capital market scenario files parameters using data through September 2013 were used as inputs to the process. A discussion of each of the key parameters is found below.

Source data

Figure 4 provides the fund categories and mapping data used for calibration purposes. Market index returns data was sourced from Bloomberg; and US Treasury rate return data was sourced from the US Treasury.

Figure 4: source of asset class data

Fund class	Fund mapping
Large cap	S&P 500 Total Return index
International	MSCI EAFE index
Bond	Barclays U.S. Long Government/Credit Bond index
Alternative	NAREIT Equity real estate investment trust index

Economic Scenario Parameters

Fund return correlations

The correlation matrix produced using index values from January 1985 through September 2013 is found in Figure 5 below.

Figure 5: correlation matrix

	Large cap	International	Bond fund	Alternative
Large cap	1.00			
International	0.69	1.00		
Bond fund	0.12	0.10	1.00	
Alternative	0.58	0.49	0.16	1.00

Risk premium and volatility

Figure 6 below provides the risk premia and volatility of returns used to generate asset returns. The large cap class risk premium is set to 4.5%. The risk premia for the remaining equity classes are set using the correlation of the volatilities between the large cap class return and the other asset class returns. The risk premia is inclusive of dividend yields.

Figure 6: risk premium and standard deviation

	Risk premium	Standard deviations
Large cap	4.50%	15.61%
International	6.24%	18.11%
Bond fund	0.30%	8.75%
Alternative	3.09%	18.57%

*The standard deviations are produced using fund returns from January 1985 through September 2013.

Treasury yield curve and mean reversion targets

Figure 7 below provides the beginning yield, the standard deviation, and the mean reversion target assumptions.

Figure 7: treasury yield curve and mean reversion targets

Treasury type	Beginning yield*	Standard deviation**	Mean reversion target
1 year	0.12%	32.51%	3.50%
7 years	2.22%	22.86%	4.25%
30 years	3.79%	14.61%	5.00%

* The Treasury yield is the monthly rate for September 2013.

** The standard deviation is calculated using Treasury return data from January 1985 through September 2013.

The reversion strength assumed in the Vasicek model was 20.0%. The maximum treasury yield parameter was set to 25.0%.

Investment expense

The investment expense is assumed to be 30 basis points for Treasury bonds, and 50 basis points for the remaining asset classes. The investment expense assumptions are reflective of the market quotes for similar managed asset volume.

Summary statistics

After updating the assumptions used to generate the scenario file, key statistics were developed for each fund category and de-risking strategy (see details of each strategy in Appendix D). Figures 8, 9 and 10 below summarize the calculated statistics for the generated scenarios over five year and ten year projection periods.

Figure 8: treasury rate statistics

Treasury type	Average yield rate at Year 5	Average yield rate at Year 10	Standard deviation of yield rates at Year 10
1-year	2.41%	3.16%	1.81%
7-year	3.59%	4.05%	1.55%
30-year	4.61%	4.90%	1.16%

Figure 9: equity and fixed fund return statistics

Fund Class	Average return over five year projection	Average return over ten year projection	Standard deviation of returns over ten years
Large Cap	6.76%	7.25%	5.79%
International	8.65%	9.08%	6.79%
Bond fund	1.93%	2.62%	2.70%
Alternative	5.38%	5.86%	6.72%

Figure 10: nominal return by strategy statistics

Strategy	Average return over five year projection	Average return over ten year projection	Standard deviation of returns over ten years
Static allocation	5.01%	5.63%	3.72%
Graded allocation	3.76%	3.45%	2.65%
Traditional LDI	3.63%	3.44%	2.55%
Insured solution	4.39%	4.24%	1.61%

PPA treasury high quality market corporate bond yield curve

For liability valuation throughout the projection, we forecasted the High Quality Market (HQM) corporate bond spreads using a linear explanatory model whose main purpose is to create spreads that are consistent and reactive to (1) changes in interest rate levels and (2) changes in the economic environment as reflected by equity returns and captured by the S&P 500 total index return.

To calibrate the model, we used economic data from 1985 to September 2013. Figure 11 below compares the estimated spread against actual spreads.

Figure 11

Estimated versus actual 30-year corporate spread

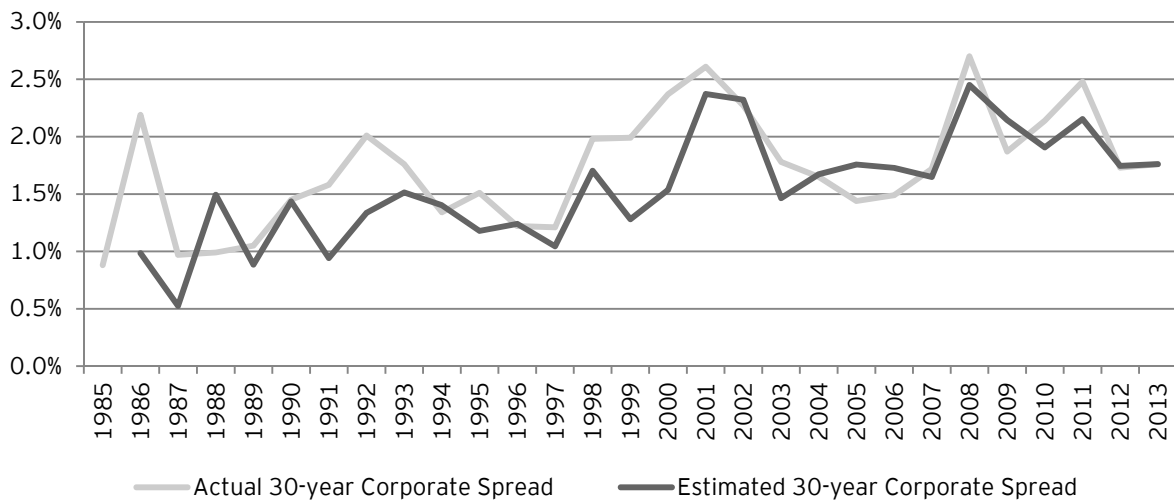
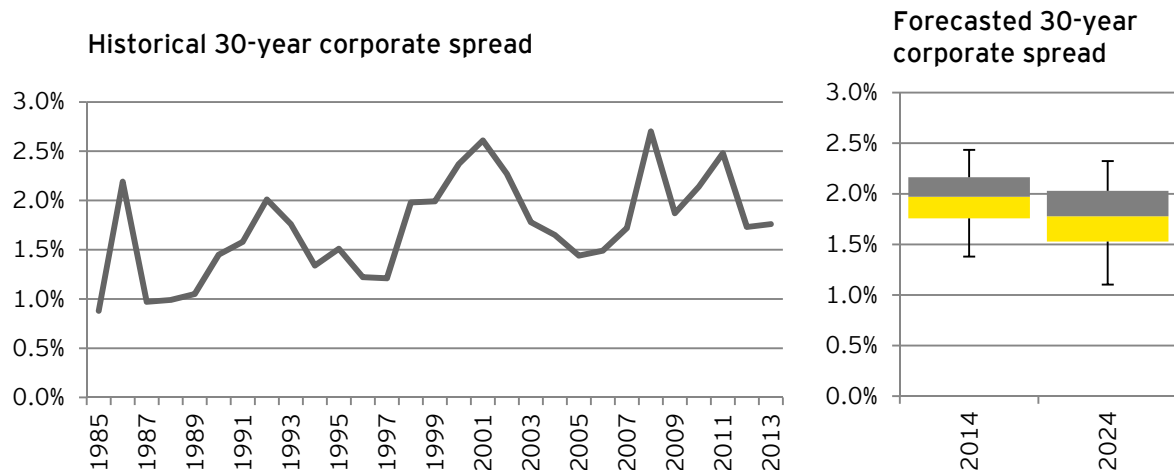


Figure 12 below shows historical spreads and the range of forecasted spreads.

Figure 12

Historical and forecasted 30-year corporate bond spread



Appendix D Asset liability management modeling

Initial asset allocation

The initial asset allocation for all de-risking strategies is 60% in return-seeking assets and 40% in risk-protection assets, which is reflective of the current allocation of similar plans today. Figure 13 below provides the starting asset allocations in each strategy.

Figure 13: initial asset allocations in each strategy

Strategy	Large Cap	International	Alternative	Bond Fund	30-yr Treasury bond	Insurance
Static allocation	40%	15%	5%	40%	-	-
Graded allocation	40%	15%	5%	40%	-	-
Traditional LDI	40%	15%	5%	40%*		-
Insured solution	40%	15%	5%	-	-	40%

* For Traditional LDI, the combined allocation in the bond fund and 30-year Treasury is 40%. The specific allocations within each class are determined based on a dollar-duration matching strategy (see details below).

Additional assumptions

- ▶ Target employer contributions remain constant within all strategies throughout the projection, with regulatory caps and floors applicable as needed.
- ▶ When the plan is a 100% funded on a termination basis, the plan is fully terminated through a buy-out transaction.

De-risking strategy parameterization

Strategy 1 - static allocation

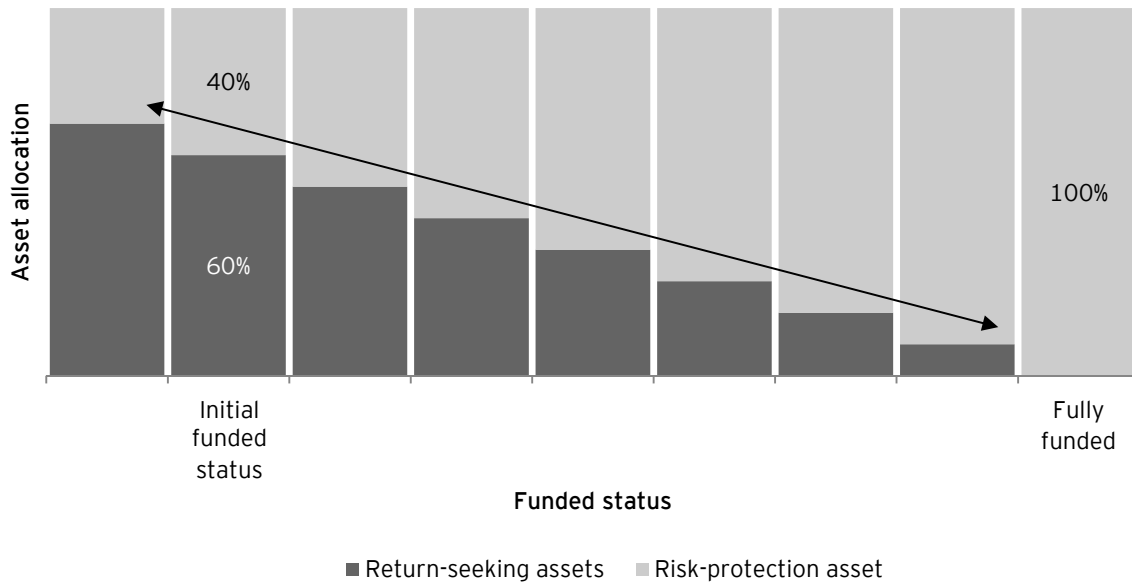
The target asset allocation is unchanged throughout the strategy at the current mix: 60% return-seeking assets and 40% risk-protection assets. When the portfolio is more than 5% outside the target allocation at any December 31, the portfolio is rebalanced to 60/40 the following January 1. For simplicity, rebalancing occurs once annually for all strategies. The risk-protection asset is the Barclays Long GC (Barclays Long Government/Credit Index)..

Strategy 2 - graded allocation

In this strategy, the target asset allocation is set throughout the projection period based on the funded status (defined on a PPA basis) at the end of the current year. As the plan's funded status improves, the allocation to the risk-protection asset increases; conversely, if the plan's funded status deteriorates, the allocation to the risk-protection asset decreases. The portfolio is rebalanced once annually on January 1. The risk-protection asset is the same as that in the static allocation strategy: the Barclays Long GC. The following figure illustrates the linear rebalancing path (the 'glide path') followed in the model.

Figure 14:

Glide path asset allocation



Strategy 3 - traditional LDI

Similar to the graded allocation strategy, the target asset allocation is determined using a glide-path. The difference is that the risk-protection asset is composed of two assets: the 30-year Treasury bill and the Barclays Long GC. The relative weighting is set to match the dollar duration of the liability. No swaps, derivatives, or other complex financial instruments are used to achieve dollar duration. Short-selling is not allowed.

Strategy 4 - insured solution

Similar to the graded allocation and traditional LDI strategies, the target asset allocation is determined using a glide-path. However, there are two major differences. First, the risk-protection asset is solely insurance coverage. There is no direct investment in bond funds or Treasury bonds. The insurance product is designed to perfectly hedge the PPA liability under valuation assumptions, effectively transferring all the economic risks embedded in the plan. The plan sponsor only retains non-economic risks such as the deviation from expected mortality and early retirement incidence. Second, re-risking is not allowed. Once the plan purchases insurance coverage for a percentage of the liabilities, it cannot reduce the insurance coverage and increase the investment in return-seeking assets.

Figure 15 below summarizes the key characteristics for each de-risking strategy.

Figure 15: Summary of parameterization of strategies

Strategy	Risk-protection asset	Rebalancing	Glide path	Re-risking
Static allocation	Barclays U.S. Long Government/Credit Bond index	✓	×	×
Graded allocation	Barclays U.S. Long Government/Credit Bond index	✓	✓	✓
Traditional LDI	Barclays U.S. Long Government/Credit Bond index and 30-year Treasury bonds	✓	✓	✓
Insured solution	Fixed income portfolio that perfectly hedges the economic basis of the liabilities	✓	✓	×

Estimating the cost of plan termination

The cost of plan termination can be expressed as a multiple of the liabilities on either a PPA basis or a GAAP accounting basis – and this multiple can be used as the funding target when constructing the glide-path. In our example, the company is most concerned about the volatility of cash contributions that are driven by the liabilities calculated on a PPA basis; therefore, we will express our target in those terms.

Indicative pricing for the company’s two plans showed that, in today’s environment, the termination multiples are approximately 120% of the PPA liabilities.

It is important to adjust this metric over time to account for changes in the economic environment. To accomplish this, we use an algorithm that measures changes in the US Treasury curve and the S&P 500 to forecast their effects on these prices and have applied this algorithm throughout the projection period.

Appendix E Model analytics

Strategies are analyzed under 2,000 stochastic economic scenarios (for further details, see Appendix C). Plan assets and liabilities were projected until either the available assets were sufficient to fund termination liabilities, or the 10 year projection horizon was reached.

To measure the relative performance of each strategy in each plan, we focused on the following metrics:

- ▶ Years to achieve full plan termination
- ▶ Total employer contributions required such that available assets equal the termination premium
- ▶ Unfunded termination liability in a given projection year
- ▶ Total cost of plan termination, defined as the cumulative contributions made to the plan, plus any shortfall between plan assets and the funding target at the end of the projection period.

The following exhibits show the results of our analytics by metric for each plan.

Years to achieve full plan termination

Figures 16 and 17 show the percentage of scenarios that achieve full termination prior to, or during a given year on a cumulative basis.

Figure 16

Cumulative termination rate - salaried plan

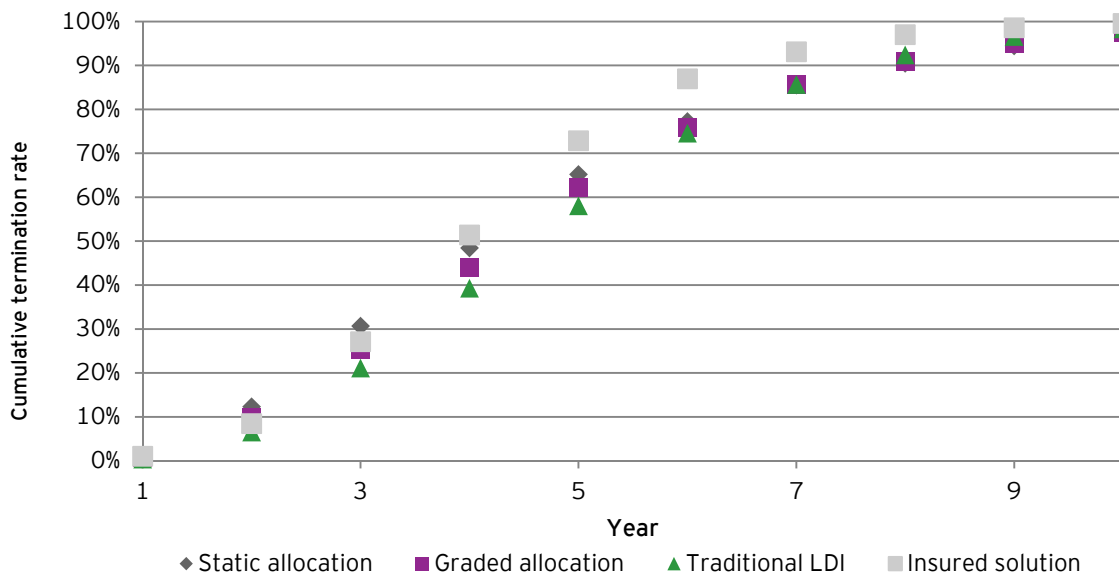
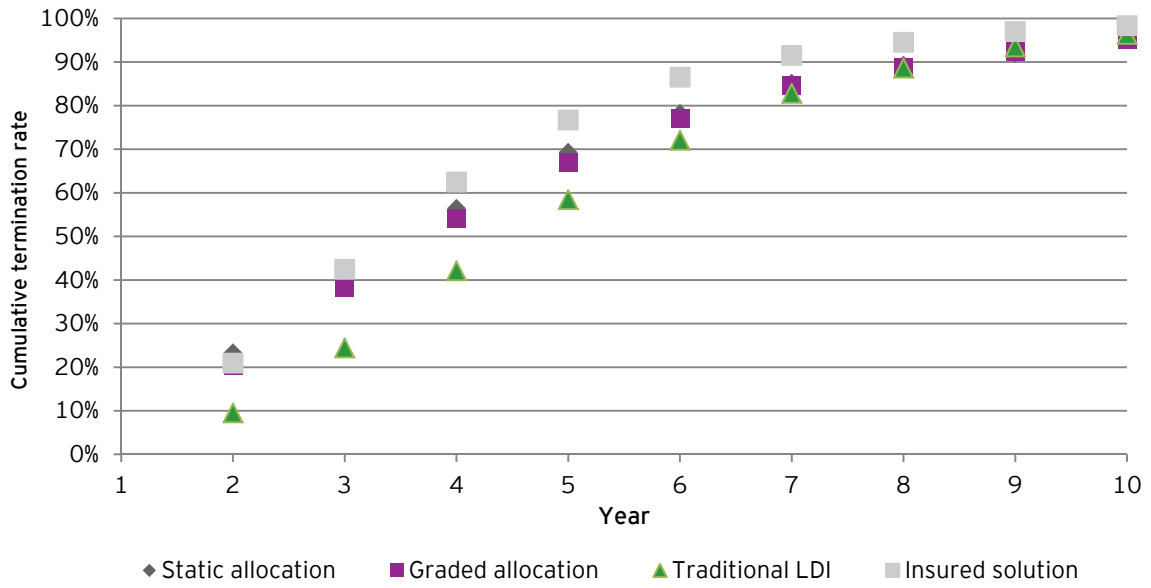


Figure 17

Cumulative termination rate - hourly plan



Aggregate employer contributions

Employer contributions were set such that available assets would be sufficient to fund the termination premium at the end of five years. Budgeted contributions remained constant between both scenarios and strategies.

Figures 18 and 19 illustrate the percentage of scenarios under which, at the end of the 10-year projection period, the plan sponsor had been required to remit less than, equal to, or greater than budgeted amounts. Negative values reflect the average savings in scenarios where the cost of plan termination was less than that budgeted; positive values reflect the average additional contributions that were required over and above budgeted amounts.

Figure 18

10 year aggregate contribution - Salaried Plan

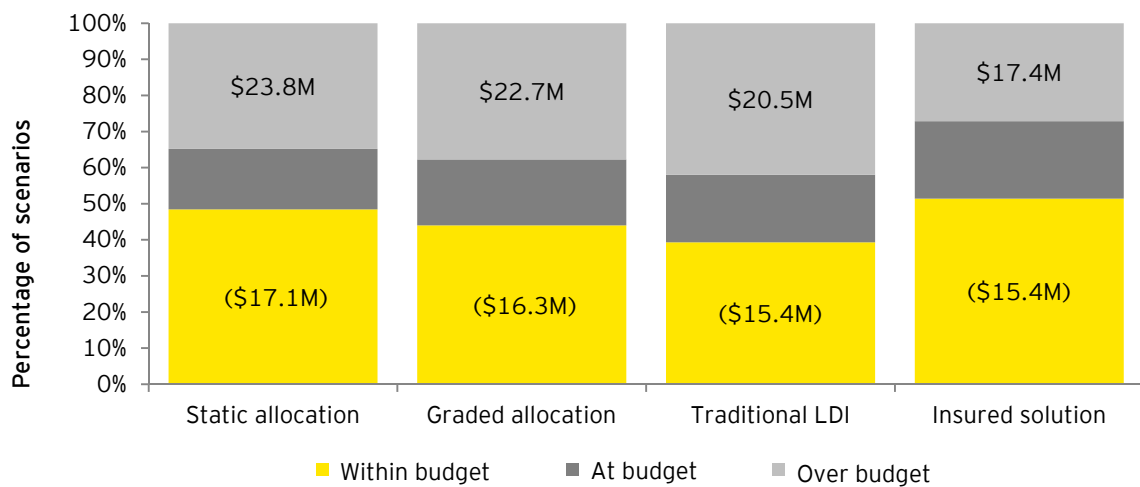
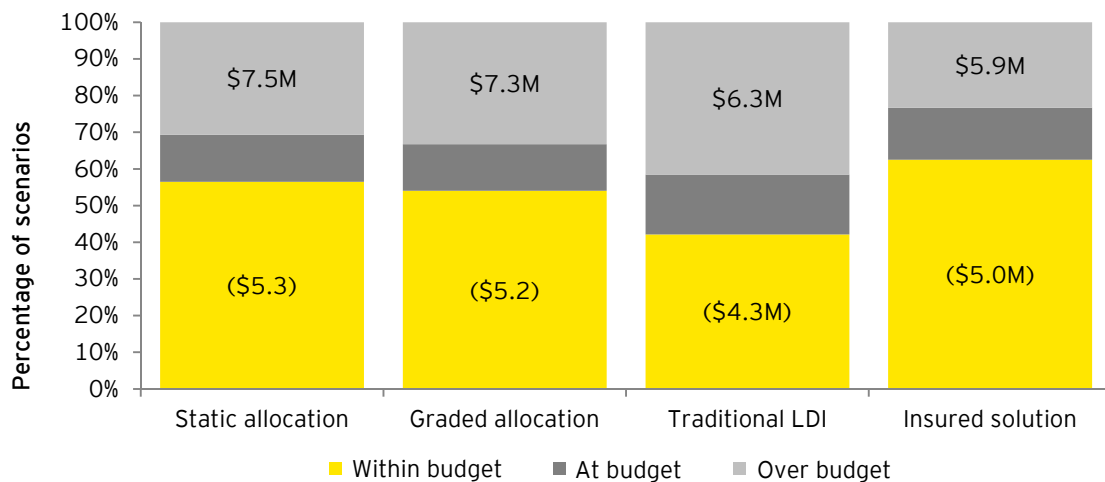


Figure 19

10 year aggregate contribution - Hourly Plan



Unfunded termination liability

Figures 20 and 21 illustrate the percentage of scenarios that achieved full termination at the end of Year 5 versus those that did not. For those cases where the available assets were insufficient to cover the termination premium, Figures 20 and 21 show the average and standard deviation of the funded status on a termination basis.

Figure 20

Year 5 funded status - Salaried Plan

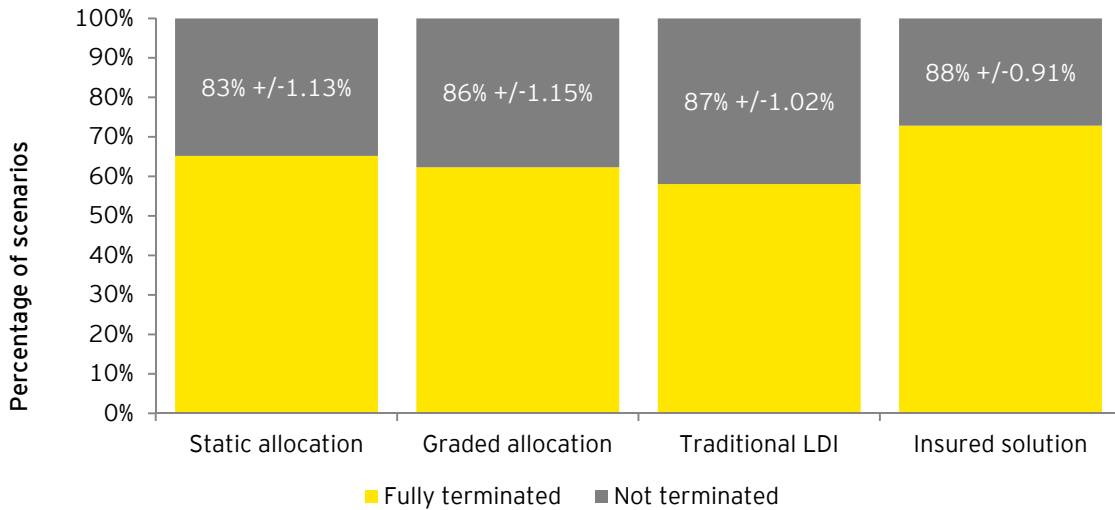
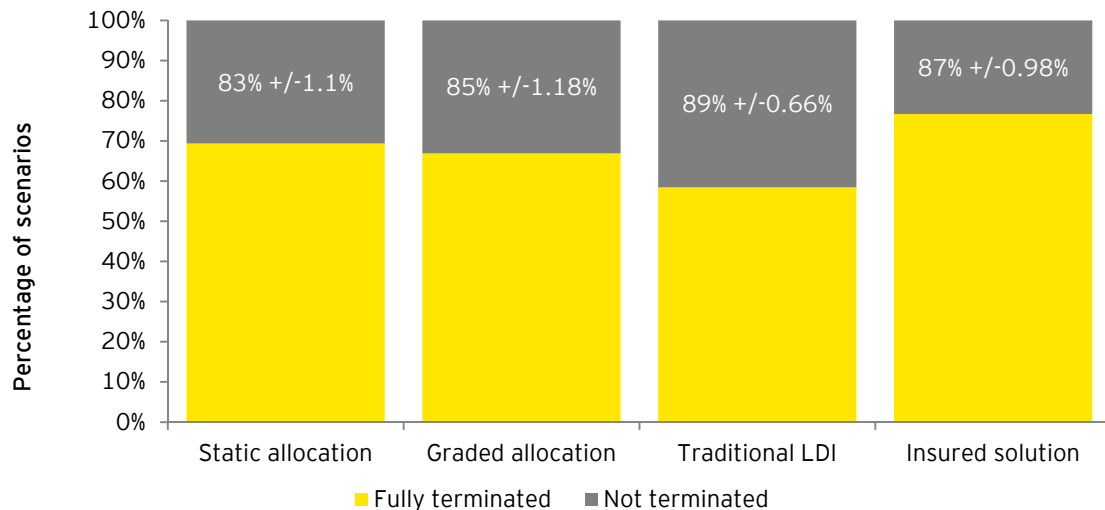


Figure 21

Year 5 funded status - Hourly Plan



Total cost of plan termination

To understand the efficacy of de-risking strategies, we measured the total costs from the plan sponsor perspective using the following metrics:

- ▶ A = Present value of total costs incurred in each strategy during five years (annual contributions and unfunded liability on a termination basis at year five)
- ▶ B = Unfunded liability on a termination basis at year zero
- ▶ C = A/B

If C is below 100%, the cost of the strategy was less than budgeted; otherwise, the strategy incurred higher costs than expected.

The boxplots in Figures 22 and 23 show the distribution of C, the relative cost/savings of implementing each de-risking strategy. The area within the box represents results that fall between the 25th and 75th percentile; results at the end of each line represent the 5th to 95th percentile.

Figure 22

Five year cost of termination - Salaried Plan

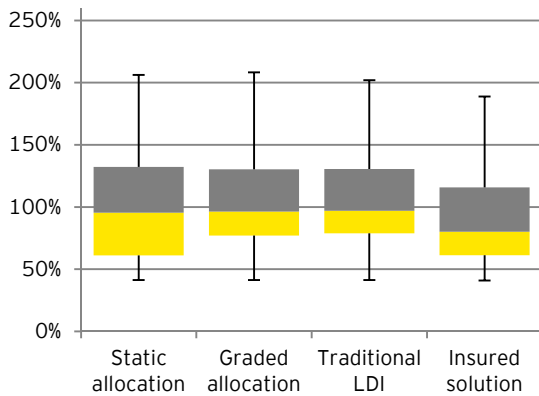
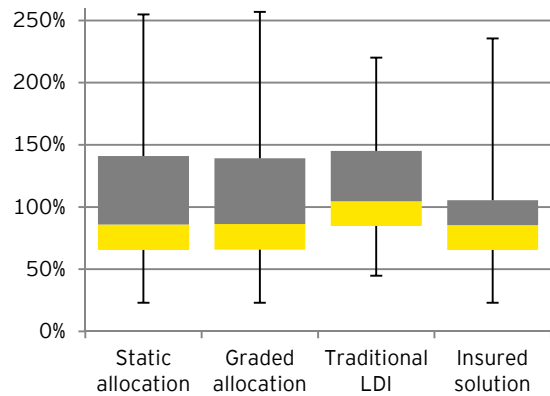


Figure 23

Five year cost of termination - Hourly Plan



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