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The Pension Risk Management Framework

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Abstract

In recent years, the economic landscape for defined benefit (DB) pension schemes has evolved dramatically for the worse. Among the ongoing challenges are the continued weaknesses in equity markets, falling interest rates, inflation levels that persist despite a drop in economic activity, and ever-increasing life expectancy due to improving medical care, all of which have left pension schemes with large deficits. It is vital that pension schemes develop a framework to examine the assets and liabilities holistically and evaluate

all of the risks that a scheme is facing, both together and separately. This paper will present Redington's Pension Risk Management Framework (PRMF), an effective framework for trustees and sponsors to identify, measure, and understand risk and to respond to them effectively. The PRMF requires stakeholders to agree key objectives and constraints, ensures that these are realistic in light of the scheme's risk budget, and provides clear "calls to action" when actual outcomes diverge from the planned path to full-funding.

“If a man does not know what port he is steering for, no wind is favorable to him” – Seneca

Current climate for DB schemes

In a DB scheme the employer is legally required to pay the employee a pension as outlined by their contract. The amount is usually determined by the earnings of the individual, their length of service at the firm, and the age at which they retire. The majority of pensions are also linked to inflation [Demptser et al. (2009)]. This set-up renders the scheme’s sponsoring employer as the risk bearer, as they must absorb any difference between the value of the pension fund assets and pension entitlements. Liabilities that are significantly greater than assets not only endanger pensioners’ benefits but can also put a sponsor’s commercial viability and growth at risk.

In recent years, the fair market value of DB deficits has grown particularly quickly. This has come about as a result of several factors:

- Falling equity markets, with the FTSE 100 and MSCI World indices down by 18.74 percent and 26.11 percent (as of September 30th, 2011), respectively since the beginning of 2007. In addition to the long-term downward trend, volatility has also increased sharply over the same period.
- Declining long-term interest rates, with the 30-year U.K. gilt yield down to 3.55 percent (as of September 30th, 2011) from 4.21 percent at the start of 2007.
- Resilient inflation expectations, with 30-year swap breakeven inflation at 3.54 percent (as of September 30th, 2011), up from 3.04 percent at the beginning of 2007.
- Increasing longevity, with male (female) life expectancy at 65 up from 15.9 (19.0) years in 2000 to 17.6 (20.2) years in 2009.

As Figures 1 and 2 show, this has had a dramatic impact on the funding position of U.K. defined benefit schemes. Firstly, on an s179 basis,² the aggregate funding ratio of the approximately 6500 schemes in the PPF universe has plunged from 121 percent in June 2007 to 83.1 percent in September 2011.³ Secondly, the recent equity market downturn and sharp decline in gilt yields has been particularly damaging. Between February 2011 and September 2011, the aggregate balance of PPF schemes has deteriorated from a surplus of £48.4bln to a deficit of £196.4bln. Finally, between July 2007 and September 2011, the aggregate balance of all FTSE100 company pension schemes has deteriorated from a surplus of around £30bln to a deficit of £36.3bln (measured on an accounting basis).⁴

Renewed importance for risk management

In this environment, effective risk management is ever more important for trustees and sponsors. Those responsible for managing assets and liabilities of pension schemes need to use the most robust and informative

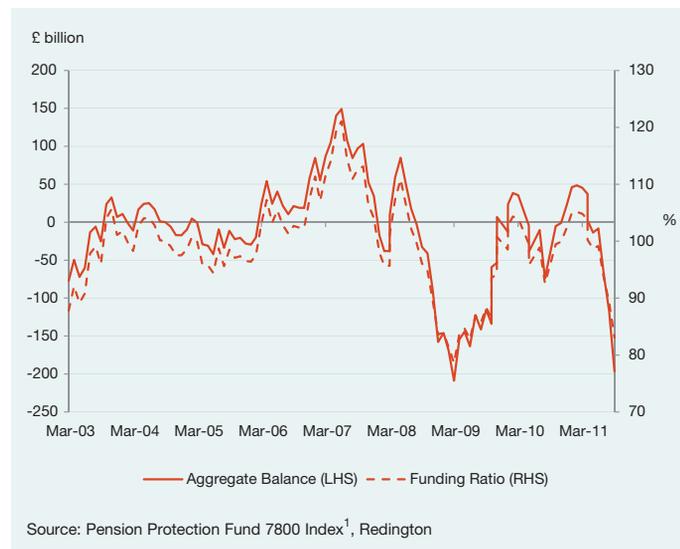


Figure 1 – Estimated aggregate balance (assets less liabilities) and funding ratio of PPF-eligible schemes

analytic models and the most effective risk management strategies to cope with volatile financial markets, address rising deficits, and take advantage of investment opportunities.

In DB pension schemes, risk management involves the measurement and assessment of pension fund risks and the design, monitoring, and revision of the fund’s investment strategy, asset allocation, and performance benchmarks to meet the requirements of both pension scheme members and sponsor. A risk management framework should seek to minimize sponsor contributions as far as this is possible as well as minimizing the risk of benefit cuts to beneficiaries. These goals require trade-offs to be made between contributions, asset allocation, and risk as the objectives of different stakeholders vary. Risk management also needs to take into account the sponsor covenant which ultimately supports the deficit. However, if the scheme becomes materially underfunded and starts to divert cash this in turn could undermine the sponsor covenant.

The Pension Risk Management Framework (PRMF)

Most sponsors and trustees were not prepared for the recent financial market turmoil both in 2008 and more recently in August and September 2011. They have differing and sometimes conflicting concerns and

1 An index of all U.K. pension schemes required to pay the PPF levy. In return, the PPF provides compensation to scheme members should the sponsor become insolvent.
 2 A pension liability valuation methodology used for calculating the PPF levy, it uses highly conservative assumptions regarding yields, inflation, and longevity.
 3 Pension Protection Fund. PPF7800 Index. http://www.pensionprotectionfund.org.uk/DocumentLibrary/Documents/PPF_7800_september_11.pdf.
 4 AON Hewitt Pension Risk Tracker. <https://rfmtools.hewitt.com/PensionRiskTracker/>.

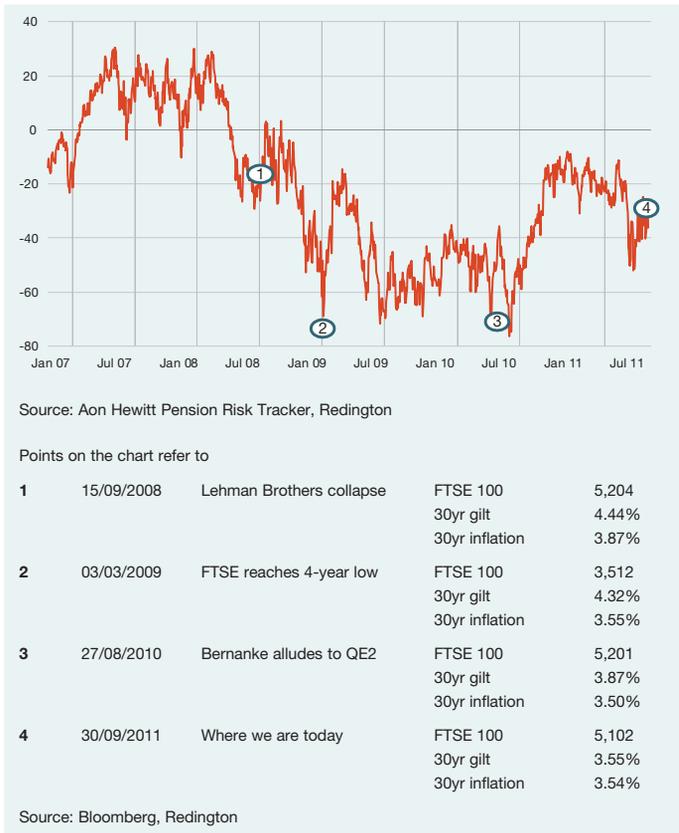


Figure 2 – Cumulative surplus/deficit (£ Billions) of all FTSE 100 pension schemes on accounting basis

objectives. The board of trustees is responsible for “ensuring that the pension scheme is run properly and that the members’ benefits are secure.” They are also required to “act in the best interest of the scheme beneficiaries” [The Pensions Regulator (2011)]. Trustees must ensure that the pension fund is able to make payments on time and in full to members who reach retirement age, and ensure that there is a strong covenant backing the scheme. Additionally, scheme sponsors are obliged to make contributions as necessary to ensure that schemes have sufficient assets to meet their liabilities. The scheme sponsor, however, faces a dilemma as diverting funds to the pension scheme that could have been used to invest in and expand the business has potential consequences for the long-term growth and profitability of the company. Consequently, the scheme sponsor generally seeks to minimize the contributions it makes to the pension scheme. The scheme sponsor must collaborate with the board of trustees to determine an acceptable level of contributions over an acceptable timeline.

The PRMF provides a framework for stakeholders to understand and agree key objectives and constraints, and helps put in place the right governance structure so that trustees can make quick and effective

Overall objective	Risk targets	Aspirational targets	Scheme constraints
Objective	Trigger	Performance indicators	
What is the overall objective?	Full funding on self-sufficiency basis	By 2020 on a swaps + [50]bps basis with contributions of £[25]m p.a.	
How will we measure the objective?	Required return on the scheme’s assets	Required return of assets is swaps + [160]bps	
What are the primary risk targets?	Required return at risk (RRaR) Contributions at risk (CaR)	RRaR < swaps +[200]bps CaR should be kept below £[50]m	
What is the secondary risk target?	Value at Risk (VaR)	VaR should not exceed [20]% of the liabilities	
What are the primary aspirational targets?	To be fully inflation and interest rate hedged	Hedge ratios should be equal to [100%]	
What are the secondary aspirational targets?	Increase efficiency of hedges by earning more return for same risk	Regular monitoring of relative value of swaps vs. gilts	
What is the primary scheme constraint?	Liquidity	Sufficient liquidity to make pension payments	
What is the secondary scheme constraint?	Collateral requirements	Enough available collateral to cover the 1-year derivative [VaR95]	

Source: Redington

Figure 3 – Example PRMF

decisions in response to both market turbulence and opportunities. The PRMF ensures that the objectives chosen are realistic and provides consistent metrics to assess progress towards these goals. By measuring liabilities in a market consistent manner, the scheme is better placed to exploit opportunities to achieve these goals. Moreover, the PRMF provides stakeholders with clear “calls to action” when actual outcomes diverge from the scheme’s objectives. In tandem, these features enable the scheme to chart the most efficient path to its ultimate objective of full-funding.

Formally, the PRMF serves three purposes: to identify and set objectives and constraints; to monitor the pension scheme’s progress towards objectives; and to respond to changes.

Setting and defining objectives

The first step of the framework is to establish clear objectives. It is vital for stakeholders to identify and define a set of objectives which are tailored to the specific funding, contribution schedule, and recovery period of the scheme. The PRMF should encompass an overall objective, risk targets, aspirations, and constraints.

The overall objective⁵ shared by most trustees and sponsors is “a fully funded scheme.” However, the funding basis used to determine liabilities and time horizon over which to achieve fully-funded status will differ based on the respective interests and limitations of trustees and sponsor. Covenant strength and pension entitlements will determine the capacity for the sponsor to allocate contributions and, consequently, the funding basis and time horizon. Articulating an overall goal clearly and succinctly before an investment strategy is implemented significantly improves the probability of a favorable outcome. The subsequent section on measuring risk provides an overview of the key risk metrics that might be employed for understanding and reviewing risk targets and the scheme’s performance against them. Setting these parameters ensures that a pension scheme has an overall funding and investment benchmark by which to gauge the risk associated with different asset allocations and to identify and the ability and agility to take advantage of investment opportunities.

Aspirational objectives are those that the scheme would like to achieve but which are secondary to its primary goals. However, the PRMF provides a framework for achieving these should market opportunities make this possible. Aspirational objectives take into consideration the impact of volatile market conditions that could increase deficits and thereby affect the required returns to reach full funding. These conditions might include an instantaneous shock to interest rates, inflation expectations, or equity market valuations. For example, an aspirational target might be to increase the interest rate and inflation hedge ratio to equal the funding ratio, as this stabilizes funding level volatility with respect to interest rates and inflation.

The constraints are limits that a scheme cannot breach whilst pursuing its path to full funding. A primary constraint that a scheme faces is liquidity. The pension fund must hold cash and readily realizable assets in order to pay out members of the scheme. A secondary scheme constraint is the collateral requirement. A pension fund must also hold sufficient and eligible collateral to meet potential collateral calls on derivative contracts, such as interest rate and inflation swaps. This constraint will require greater focus with the introduction of central clearing and CRDIV in 2013. Ultimately, the PRMF enables pension scheme stakeholders to act with the agility, control, and transparency to realize their objectives.

The “Flight Plan”

Once the trustees and sponsor have outlined and defined the overall objective, risk targets, aspirations, and constraints, they can begin with designing their scheme’s “Flight Plan.” The Flight Plan projects the future path of the assets and liabilities needed to achieve the long-term funding objective (Figure 4). Building a Flight Plan requires three key variables: (i) the cash contribution schedule, (ii) the target date to reach full funding, and (iii) the required rate of return needed by the assets. Note that the Flight Plan is constrained by both the trustee and sponsor’s risk appetite, which might be expressed as funding ratio at risk, or contributions

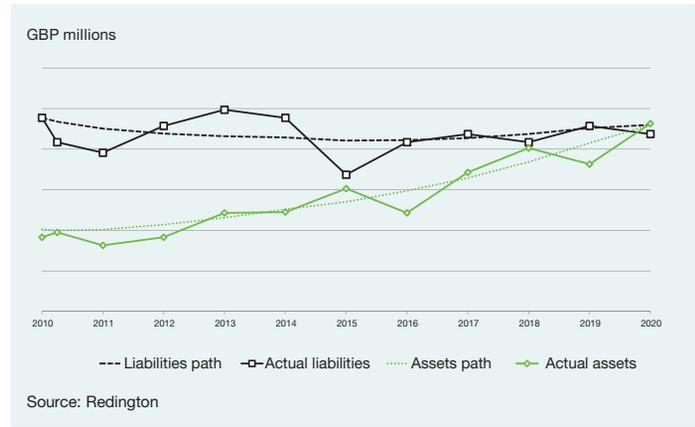


Figure 4 – Example “Flight Plan”

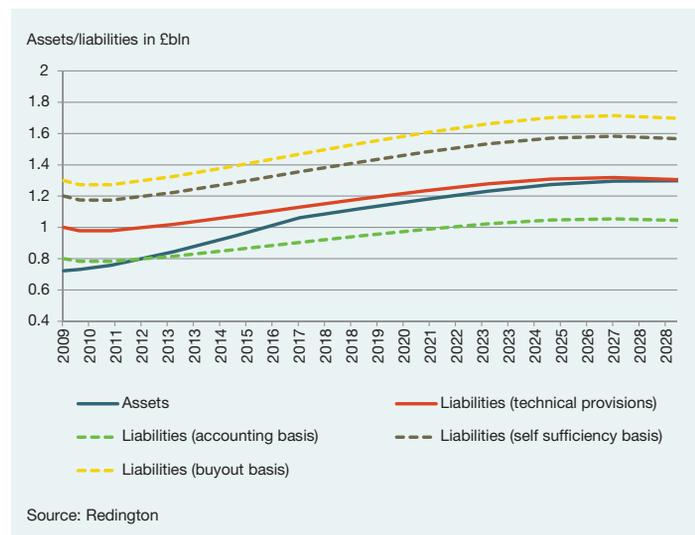


Figure 5 – Flight Plan against different funding bases

at risk. An earlier target date for full funding (and thus higher required return) might mean taking more risk than the scheme feels comfortable with. Ultimately, the Flight Plan assumes that the deficit will be funded through a combination of investment returns and sponsor contributions. Note the length of the recovery plan is limited by the long-term viability of the sponsor.

Both sponsors and trustees have a mutual interest in managing the absolute deficit volatility and/or funding ratio and reducing the long-term dependence on the sponsor. Trustees wish to minimize covenant risk and to ensure benefit payments to the scheme’s members. Consequently,

⁵ The scheme’s overall objective is illustrated by its “Flight Plan.” The Flight Plan maps out the path of the scheme’s asset and liabilities, using market consistent yield curves, from their current position to the funding goal under a given investment strategy (see below).

trustees will generally adopt self-sufficiency and/or buyout as targets for full funding. On the other hand, the sponsor wishes to reduce accounting volatility from the deficit and cash flow by minimizing future contributions. The different funding objectives are formulated and illustrated using the Flight Plan. There are several differing funding bases to establish the level of liabilities against which to measure the overall objective. As Figure 5 illustrates, the choice of discount rate has a significant impact on the value of liabilities and, hence, on whether the chosen objective in the PRMF is realistic.

The primary purpose of the PRMF is to set realistic goals and objectives and to manage risk effectively. The Flight Plan can be used to monitor through time whether a scheme is on track to achieve its funding objectives. The Flight Plan also highlights the opportunity costs of investment strategy decisions. For example, a higher allocation to equity may shorten the time period required to reach full funding, but it could simultaneously increase volatility, making it more likely the funding target will be missed. Consequently, the PRMF allows the scheme to assess how realistic and achievable its chosen Flight Plan is within its risk budget and constraints. This helps the scheme to be proactive about reacting to new developments and thus to increase its probability of travelling along its desired path. Together with the parameters set out in the PRMF, the Flight Plan, therefore, produces “calls to action” whenever the scheme diverges too far from its objectives (Figure 7). The framework will signal to the scheme that it will have to take action, i.e., hedge risks or potentially re-risk if it wants to achieve its desired funding objectives. See case study below to understand how this has been implemented in practice.

Flight Plan Consistent Assets (FPCA)

One effective way of flying the Flight Plan and achieving the objectives laid out in the PRMF are FPCA. These are assets that provide a good proxy match for pension liabilities. They provide secure, long-dated, inflation-linked cash flows. Moreover, their illiquid nature means that they tend to deliver higher real returns than traditional matching assets, such as government bonds (the “illiquidity premium”). They, therefore, reduce risks by matching interest rate and inflation risk in the liabilities and enable schemes to achieve their required rate of return to reach full funding. Examples of FPCAs include secured leases, social housing, and infrastructure investments. Given their combination of higher real returns and liability-matching properties, these assets can be thought of as lying on the spectrum between traditional return seeking (growth) and matching asset classes. As a result, they have tended to be overlooked by many pension schemes. Investments in FPCAs also tend to be more complex to access, with a wide variety of investment structures and risk/return profiles available to the investor. It is, therefore, imperative that schemes have a transparent and actionable framework in place to make informed investment decisions and access FPCAs in a way tailored to their specific objectives and risk budget.

Funding Basis	
Accounting basis	Liabilities discounted at a corporate bond “AA” rate.
Technical provisions basis	Actuarial basis that takes into account the expected return on the assets. May often be a dual discount rate. For example, pensioners at gilts + 50bps, and actives and deferred members at gilts + 200bps.
Self-sufficiency basis	The basis on which the scheme has sufficient assets to run the scheme on a low-risk basis without further support from the sponsor, i.e., gilts flat.
Buyout basis	The conservative basis on which an insurance company would be willing to assume legal responsibility for the pension scheme (note: insurance companies are required to hold capital). Typically closer to Libor flat or gilts -50bps.

Source: Redington

Figure 6 – Different funding bases

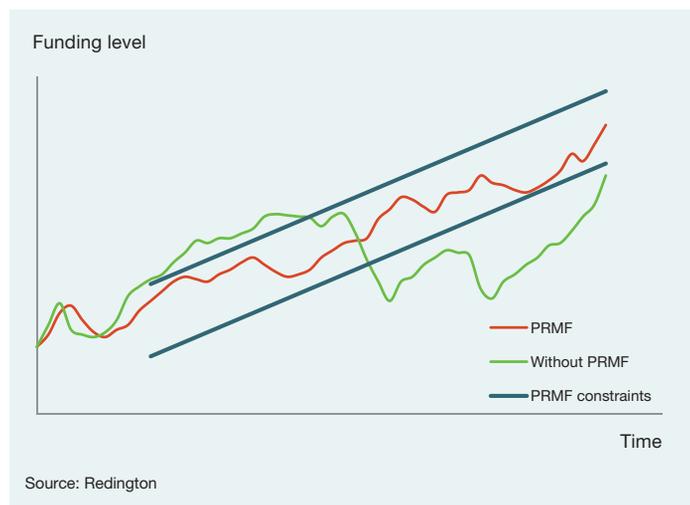


Figure 7 – Development of funding level over time

Measuring risk

The PRMF highlights the risks that schemes will be blown off their chosen path to full funding. It is thus important to develop the right methodology to monitor progress towards risk targets.

The “three lenses approach”

To properly understand a scheme’s exposure, it is not sufficient to look at just one risk metric. Consequently, we employ three different but complementary analytical methods to assess risks in order to gain a comprehensive picture of a scheme’s exposure. Each metric highlights different risks and hence a different aspect of a scheme’s exposure.

The risk telescope

The first lens, the “risk telescope,” uses value-at-risk (VaR) to measure the total amount of risk for a variety of confidence intervals over various

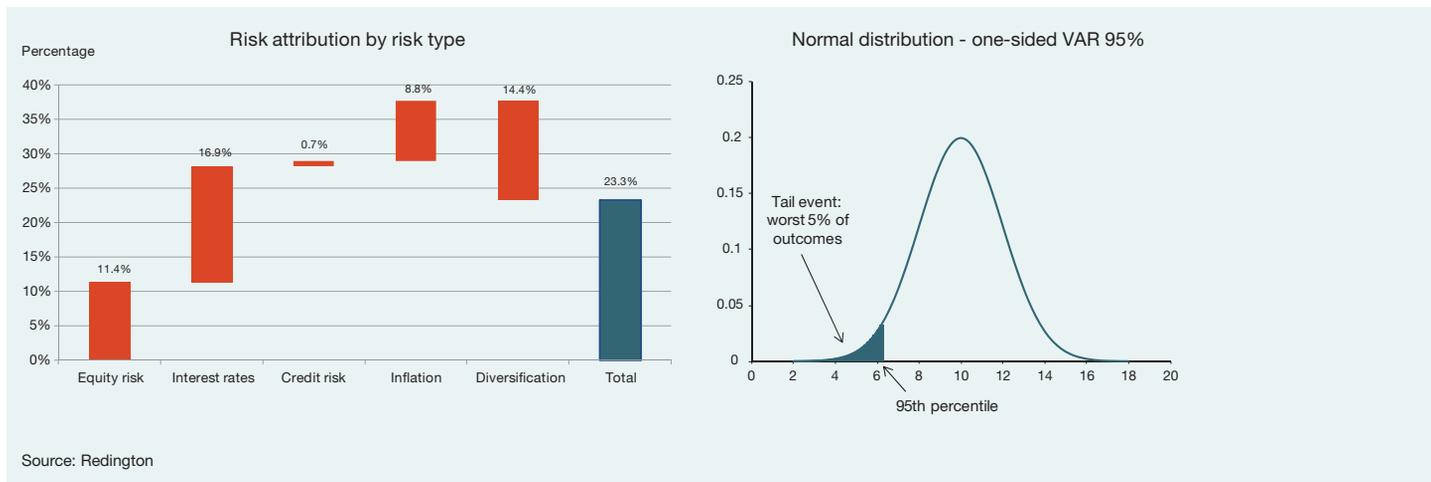


Figure 8 – VaR and VaR risk attribution

time horizons. Formally, VaR represents the single minimum amount the scheme might expect to lose over a one-year horizon in a worst case scenario (typically at a 95 percent confidence level). VaR is a useful measurement for pension fund trustees as it provides a single number that allows them to intuitively compare the effects that changes to their asset allocation have on the total risk of their portfolios. The risk telescope is probabilistic in the sense it shows what could happen – the minimum 5 percent worst-case loss – with a reasonable degree of probability. The “risk attribution” chart shows both the total risk as determined by VaR – which is reported both in absolute £ terms and as a percentage of liabilities to allow for comparisons across schemes and time – and the main components of this risk.

In addition to VaR, a number of complementary variables can be employed to measure total risk. The four main risk metrics used by pension schemes in their PRMF are summarized in Figure 9.

Risk parameter	Definition (for given confidence level)
Value at risk	The likely worst-case single minimum amount the scheme might expect to lose over a one-year horizon.
Required return at risk	The worst case increase in the return assets must earn to reach full-funding over a one-year horizon. The measure is most useful for understanding the impact of a deteriorating funding level on the return required to reach full funding.
Funding ratio at risk	The worst case decrease in the scheme's funding ratio over a one-year horizon.
Contributions at risk	The worst case increase in contributions over a one-year horizon to reach full funding by the target date. A popular measure for sponsors wishing to assess risk's potential impact on their contribution future schedules.

Figure 9 – Measures of risk

The “sensitivity microscope”

In contrast to the “risk telescope,” the “sensitivity microscope” is deterministic. PV01 (present value of one basis point) analyses how the scheme will be affected by a single basis point change in inflation and/or interest rates across different liability maturity buckets (Figure 10). Sensitivity testing also shows the size and shape of the swap overlay necessary to fully hedge the risk in each duration bucket. As interest rate and inflation risks are often unrewarded and can impact scheme funding positions far more severely than equities, PV01 analysis can be particularly useful in putting these risks into perspective.

The “scenario kaleidoscope”

Complementary to the previous two lenses, the “scenario kaleidoscope” assesses the impact of extreme scenarios on the pension scheme. This is done via stress tests – simulations that subject the portfolio to extreme market conditions – which allows the scheme to estimate the magnitude (though not the probability) of the loss associated with highly adverse events. Stress testing can be used to analyze the impact of a single factor, such as a significant fall in equity values, or of multi-factor economic scenarios, such as a repeat of the 2007-2008 financial crisis (Figure 11).

Responding to changes

Once the objectives, constraints, and risk targets are in place, the PRMF enables the scheme to quickly adapt if specific parameters are breached and opportunities arise to secure improvements in the funding level. “Dynamic de-risking” is one strategy made possible by implementing a robust PRMF and Flight Plan monitoring.

Case study in practice: scheme ABC with dynamic de-risking

Scheme ABC had £100m of assets and a high allocation to equities. The scheme was well-funded in early 2008 and was in the position where

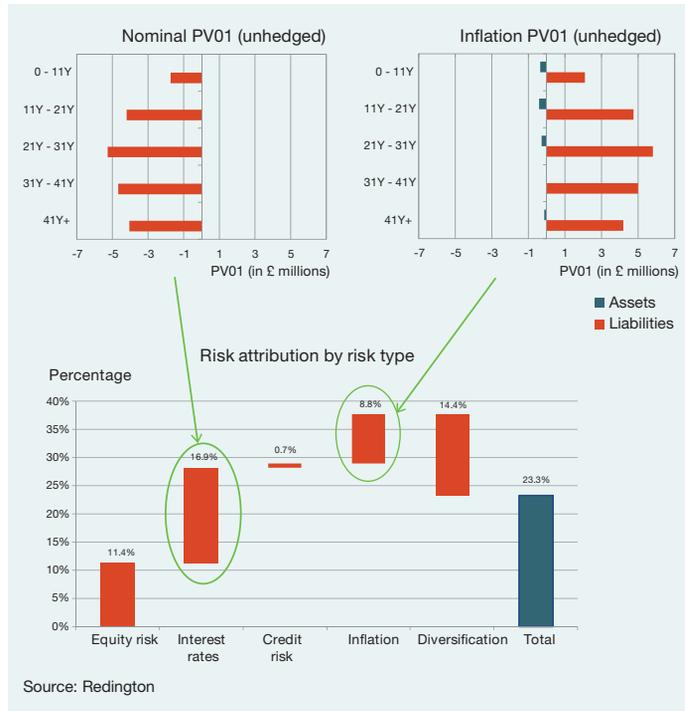


Figure 10 – Interest rate and inflation PV01



Figure 11 – Example stress tests

it could consider the possibility of a buy-out. However, the absence of a PRMF and ongoing monitoring meant that the scheme missed the opportunity to reduce risk in response to improved funding conditions. Consequently, the volatile financial markets of 2008/2009 resulted in a significant deterioration in its funding level. Seeking to avoid a repeat of this scenario, the scheme decided to implement a PRMF and dynamic de-Risking strategy:

- The scheme’s primary objective under the PRMF was to achieve full funding in 2022 on a self-sufficiency basis of gilts + 25 bps assuming contributions until 2022.
- The scheme put in place a “dynamic de-risking” framework whereby equity exposure and the associated risk would be reduced as the scheme’s funding ratio improved. Trigger levels for these actions were established based on the funding level, which would be monitored daily by the scheme’s investment consultants.
- The investment committee initially implemented the process on a recourse basis (the trustees wished to be consulted before a decision was taken).
- Between September 2010 and September 2011, the scheme was able to capture improvements in its funding ratio whilst at the same time significantly reducing the risk it is exposed to – as Figure 12 shows.



Figure 12: ABC funding level comparison (1-Oct-2010 to 30-Sep-2011)

	Original	New without de-risking	New with de-risking
Funding level 1-Oct-2010	78.4%	79.2%	79.2%
Funding level 30-Sep-2011	65.7%	66.8%	71.6%
Volatility of funding level	17.5%	15.9%	13.3%

Figure 13 – Comparisons of ABC funding levels with different strategies

The success of this strategy followed directly from the three features

of the PRMF: a clear set of long-term objectives, a system to regularly monitor progress towards these goals, and “calls for action” as market opportunities arise and conditions deviate from the expected path to full funding.

Conclusion

The Pension Risk Management Framework performs three vital tasks for any pension scheme with strategic funding and risk objectives. First, a PRMF identifies and defines objectives that relate to achieving a specified funding level by a certain date. Second, the PRMF measures the objectives in relation to key risk factors of interest rates, inflation, equities, credit, etc. By reducing these risks, a trustee or sponsor increases the certainty of achieving its objectives. Finally, the PRMF is most effective when efficient governance structures facilitate focused and proactive decision-making. Regular monitoring of market and scheme conditions, and of the effectiveness of any actions taken, is key to ensuring responses are timely and appropriate. We see this as having the ability to act through agility to respond to rapidly changing market conditions, control through the PRMF, and transparency through daily monitoring of the Flight Plan.

In recent years, U.K. schemes have reduced investment risk by shifting towards gilts and fixed interest assets and away from equities [Pension Protection Fund (2010)]. However, the sharp decline in funding ratios over the past six months suggests that there remains significant scope for schemes to implement more effective risk management frameworks. As market volatility persists, a clear and powerful guide to investment strategy and asset allocation like the PRMF is essential to ensure pension schemes remain firmly on the path to full funding.

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