



Pension
Protection
Fund

PPF Long-Term Funding Strategy

August 2010

1. Foreword

The PPF has evolved considerably since 2005. The past five years have brought growing financial responsibility and a rapidly evolving economic climate, to which we have actively sought to respond as an organisation. We believe that this development, five years on, provides the opportunity and experience to reassess our operations and establish new and constructive objectives.

Our Management Plan to 2012/13, published in April 2010, provides strategic objectives and key operational performance indicators for the years ahead. In addition, we believe it prudent to assess how the PPF's funding position and key financial risks may develop, not just over the next year or five years, but far into the future. Our long-term funding strategy, which this paper describes, establishes a robust framework for addressing this question.

Our analysis of current trends suggests that the risk to the PPF balance sheet is likely to diminish over time. A number of factors, including regulatory intervention and liability-driven investment, can be expected, all else being equal, to reduce the size and volatility of scheme deficits. The number of schemes is also likely to decline, as schemes transfer their liabilities to the insurance regime, enter the PPF, or otherwise become ineligible for PPF protection.

Against this background, we recognise that there will come a point in time when the PPF is unable to rely on surviving schemes to amortise any deficit it may have accrued. We therefore aim to be sufficiently funded by this point, with adequate protection against the key risks to our balance sheet.

Substantial care has been taken in the design of the funding objective. We recognise that aiming too high, too soon, may create undesirable intergenerational transfer effects. On the other hand, complacency in the form of a protracted or unambitious target would provide insufficient security for the members themselves. Our desire to balance these concerns has led us to opt for a target that we believe is both achievable and robust, namely the removal of all primary funding risks over a twenty-year horizon.

This strategy illustrates the exceptional progress the Fund has made over the five years since its inception. The establishment of a funding objective formalises our aspiration to fulfil our responsibilities over the long term. Furthermore, through the provision of a flexible and concise risk monitoring framework, the funding strategy provides a basis upon which we can effectively assess and plan for our future. As such, it best places us to ensure that levy payers and members receive the security they deserve.

Alan Rubenstein
Chief Executive

2. Summary

2.1 The funding objective

- 2.1.1. In order to fulfil its broader statutory objectives, the PPF must have sufficient funds to pay compensation to the members of eligible defined benefit occupational pension schemes or defined benefit elements of hybrid occupational pension schemes, where these schemes transfer into the Fund.
- 2.1.2. We will target a state of self-sufficiency by the time that the level of risk to the Fund from future insolvencies has reduced substantially. Our analysis suggests that this timeframe could be around 20 years.
- 2.1.3. Our current objective is therefore to be fully funded in 2030 with, at that point, no exposure to interest rate, inflation and market risks and with protection against the risks of longevity improvements in excess of our best estimates and future claims.
- 2.1.4. Projections obtained from our Long-Term Risk Model (LTRM) suggest that, on the basis of data at 31 March 2010, we have an 83 per cent chance of meeting this funding objective.¹ This result, which assumes the implementation of the investment allocation set out in the March 2010 Statement of Investment Principles (SIP), is sensitive to the targeted degree of protection against longevity and unexpected claims risk, in addition to a range of other important modelling assumptions.² The Board has expressed comfort with circumstances in which this probability is greater than 80 per cent.

2.2 Approach

- 2.2.1. We will collect an annual levy, having due regard to fairness and affordability. We will invest those levies alongside the assets of the pension schemes transferred into PPF and accumulated investment returns to:
 - provide sufficient liquidity to meet compensation payments as they fall due.
 - maintain confidence in reaching the long-term funding target.
 - operate within the low risk tolerances for balance sheet volatility set by the Board.
- 2.2.2. We will also work with the Pensions Regulator and others to reduce the level of risk to members' pensions in the UK defined benefit system.
- 2.2.3. We will assess progress towards the funding objective using measures including the following:

¹ A full explanation of the modelling methods employed is provided in section 5.

² Modelling assumptions are detailed in Annex 1. The sensitivity of modelling results to these assumptions is explored in Annex 2.

- The PPF's own funding levels
- The retrospective and prospective performance of the Fund's investment strategy
- The aggregate level of funding of eligible pension schemes
- The aggregate degree of risk evident in scheme investment strategies
- The outlook for insolvencies among the group of eligible scheme sponsors
- The aggregate length of pension scheme deficit recovery plans and targeted levels of Technical Provisions
- The outlook for the UK economy

2.2.4. We will review the appropriateness of, and progress towards, the funding objective on an annual basis.

2.3 Risks and mitigation

2.3.1. We believe the primary risks to our meeting the funding objective are:

- the risk that eligible pension schemes have insufficient assets to cover PPF levels of compensation (underfunding risk)
- the risk that our own investments fail to reach their target returns (investment risk)
- the credit risk posed by the sponsors of eligible pension schemes (insolvency risk)
- the risk that PPF members live longer than our expectations (longevity risk)

2.3.2. Underfunding risk is actively managed by the Pensions Regulator under its scheme funding regime, ensuring that trustees and sponsors work towards prudent Statutory Funding Objectives. Scheme investment strategies also influence underfunding risk to the extent that they correlate with liabilities and the incidence of insolvencies. The reduction or elimination of underfunding risk mitigates or removes the impact of insolvency risk.

2.3.3. We can control the extent of our exposure to investment risk by altering our investment strategy, i.e. investing in more or less risky assets. The objective of self-sufficiency requires us, at 2030, to invest in a portfolio with zero market risk, so that any movements in liabilities are matched by corresponding movements in assets. This can be achieved through a combination of financial swap agreements and low-risk investments in government bonds and cash.

2.3.4. None of the key players in the pension protection system (Department for Work and Pensions, the Pensions Regulator and the PPF) have any direct influence over insolvency risk. For some companies of strategic national importance, Government as a whole may have some influence.

2.3.5. For now, we believe that uncertainty around longevity improvements and sponsor insolvencies can be allowed for by gradually building up a prudent

and explicit reserve. In time, it is possible that solutions and capacity will develop sufficiently to enable us to transfer this risk to the insurance and/or capital markets.

2.3.6. We have also identified a number of other risks, which we believe it is not possible or appropriate to protect against as part of the funding strategy. These include:

- the risk that legislation alters the structure and/or operation of the PPF (legislative risk)
- the risk that investments must be redeemed at an inappropriate time in order to provide cash to pay compensation or meet collateral calls (liquidity risk).
- the risk that administrative shortcomings adversely affect the timely payment of obligations (operational risk)

2.3.7. The risk of legislative intervention is outside our control, although we do use our influence to support the appropriateness of the PPF's statutory objectives.

2.3.8. We will maintain a core part of the PPF portfolio in high quality, liquid government bonds partly in order to mitigate liquidity risk.

2.3.9. We seek to adhere to the highest possible administrative and behavioural standards in order to minimise operational risk.

2.3.10. The funding strategy will be reviewed annually to ensure it remains appropriate. It is not intended that the funding strategy should operate to fetter the discretion of the current or any future Board in relation to investment or the setting of the levy.

2.3.11. In the event of significant deviation in progress towards the funding objective, the Board may opt to:

- review the funding objective itself
- review the investment strategy, and/or
- consider an increase or decrease to the PPF levy in the medium term.

2.3.12. If, having reviewed the available investment and levy options, the Board concluded that an appropriate funding objective could not be met, this would trigger consideration of whether other powers conferred by the Pensions Act 2004 should be used.

3. Introduction

- 3.1 This document has been commissioned by the Board of the PPF in order to share the Fund's long-term funding strategy with stakeholders.
- 3.2 The Pension Protection Fund (PPF) is a statutory public corporation established by the Pensions Act 2004. Our mission is to pay compensation to members of occupational defined benefit pension schemes, following sponsoring employer insolvency, where there are insufficient assets to pay the Pension Protection Fund level of compensation.
- 3.3 In order to be able to fund payments to members under its protection, we must raise sufficient funds from a combination of the assets of transferred schemes, an annual levy raised from eligible pension schemes and investment returns on assets held by the Fund. For a full explanation of the role of the PPF, including the conditions under which schemes are eligible for protection by the PPF and the design of the Pension Protection Levy, please see www.pensionprotectionfund.org.uk
- 3.4 The Fund has grown rapidly since beginning operation in April 2005. As at 31 March 2010, we managed assets in excess of £4 billion, up from £1.45 billion in March 2008. Numbers of schemes and members transferred into the Fund has grown similarly, totalling more than 120 and 46,000 respectively by March 2010. To date, the Fund has paid out in excess of £150 million in compensation.
- 3.5 As stated above, our statutory purpose is to protect the pensions of defined benefit scheme members up to the level of PPF compensation. The Board of the PPF seeks to balance the cost of a robust protection regime through a well-diversified investment strategy expected to outperform its liability benchmark and by the setting of a proportionate and risk-based Pension Protection Levy.
- 3.6 In considering the financial condition of the Fund, the Board has regard to the assets and liabilities of those schemes that have transferred, or are expected to transfer, to the PPF and the risks that such assets may prove insufficient to meet accrued liabilities (i.e. balance sheet risks). It also considers the prospect of future claims on the Fund from insolvency events that have yet to happen (i.e. off balance sheet risks). Finally, it must judge the value of future levies payable by eligible pension schemes.
- 3.7 In the light of the long-term nature of the liabilities of UK pension schemes, the Board has decided to frame its funding objective around a long-term target. It has decided to target a fully funded position over 20 years with, at that time, adequate protection against the Fund's primary risks, specifically longevity, claims, interest rate, inflation and market risks.
- 3.8 The PPF Long-Term Risk Model (LTRM), a balance sheet modelling tool, is used to examine and understand how our balance sheet might develop over time in a wide range of different scenarios. This allows us to quantify the

probability with which the Fund can be expected to meet its target and also to understand the extent of the 'worst-case' scenarios we might face. By monitoring the movement of these measures over time, the Board can judge the progress of the Fund towards its funding objective.³

- 3.9 This approach to strategy is similar in several respects to that adopted by a number of defined benefit schemes targeting self-sufficiency or buy-out over a lengthy time period. Important distinctions exist, however, in that pension schemes need not consider the risk of unpredictable fresh liabilities from new claims, nor are they able to supplement their assets through levy.
- 3.10 The primary purpose of the funding strategy is to enhance the clarity with which the Board can gauge the impact of market, insolvency and longevity events on the long-term direction of the Fund. By the same token, the monitoring framework will assist to provide a context for developments in our funding position in communication to external stakeholders. Key recipients will include sponsoring employers, scheme trustees, and scheme members as well as the Pensions Regulator and Department for Work and Pensions. In providing a mechanism for clear communication of the PPF risk environment, and a basis for review of the key risk metrics, we are directly responding to a central recommendation of the National Audit Office's Value for Money study of the PPF, published in February 2010.⁴
- 3.11 The framework for monitoring progress towards the funding objective (detailed in Annex 3) specifies summary and constituent risk indicators for regular review. It is important to note that the monitoring of these indicators does not entail the establishment of thresholds intended to automatically trigger corrective action on the part of the Board. Nor does the funding strategy and attendant monitoring framework define any levy response to hypothetical circumstances. Such decisions are for the Board to make on the basis of a range of information and consultation, of which funding strategy analysis will form a part.

³ As with any financial model, the risk of misleading output cannot be eliminated. We seek to minimise this risk through regular model audit and output reconciliation (see section 8).

⁴ See http://www.nao.org.uk/publications/0910/pension_protection_fund.aspx, p.8, paragraph 16

4. The PPF Funding Strategy

4.1 The case for self-sufficiency

- 4.1.1. The PPF exists to protect members of eligible defined benefit (DB) pension schemes against the risk of financial loss in the event of sponsor insolvency. As at 31 March 2009, there were approximately 7,100 defined benefit pension schemes eligible for PPF protection with total memberships in excess of 12 million.⁵ We publish detailed analysis of the composition of this pensions 'universe' each year in collaboration with the Pensions Regulator.⁶
- 4.1.2. Claims on the Fund are triggered by company insolvencies, with the size of those claims depending on the existence and extent of the scheme's deficit on insolvency. As of March 2010, we had transferred over 120 schemes with a further 250 being assessed for entry.
- 4.1.3. It is inevitable that we will continue to experience failure of scheme sponsors according to economic and idiosyncratic conditions. It is, however, likely that the impact of claims on the Fund will decline over time:
- Pension scheme funding, which is actively managed by the Pensions Regulator under its scheme funding regime, is likely to improve over time
 - Schemes are expected to participate increasingly in risk mitigation strategies such as funding triggers, and interest rate and longevity hedging
 - Current activity points to growth in pensions buy-out and buy-in activity that reduces risk to the Fund
 - The trend towards closure of schemes to new entrants or new accrual is expected to continue, as is the increasing preference for defined contribution schemes as the solution to employer-sponsored pension provision
- 4.1.4. This expected decline, over a long period, in the scale of claims on the Fund is likely to lead to a point when the off balance sheet risks (i.e. future claims) are much less significant than the balance sheet risks. Any funding shortfall at this time could become a significant burden on the remaining levy payers. Furthermore, as the level of risk in the eligible defined benefit universe shrinks over time, it might be desirable for the PPF levy to reduce proportionally.
- 4.1.5. The PPF is funded entirely by the levy payments and transferred assets of eligible schemes, so 'self-sufficient' here means:

⁵ A membership is one individual's participation in one scheme. One individual can have multiple memberships. Hence the number of memberships exceeds the number of individuals.

⁶ <http://www.pensionprotectionfund.org.uk/Pages/ThePurpleBook.aspx>

- being fully funded on a 'risk-free' measure of liabilities,⁷
 - having zero exposure to interest rate and inflation risk,
 - having zero exposure to financial market risk, and
 - having acquired protection against residual risks such as longevity and residual insolvency risk.
- 4.1.6. In order to reach this position, we intend to remove risk gradually over a period of time, using market instruments where available and cost effective.
- 4.1.7. The alternative to this strategy is to allow risk to the PPF balance sheet to persist, even in the long term. This may lead to a potentially lower levy over the next 20 years, but preserves the possibility of a substantial cost to schemes beyond this horizon in the event of adverse investment, longevity or credit conditions. Indeed, the levy required to amortise an extremely large deficit beyond 2030 may be unsustainable given the expected reduction in the population of eligible schemes. We are keen to ensure that the levy is stable and remains proportionate to risk across schemes and over time. This aim is best served by minimising risk to our funding, and we have therefore chosen to target a resilient balance sheet over the long term.

4.2 The funding horizon

- 4.2.1. We have considered how we should quantify the expected decline in insolvency risk and at what point to draw the line in terms of setting a funding target. Our conclusion is that 20 years is an appropriate timescale to aim for, although there is an element of subjectivity in this choice.
- 4.2.2. The length of the horizon is important in ensuring the levy follows a balanced and stable trajectory over time. A short horizon may lead to the PPF charging excessive levy over the short term as we seek to become self-sufficient in the face of persistent financial risk. On the other hand, an extended horizon would increase the likelihood of the Fund falling short of self-sufficiency at a point where there remains little potential for continued levy.
- 4.2.3. We chose the 20-year horizon after considering projections of annual claims on the PPF as a proportion of the size of PPF liabilities.⁸ These projections are obtained from our stochastic risk modelling tool, the Long-Term Risk Model (LTRM).⁹ The LTRM produces 500,000 projections of the PPF's balance sheet based on the interaction between 500 scenarios for scheme sponsor solvency and 1,000 scenarios for asset returns.

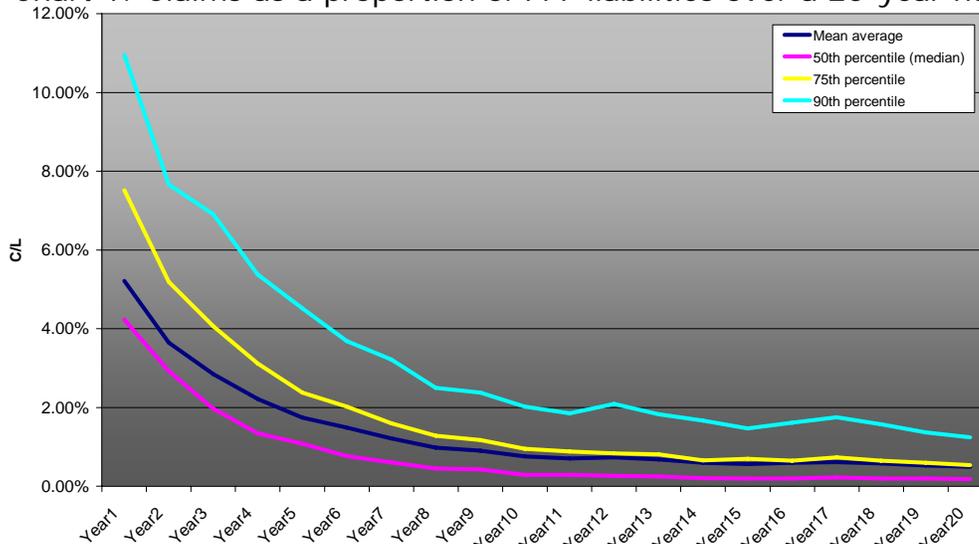
⁷ The PPF valuation basis discounts PPF liabilities according to the higher of gilt or swap yields. For a full description of this basis, please refer to the PPF Annual Report and Accounts 2008/09, www.pensionprotectionfund.org.uk/DocumentLibrary/Documents/ARA_0809.pdf

⁸ 'Claims' on the PPF are quantified by the size of the deficit in each scheme we take on.

⁹ A description of the LTRM is provided in section 5.

4.2.4. Chart 1 below shows the mean, median, 75th and 90th percentile claims as a proportion of the PPF's projected liabilities, for each year of the 20. For reference, the dark blue line is consistent with mean projections of the PPF balance sheet produced elsewhere (such as the 2008/09 Annual Report and Accounts).

Chart 1: Claims as a proportion of PPF liabilities over a 20-year horizon



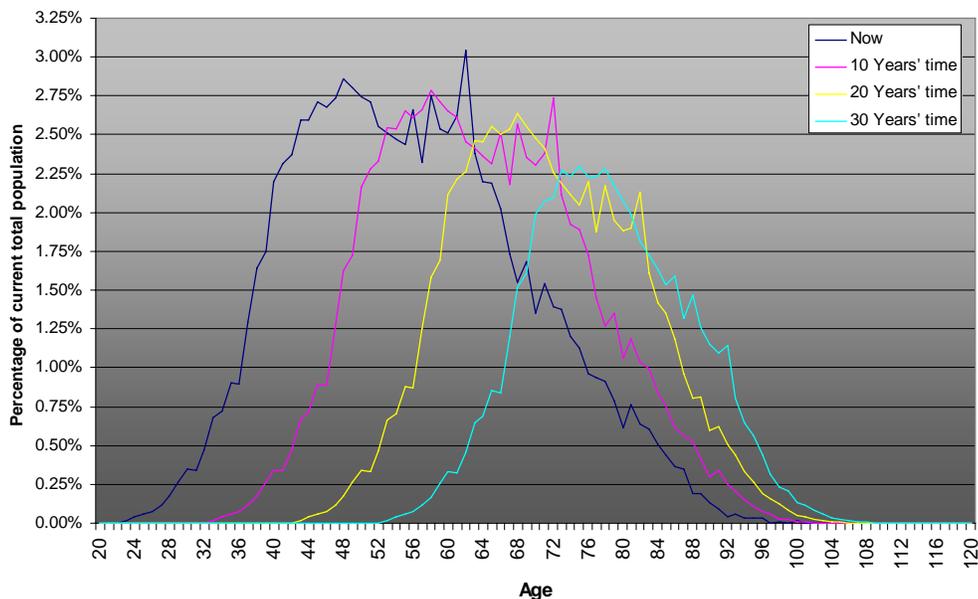
4.2.5. Chart 1 illustrates that, in 20 years' time, annual claims are expected to be less than 1 per cent of PPF liabilities (the mean projection of our liabilities is around £80 billion in 2030). Even at the 90th percentile, representing the worst 10 per cent of balance sheet outcomes, claims are less than 1.5 per cent of liabilities. This analysis suggests that, by 2030, risk from insolvency events will have reduced dramatically relative to accrued liabilities.

4.2.6. This conclusion is supported by analysis of scheme maturity. Employing plausible assumptions regarding the development of scheme membership, it is projected that by 2030:

- the average age of DB scheme members will have increased from 56 to 71 (pensioner average age rising from 68 to 76, non-pensioner average age moving from 47 to 59).
- around 70 per cent of scheme members will be pensioners, up from around 40 per cent today.

4.2.7. As a result, the duration of the Fund's liabilities will have reduced from 21 years to 12 years. This makes pension payments substantially easier to match with conventional investment techniques, as a smaller proportion of liabilities will exceed the term of long-dated gilts.

Chart 2: Projected development of the age profile of PPF membership



4.2.8. Claims and scheme membership projections therefore point to a much improved risk environment for the PPF balance sheet in 2030. If the Fund arrives at this date in a sound funding position, with assets that match its liabilities as far as possible and with arrangements in place to protect it from residual risks, there should be low risk of the Fund failing to meet its financial obligations. A 20-year period from 2010 has therefore been set as the horizon over which we will seek to achieve a highly resilient balance sheet.

4.2.9. While we intend to target self-sufficiency over a 20-year horizon, this timeframe is not immutable. If financial markets and PPF circumstances present the opportunity to eliminate risk prior to 2030, then member interests may be best served by doing so. On the other hand, stressed economic conditions and persistent risk may result in the Fund being unable to achieve self-sufficiency within 20 years. In these circumstances, we may decide to extend the funding horizon.

4.3 Protecting against residual longevity and unexpected claims risk

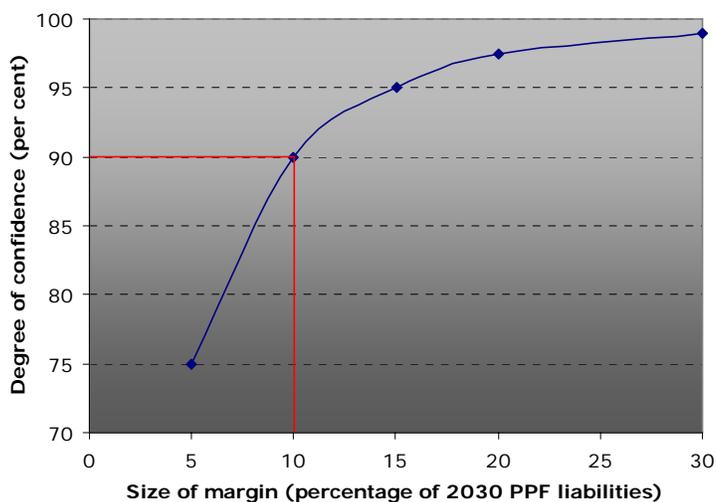
4.3.1. Risk to the PPF balance sheet will not be entirely eliminated by 2030. We will aim to remove market, interest rate and inflation risk using appropriate investment techniques. Nevertheless, the risk of unexpectedly high claims and member longevity are likely to persist. The Fund will also need to deal with operational hazard, such as the risk of counterparty insolvency. Additional risks of this sort are discussed in section 4.4 below.

4.3.2. It may be possible to protect against a proportion of residual longevity and unexpected claims risk. Instruments to hedge longevity, for instance, are already available. But the markets providing insurance against these residual risks remain at a relatively early stage of development. Only seven

longevity swap deals were agreed in the nine months to March 2010.¹⁰ The Fund's liabilities are expected to grow substantially to 2030 and it is unclear whether such markets will be sufficiently large and sophisticated to absorb the full extent of PPF claims and longevity risk.

- 4.3.3. The Board therefore considers it prudent to target a margin above best estimate liabilities in order to protect against these residual risks. At the same time, it recognises that it must balance the interests of different generations of levy payers and members in determining the size of this margin.
- 4.3.4. In order to identify a range of candidate margin values, we have undertaken stochastic modelling of longevity and claims using the LTRM. The first step was to produce an expected PPF and scheme profile at 2030 using LTRM output, credit transition matrices and current mortality tables. A range of scenarios was then generated for insolvencies over five years and longevity over the outstanding lifetime of the Fund.¹¹ This was applied to the expected PPF and scheme profile at 2030, providing a set of outcomes for claims and PPF funding. From these outcomes, it was possible to examine the protection against combined longevity and claims risk provided by various sizes of reserve.¹² The estimated relationship between the size of margin and the extent of protection is illustrated below.

Chart 3: Funding margins for combined longevity and claims risk



¹⁰ Hymans Robertson, 'Buy-outs, Buy-ins and Longevity Hedging', Q1 2010 update

¹¹ Longevity scenarios were generated according to the Cairns, Blake and Dowd (2007) model with cohort and curvature effects. For details of this method, see Cairns et al, *A quantitative comparison of stochastic mortality models using data from England & Wales and the United States*, March 2007. We took the expected demographic profile of the universe in 2030 as our baseline, along with current expectations of longevity improvements up to that date. Any movement away from expected longevity improvements prior to 2030 will affect the probability of meeting the funding objective. Significant deviation may also necessitate reassessment of the margin itself.

¹² This calculation assumes the independence of claims and longevity risk.

- 4.3.5. The Board proposes to target a margin equivalent to 10 per cent of liabilities to protect, with 90 per cent confidence, against unexpected claims over five years and longevity over the outstanding lifetime of the Fund. This target need not be static over time, however, and may be re-evaluated against changing economic and demographic circumstances. Revision may also occur as a result of the development of more sophisticated modelling techniques.
- 4.3.6. This margin does not provide complete protection. In 10 per cent of projected scenarios, unexpected increases in claims and/or longevity events are sufficient to erode PPF funding in excess of the reserve. A strengthening of the margin would reduce this risk, but at cost of a potentially higher levy over the funding horizon. As stated in 4.3.3., the Board considers it important to balance the costs and benefits to levy payers and members across time.
- 4.3.7. A potential reference point, albeit from a different financial sector, is the stress test for longevity risk specified by the Financial Services Authority as part of the Solvency II framework. It is important to recognise that this framework does not apply to pension schemes, and is instead intended to regulate the capital requirements of insurance firms, organisations with materially different operations and incentives to that of the PPF. Despite this difference in subject, results may still help to contextualise the funding margin specified above. The test involves a 25 per cent reduction in all mortality rates. An application of this test to the expected PPF member profile at 2030 suggests a margin of 11 per cent of PPF liabilities to protect against the resultant increase in longevity.
- 4.3.8. The Board will keep this funding margin under review. We welcome any comments on the extent and suitability of the margin, including the balance it strikes between various stakeholder interests.

4.4 Other risks

- 4.4.1. We have identified a group of additional risks. These are risks against which we consider explicit protection as part of the funding strategy to be unnecessary or inappropriate. The first of these is legislative risk. The PPF is a public body and, as such, is accountable to Parliament. It is not inconceivable that future legislation may alter the structure and/or operation of the PPF or affect the risks we face. It is not possible, however, to predict or model the potential outcome of such legislative change. Furthermore, it is not clear how such action might affect the attainability (or relevance) of the funding objective. For these reasons, we believe it inappropriate to attempt to factor this risk into our calculations.
- 4.4.2. The second residual risk is liquidity. As with any fund, there exists the perpetual non-zero risk that we will be unable to sell down our assets to a schedule that permits timely payment of our obligations. At present, the Fund is faced with minimal liquidity risk, evident from the size of PPF assets compared with annual compensation payments. Moving forward, however,

this risk will grow as the membership and maturity of PPF membership rises. Partly in order to mitigate this risk, the core of the PPF portfolio will remain in high quality, liquid government debt.

- 4.4.3. A third residual risk surrounds operational failure. We seek to minimise this risk by targeting the highest possible operational and behavioural standards. Nevertheless, some of this risk is outside our direct control. The risks attached to counterparty failure will intensify as we build a progressively more comprehensive hedging framework. Our current counterparty risk is effectively hedged through collateral arrangements. These arrangements will need to grow both with liabilities and the range of risks hedged.

4.5 Risk monitoring

- 4.5.1. We believe that the funding objective is an appropriate benchmark for ongoing performance measurement because it represents a state in which we have successfully taken all relevant steps to ensure that the Fund meets its purpose, namely the payment of all existing and future liabilities. In this state, we have achieved full funding and have hedged out all primary risks. Only risks such as the legislative change remain and such risks are, in any case, inherently difficult to remove.
- 4.5.2. The probability of achieving the funding objective is therefore effectively a probability of the PPF meeting its financial remit. This statistic can be calculated on the basis of output from the LTRM. The model is employed to create a distribution of PPF balance sheet outcomes over a 20-year horizon, from which the proportion of outcomes exceeding the funding objective is straightforwardly extracted. Regular update of this statistic on the basis of the latest data would provide a 'headline' measure on the basis of which we can gauge the progress of the Fund over time.
- 4.5.3. The probability of meeting the funding objective provides an important, but not sufficient, portion of the information required for effective decision making. There are, for instance, investment strategies that would improve the probability of our meeting the funding objective while simultaneously increasing the size of any deficit emerging in an adverse economic environment. In order to measure the dispersion of adverse funding outcomes under certain economic or policy conditions, we have constructed a measure of 'downside risk'. This is calculated by taking the 90th percentile of the largest deficits to develop at any point in each of the 500,000 projected balance sheet scenarios. It is important to note that, in practice, the deficit expressed by the downside risk statistic has a less than 10 per cent chance of occurring, given the PPF's ability to mitigate underfunding through levy and investment strategy.
- 4.5.4. Further details on the LTRM and its constituent processes are provided in section five below. Current statistics and analysis of the corresponding modelling output are presented in section six. A full description of the

modelling assumptions that underpin these results is provided in Annex 1. The sensitivity of results to these assumptions is assessed in Annex 2.

- 4.5.5. For the purpose of risk monitoring, the Board of the PPF will be presented with updated probability and downside risk figures, along with information on the constituent risk factors (such as scheme funding and PPF investment risk), on a regular basis. The set of constituent risk metrics given regular review is described in Annex 3.

4.6. Review

- 4.6.1. The funding strategy, comprising the risk monitoring framework and funding objective, is not intended to be static. Risk metrics will be updated so as to present the latest risk position to the Board. Developments may prompt the Board to request further information on the constituent risks or analysis of additional risk aspects.
- 4.6.2. Neither is the funding objective necessarily and indefinitely fixed. As noted in 4.2.9, pronounced upside or downside experience over an extended period may prompt revision to the funding horizon. Equally, analysis of emerging trends in longevity and credit risk, and particularly assessments of growing credit and longevity derivatives markets, may drive a re-evaluation of the cost of hedging longevity and claims risk. The Board will formally review the funding objective and risk monitoring framework, in conjunction with the latest modelling output and risk metrics, on an annual basis.

5. Modelling risk to the PPF

5.1 The PPF's Long-Term Risk Model

- 5.1.1. As for any organisation providing a form of protection, it is essential for the PPF to possess a method of gauging the full extent and range of risk it faces. Assessments of risk are vital to a number of core PPF activities, most notably to decisions on the total levy estimate and the design of an appropriate investment strategy.
- 5.1.2. To this end, we have developed a system capable of capturing, quantifying and expressing the potential impact of all primary risks to the PPF balance sheet. The outcome of this effort has been the Long-Term Risk Model (LTRM), a stochastic balance sheet model. The LTRM generates an extensive range of asset return, insolvency and longevity scenarios over a chosen time horizon, and on this basis projects a distribution of possible PPF balance sheet outcomes.
- 5.1.3. Stochastic analysis, also termed 'Monte Carlo' analysis, involves the use of historical distributions and a random process to generate a large number of scenarios for a given variable over time. The technique is already widely used in the financial services industry. Its primary advantage (over deterministic or 'single point' forecasts) is the generation of a distribution of outcomes to which probabilities may be assigned. This permits assessments of the likelihood of specific, usually adverse, outcomes.
- 5.1.4. As with any financial or economic model, it is important to exercise an appropriate degree of caution when analysing LTRM output. Economic models are not infallible; there is no guarantee that future outcomes will conform to dynamics observed in present and past data. In order to minimise the risk of misleading output, care is taken to review and update the model on a regular basis and to reconcile its results to previous output and known outcomes. Details of external model audits are provided in section 8.

5.2 Structure of the model

- 5.2.1. The projection process begins with the generation of 1,000 economic scenarios. Each economic scenario is a set of projected paths for relevant asset prices (including bond yields, equity prices and risk-free rates). These are obtained from an Economic Scenario Generator (ESG) provided by an external provider, Barrie and Hibbert.
- 5.2.2. The extent and profile of corporate insolvencies is generated on the basis of sponsor insolvency probabilities. Five hundred corporate insolvency scenarios are generated, with insolvency probabilities stochastically migrating over time according to historical data summarised in externally-provided transition matrices. Each corporate insolvency scenario is mapped to each of the 1,000 economic scenarios (providing 500,000 scenarios in

all), with the insolvency dynamics adjusted to reflect the degree of stress at play in asset markets.

- 5.2.3. PPF assets and liabilities are rolled forward under each scenario, taking account of investment returns and passive movements in the discount rate. Scheme funding is rolled forward in a similar manner. Funding paths combine with insolvency dynamics to determine the profile and size of claims on the Fund. These aggregate deficits are transferred onto the PPF balance sheet at the point at which they occur. Levy collections are not modelled, being determined instead by pre-set assumptions. The result is a distribution of PPF balance sheet outcomes over a chosen horizon that takes account of all primary funding risks.
- 5.2.4. For more information on the mechanics of the LTRM, please see http://www.pensionprotectionfund.org.uk/DocumentLibrary/Documents/ltrm_paper_aug_2007.pdf

5.3 Modelling assumptions

- 5.3.1. In projecting forward the PPF balance sheet, the LTRM models the behaviour of asset returns and scheme sponsor insolvencies. Modelling techniques are insufficient, however, to capture many of the additional dynamics affecting pension scheme risk, especially those relating to scheme behaviour. In these cases, subjective assumptions are used, a selection of which is provided below.
 - Scheme contributions are determined in accordance with current recovery plans, as reported to the Pensions Regulator.
 - Schemes reduce the risk of their investments over time (migrating on average to 85 per cent allocation to long-dated bonds).
 - No new schemes become eligible for PPF protection.
- 5.3.2. Our stochastic model is not subject to uniformly-applied assumptions regarding the risk premia for investment in equity or credit. Instead, such premia are generated stochastically as part of the modelling process. Observed data and current market information inform long-term averages around which stochastic projections fluctuate. In the most recent projections, the risk-free investment return stabilises at a long-term average of around 3.5 per cent, with an average risk premium for equity investment of 3.5 per cent. Sponsor insolvency probabilities are assumed to exhibit a degree of correlation with equity market conditions.
- 5.3.3. With regard to PPF behaviour, asset projections assume that the Fund maintains its investment strategy throughout the funding horizon. In other words, our modelling does not capture the dynamic response to changing circumstances that we might in reality employ. Of particular relevance is the inability of the projections to account for the likely de-risking of PPF

investments in benign circumstances, a response which could be expected to reduce the corresponding surpluses accrued.¹³

- 5.3.4. The modelling output presented in this paper has been constructed assuming a constant annual levy collection of £700 million, not indexed to inflation. In practice, the total levy target has grown from £700 million in 2009/10 to £720 million in 2010/11 as a result of indexation to earnings. The choice in our modelling of a profile without this indexation effect reflects in part the expectation that the levy would trend downwards as the number of schemes, and the risk they represent, recedes. This profile is, however, in no way an indication of likely long-term PPF policy, it is an example profile for use only as a base of reference. The sensitivity of modelling results to the choice of levy profile, along with sensitivities to all other key assumptions, is illustrated in Annex 2.

¹³ The sensitivity of modelling output to a simple method of accounting for de-risking in benign scenarios is explored in Annex 2.

6. Modelling outputs

6.1 Base case modelling results

- 6.1.1. The modelled probability of the Fund meeting its funding objective over 20 years is 83 per cent, produced on the basis of scheme, market and PPF data to 31 March 2010.
- 6.1.2. The corresponding downside risk statistic, the 90th percentile of largest deficits to develop in each of the 500,000 scenarios, is £14 billion. This deficit provides an indication of the dispersion of adverse balance sheet outcomes. It is highly unlikely to arise in practice, given the potential for PPF recourse to levy and investment strategy to mitigate a deficit.
- 6.1.3. The Board of the PPF is comfortable with the overall outlook for risk in circumstances in which the probability of success is greater than 80 per cent. Circumstances in which the probability falls short of 80 per cent are not deemed to provide a sufficient level of security for current and future members. Nevertheless, the Board will consider a range of factors before taking action on the balance sheet, for instance through levy or investment strategy.

6.2 Sensitivity to modelling assumptions

- 6.2.1. LTRM output has been tested for sensitivity to an extensive range of modelling assumptions. A selection of key sensitivity tests is presented in Table 1 below. The full set of sensitivities is described in Annex 2.

Table 1: Sensitivity of model output to key assumptions

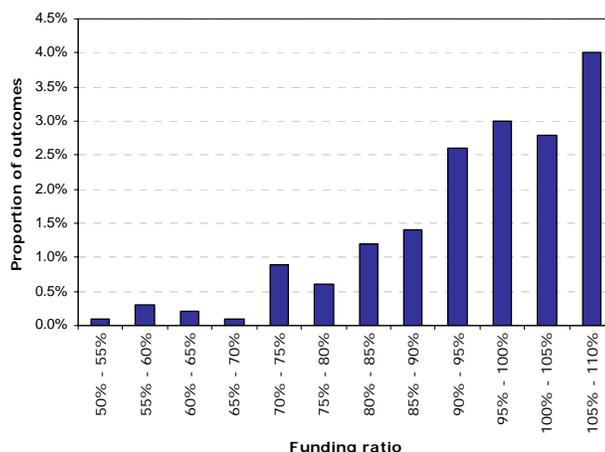
Change in modelling assumption	Modelled prob. of meeting funding objective	Downside Risk
Base case (no change)	82.8%	£14bn
1 percentage point reduction in asset returns (excluding cash)	76.4%	£24bn
Initial PPF funding reduced by 10 percentage pts	80.7%	£16bn
Initial scheme funding increased by 15%	87.6%	£7bn
Sponsor insolvency probabilities increased by 20%	81.6%	£17bn
Length of scheme recovery plans doubled	78.3%	£23bn
Scheme Technical Provisions reduced by 10%	77.4%	£24bn
No funding margin for longevity and credit risk	89.6%	£14bn
Annual levy reduced by £100m	80.8%	£17bn
Future inflation reduced by 0.5% (for CPI switch)	87.4%	£9bn

- 6.2.2. It is evident that both the probability and downside risk statistics are highly responsive to assumptions concerning asset performance. This is to be expected. In the event of subdued growth in asset prices, the Fund cannot rely on investment returns to recover the deficit on incoming claims. This effect is likely to be compounded by an increased volume of claims due to the assumed correlation between market conditions and sponsor insolvency probabilities. Such conditions therefore increase the likelihood of the PPF undershooting the funding objective and/or developing a substantial deficit.
- 6.2.3. The results also exhibit a pronounced sensitivity to assumptions regarding the regulatory environment. Our projections assume that the Regulator is successful in enforcing current recovery plans according to the agreed timescales and Technical Provisions. A downward revision of contribution rates or targets would increase the Fund's exposure to large claims.
- 6.2.4. In July 2010, the Minister for Pensions announced the Government's intention to replace the Retail Prices Index (RPI) with the Consumer Prices Index (CPI) as the measure of price inflation for the purposes of certain PPF compensation calculations and relevant statutory minima that apply to occupational pension schemes. Draft regulations providing for this change in relation to the revaluation of PPF compensation and related matters are currently subject to consultation. Were the CPI change to be implemented in its current form, we estimate that the move would have a positive influence on the probability of our meeting our funding objective, as shown above. Further details are provided in section 7.

6.3. Analysis of base case modelling output

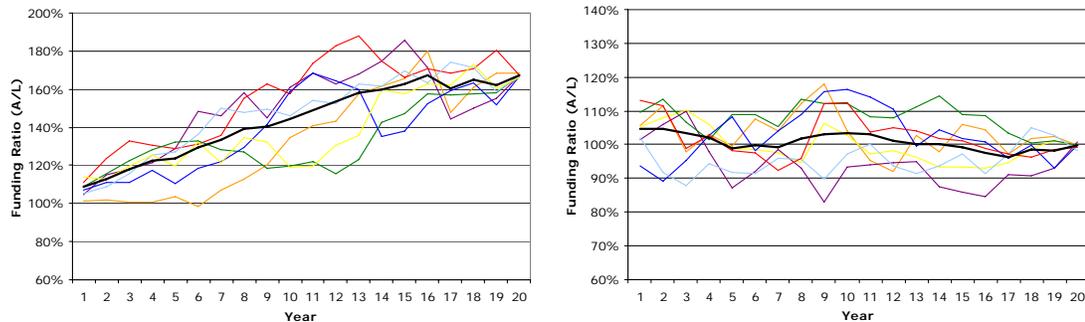
- 6.3.1. The LTRM employs stochastic techniques to project a distribution of funding outcomes over a given timeframe. The sensitivity of scheme and PPF balance sheets to financial markets, correlation between asset prices and corporate insolvencies, and the use of a 20-year funding horizon combine to ensure that this range is highly dispersed. The distribution of the 17 per cent of outcomes that fall short of the funding objective is presented in Chart 4 below.

Chart 4: Histogram of outcomes below the funding objective at 2030



6.3.2. Each of the 500,000 funding scenarios is unique. The interaction of financial market dynamics and specific credit events ensures that no two scenarios are subject to the same claims experience. Indeed, the variability of experience is such that the path of funding over time can differ dramatically, even between those scenarios with highly similar funding outcomes. This is illustrated in Charts 5a and 5b below. The charts show the various funding paths for groups of individual scenarios examined around the mean and stressed outcomes.

Charts 5a and 5b: Paths towards mean and adverse funding outcomes



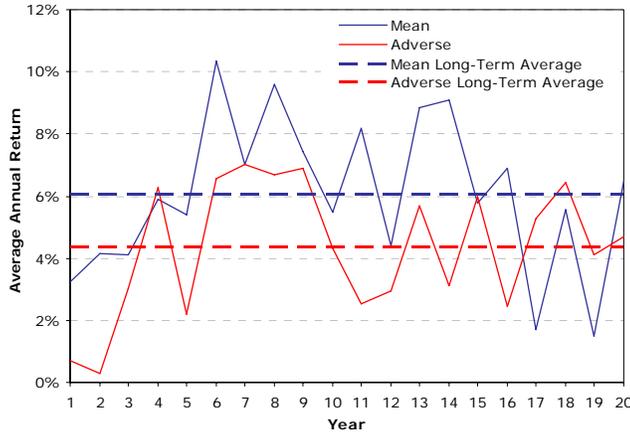
6.3.3. It is nevertheless instructive to examine scenarios corresponding to certain points of the distribution in order to gauge the general dynamics operating in expected and adverse circumstances. In the following analysis, averages have been taken for a group of scenarios clustered around the mean funding outcome and another group closest to the 90th percentile.¹⁴

6.3.4. The average annual investment returns for the mean and adverse scenario groups are provided in Chart 6.¹⁵ Long-term average returns are significantly higher for the mean scenarios than the adverse. This is the primary driver of the improvement in funding ratios for the mean group, particularly in the later stages of projection when assets on the balance sheet are considerably larger. Although our modelling assumes constant PPF levy and investment behaviour, in practice such strong balance sheet performance may trigger downward revision to the levy and/or de-risking, thereby tempering the improvement in PPF funding.

¹⁴ Given the asymmetric distribution of funding outcomes, it is appropriate to use the geometric rather than arithmetic mean.

¹⁵ Note that all analysis in this section draws on the base case projection, assuming the PPF investment allocation specified in the March 2010 Statement of Investment Principles.

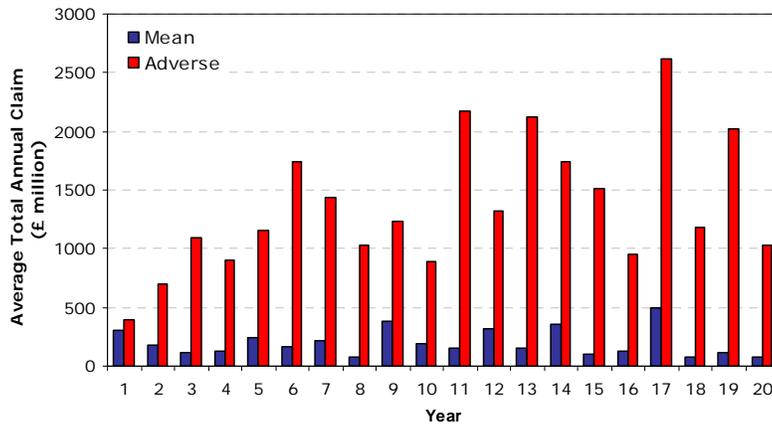
Chart 6: Average annual investment returns in mean and adverse scenarios



6.3.5. Under adverse scenarios, the impact of rising claims and subdued investment performance over the latter half of the horizon inhibits the Fund’s ability to recover a mounting deficit (Chart 5b).

6.3.6. Chart 7 below shows average annual claims for the mean and adverse scenario groups. Average claims for the adverse scenarios substantially exceed those for the mean. Claims also appear to grow over time in the adverse scenarios, despite the reduction in size of the eligible scheme universe. This is due to difficulty in amortising deficits, in combination with elevated sponsor insolvencies, against a backdrop of depressed market conditions. Under these circumstances, the Fund experiences claims not only from those schemes with currently weak employers but also those with sponsors who, at present, appear unlikely to enter insolvency.

Chart 7: Average annual claims under mean and adverse scenarios



7. Sensitivity to the use of CPI in indexation and revaluation

- 7.1. In July 2010, the Minister for Pensions announced the Government's intention to replace the Retail Prices Index (RPI) with the Consumer Prices Index (CPI) as the measure of price inflation for the purposes of certain PPF compensation calculations and relevant statutory minima that apply to occupational pension schemes. In particular, the Government intends to reference CPI in the application of annual increases to, and some escalation of, PPF compensation in payment and deferment respectively. Draft regulations providing for this change in relation to the revaluation of PPF compensation and related matters are currently subject to consultation. The following analysis is intended to estimate the potential impact of the proposal, were it to be implemented, on the PPF's risk outlook.
- 7.2. Annual CPI inflation has averaged 0.7 percentage points below its RPI counterpart between January 1989 and May 2010¹⁶. This is not a fixed relationship, however, and on a number of occasions during this period annual CPI inflation exceeded the RPI equivalent. If an RPI-CPI gap of 0.7 percentage points were to be experienced in future, the proposed switch to CPI would mean that PPF compensation payments would rise at a lower rate on average and therefore represent a smaller liability on the Fund.
- 7.3. A number of assumptions and inputs to our model are sensitive to the potential effects of a move from RPI to CPI. These include the assumptions that the PPF makes to value its liabilities, the incidence of claims that the Fund experiences in future, the growth in off balance sheet liabilities and changes to scheme funding plans.
- 7.4. There is considerable uncertainty surrounding the ramifications of the change to CPI at the time of writing. A liquid market in CPI instruments has not yet emerged and insurers have so far adopted a cautious position with regard to pricing PPF compensation linked to CPI. It is this pricing that is reflected in the PPF Section 143 basis, which helps determine whether a scheme in PPF assessment will enter the Fund. It is also too early to determine the likelihood or scale of the effect of the move to CPI, in conjunction with individual scheme rules, on the nature of existing and future pension scheme liabilities (and therefore the growth of the PPF's off balance sheet risk) or whether there will be any discernible change to scheme recovery plans already in force.
- 7.5. For the purposes of the sensitivity included in this paper, we have assumed that market-consistent pricing of CPI-linked liabilities will be at a discount to their RPI equivalent and that this will be reflected in both the PPF's internal valuation basis and the s143 basis. Furthermore, we also assume that the PPF can hedge its inflation risk, otherwise we would have to take into account the mismatched position of PPF liabilities to its investment portfolio and incorporate this additional uncertainty into our modelling. We have not

¹⁶ This gap is largely explained by the use of different averaging techniques between the two indices and the exclusion of owner occupied housing costs from CPI.

changed any assumptions about the value of contributions under scheme recovery plans or the rate of growth of the PPF's off balance sheet risk.

- 7.6. We have assumed that the gap between annual RPI and CPI inflation is a constant 0.5 percentage points. This appears to be a relatively conservative assumption in comparison to the historical average of 0.7 percentage points. In addition to the caution expressed above in relation to the emergence of a market in CPI-linked instruments, it should also be borne in mind that the composition of the index could change in future. The inclusion of some features of owner-occupied housing costs would bring the difference between RPI and CPI closer to that arising solely from the use of different averaging methods in the computation of the two indices. This so-called 'formula effect' has been observed to be relatively stable at 0.5 percentage points.
- 7.7. A key practical effect of this change in assumptions is that, as a result of a lower value placed on PPF liabilities, the initial funding position of the PPF is 4.8 per cent stronger than in the base case, moving the Fund significantly nearer to the target of 110 per cent. Furthermore, the number of schemes entering the Fund in future is also lower than in the base case, as is the value of their deficits that are inherited by the Fund.
- 7.8. Overall, the combined effect of these changes under the sensitivity is an 87.4 per cent modelled probability of meeting the funding objective with a downside risk of £9 billion.

8. Assurance and future development

- 8.1 The LTRM has been subjected to regular external audit. Detailed appraisals of the model, or aspects of the model, have been conducted by KPMG, Cardano and Oliver Wyman, among others.
- 8.2 The most recent of these reviews was conducted by the National Audit Office (NAO) in February 2010.¹⁷ Following an extended investigation, the NAO concluded that we had "developed a suitable model for assessing the impact of potential future claims" that provides an "adequate reflection of past variation in market performance and includes extreme economic scenarios."¹⁸ The NAO also noted the model's resilience in the face of a range of sensitivity tests.¹⁹ Nevertheless, the NAO made a series of recommendations aimed at ensuring the ongoing quality of the model, a number of which (such as the systematic presentation of sensitivities and execution of regular runs spanning more than 15 years) are addressed as part of this funding strategy framework.

¹⁷ http://www.nao.org.uk/publications/0910/pension_protection_fund.aspx

¹⁸ http://www.nao.org.uk/publications/0910/pension_protection_fund.aspx, p.7, paragraph 13 and p.6, paragraph 9

¹⁹ http://www.nao.org.uk/publications/0910/pension_protection_fund.aspx, p.6, paragraph 10

- 8.3 The risk modelling assumptions and methodology employed in the establishment of the PPF funding strategy have been reviewed by the Government Actuary's Department (GAD). It was GAD's assessment that the thought processes and work underpinning the funding strategy framework were sound.
- 8.4 We intend to keep our modelling techniques under continual review and implement improvements wherever possible. One area under current development surrounds the inclusion of dynamic modelling of PPF investment and levy response to financial circumstances. We are presently exploring the possibility of constructing simple behavioural rules (such as de-risking our investments or reducing the levy in surplus scenarios) that could be incorporated into the modelling process and used to drive sensitivity analysis.²⁰ Such analysis could then be used to illustrate the potential effects of possible policy responses on the key output metrics.
- 8.5 A second avenue of potential model enhancement relates to the extraction of projected scheme characteristics. Despite modelling dynamics at a scheme level, the LTRM does not at present permit the easy extraction of projected scheme data. The extensive reprogramming required to enable this function may be justified by the potential analytical enhancements. For example, richer information on scheme outcomes may help to inform the construction of more appropriate (and/or dynamic) levy assumptions.

²⁰ The sensitivity of results to a simple modification of this sort is illustrated in section 11 of Annex 2.

Annex 1: Modelling assumptions

1. Description of material assumptions

1.1 The following assumptions were employed in producing, and have the potential to significantly influence, the key modelling outputs under the baseline scenario.

1.2 PPF characteristics

1.2.1 The PPF funding objective is set on the belief that, in 20 years' time, a reserve equivalent to 10 per cent of liabilities would be sufficient to insure, with 90 per cent confidence, against the risk of greater life expectancy over the outstanding lifetime of the fund and future claims over five years (although this figure is highly dependent on assumptions about the rate of scheme closures and speed of recovery plans).

1.2.2 PPF liabilities are calculated according to the PPF valuation basis. For a description of this basis, see the PPF Annual Report and Accounts 2008/09.²¹ Longevity improvements to 2030 are projected according to the mortality tables adopted as part of this basis.

1.2.3 The PPF investment allocation is modelled as that set out in the March 2010 Statement of Investment Principles. Transition to this allocation is still underway but is assumed to be immediate for simplicity of modelling.

1.2.4 We assume that a constant levy of £700 million in nominal terms (i.e. not increasing with inflation) is collected annually throughout the 20 years of the projection. On this basis, the funding objective described in the above paragraph is achieved in 83 per cent of all scenarios.

1.3 Economics and investment returns

1.3.1 Distributions of projected asset return outcomes are created using assumptions based in part on past data and in part on current market conditions. Key characteristics include the volatility of asset returns and the correlation between returns of assets of different types, both of which are modelled largely on the basis of historical experience.

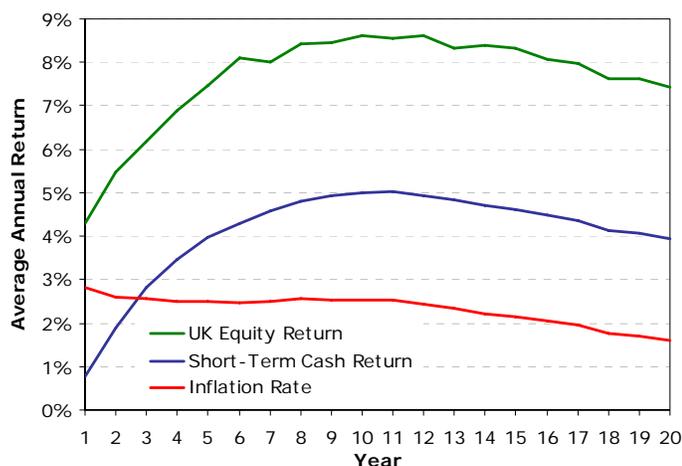
1.3.2 The correlations between the returns of different asset types are assumed to fluctuate around a constant long-term average.

1.3.3 Interest rate (risk-free investment return) projections are based largely on implied market views. The average short-term cash return is 0.8 per cent initially, peaking at 5 per cent in year 11 of the projection, consistent with comparable rates observable in the market.

²¹ http://www.pensionprotectionfund.org.uk/DocumentLibrary/Documents/ARA_0809.pdf

- 1.3.4 Projections build in an average return on equities of around 3.5 per cent over the risk-free investment return.
- 1.3.5 Inflation projections derive from implied market views based on the modelling of nominal and index-linked bond yields. The average inflation projection falls to around 1.5 per cent in the long term.

Chart A1: Average projections for economic variables



- 1.3.6 Sponsor insolvency probabilities are assumed to exhibit a certain degree of correlation with equity market conditions. That is to say that when equity markets deteriorate, sponsor insolvency probabilities generally move upward, and vice versa. As a consequence, in our projections, scheme deficits will tend to rise at the same time as the rate of insolvency. Increasing the correlation between equity returns and credit risk substantially increases the risk of very large claims.

1.4 Scheme and sponsor characteristics

- 1.4.1 Initial funding is taken for each scheme as the average for that scheme between 1 April 2009 and 31 March 2010.
- 1.4.2 Scheme contributions are determined by current recovery plans, targeting an average of 110 per cent of s179 liabilities over an average of 8 years. This means that in a scenario without any significant accident, scheme deficits are entirely removed within 20 years, with a majority of schemes successfully completing their recovery plans within 10 years.
- 1.4.3 No account is taken of the tendency for sponsors to reduce their commitment to a scheme once it has become fully mature and no longer relevant to the existing workforce.
- 1.4.4 Schemes are assumed to reduce the risk of their investments over time. The share of scheme assets invested in long-maturity bonds gradually rises from an initial 50 per cent to around 85 per cent in the long term.

- 1.4.5 As at 31 March 2009, only 22 per cent of schemes were open to new members, down from 35 per cent in 2006.²² For simplicity of modelling, we assume that all schemes close to new entrants within 2 years.
- 1.4.6 Schemes that were open to new accrual as at 31 March 2009 are assumed to remain open to new accrual.
- 1.4.7 The rate of active member withdrawal is set at a constant 5 per cent per year.
- 1.4.8 The pool of PPF-eligible schemes is assumed to be diminishing; no new schemes enter the universe.

1.5 Sponsor solvency

- 1.5.1 Movements in the probability of insolvency of schemes' sponsors have been determined by Moody's KMV on the basis of historical information. When applied to the PPF-relevant population of schemes, a long-term trend emerges whereby the population becomes increasingly concentrated around an average insolvency probability of around 0.8 to 0.9 per cent per annum.
- 1.5.2 A large proportion of our universe of employers operates in already mature manufacturing sectors. It is likely that over the long term these companies will employ fewer staff and that for a growing number of them the size of the pension scheme they sponsor will be disproportionately high compared to the size of their operational balance sheet, making the sponsor covenant weak. This likely trend is not captured in our modelling work.

2. Description of assumptions with low materiality

- 2.1 PPF funding is taken at end-March 2010. If we had chosen to start the projection as at end-December 2009, changes to the results over 20 years would have been immaterial.
- 2.2 All eligible schemes are subject to insolvency and underfunding risks and are modelled accordingly.
- 2.3 Schemes are assumed to successfully and fully insure their liabilities (i.e. 'buy out') if they achieve 140 per cent funding at any point. This assumed behaviour does not result in any material reduction in risk because, typically, any scheme reaching 140 per cent funding level or more will present very little risk to the PPF, especially as that scheme matures and progressively de-risks its investment strategy. This behaviour is also unlikely to result in a significant reduction of our levy base because, as the levy is 80 per cent risk-based, these pension schemes would pay only a very small portion of the total levy collected. However, it should be noted that if significantly more schemes were to buy out their liabilities than assumed here, then this could have a significant effect on the levy base.

²² These figures exclude hybrid schemes.

Annex 2: Sensitivity of output to key assumptions

1.1 We assess the sensitivity of the model's results to a particular assumption by changing this assumption and observing the movements in the two key model outputs:

- The probability of achieving the funding objective.
- The downside risk, which is the 90th percentile of the largest deficits that can be faced over the next 20 years (i.e. between now and 2030, not just in 2030).

2. Sensitivity to initial PPF funding

2.1 Under the baseline scenario, the initial level of PPF funding is set at the actual value at the base date (here 31 March 2010). In order to stress this assumption, we have reduced this funding ratio by 10 percentage points. Results are set out in Table A2.1 below.

Table A2.1: Sensitivity to initial PPF funding

	Probability of achieving funding objective	Downside risk
Baseline scenario	82.8%	£14bn
PPF funding minus 10 percentage points	80.7%	£16bn

3. Sensitivity to assumptions on recovery plans

3.1 Under the baseline scenario, we assume that schemes target technical provisions representing on average 110 per cent of s179 liabilities and that any asset shortfall is amortised on average over 8 years. As a first sensitivity, we have assumed that the recovery period is doubled. The second test assumes that technical provisions targeted by trustees are reduced by 10 per cent. Results are set out in Table A2.2 below.

Table A2.2: Recovery plan sensitivities

	Probability of achieving funding objective	Downside risk
Baseline scenario	82.8%	£14bn
Extended recovery period	78.3%	£23bn
Technical provisions reduced by 10%	77.4%	£24bn

4. Sensitivity to assumptions on scheme closure to new accruals

4.1 In the baseline scenario, we assume that there is no further closure to new accruals. As a sensitivity, we assume that schemes close to new accruals at

a faster pace so that half of the pension schemes will be closed to new accruals in 3 years. Results are set out in Table A2.3.

Table A2.3: Scheme closure sensitivities

	Probability of achieving funding objective	Downside risk
Baseline scenario	82.8%	£14bn
Faster scheme closure to new accruals	86.2%	£12bn

5. Sensitivity to assumptions on distribution of asset returns

5.1 The sensitivity of results was tested to two different strands of asset returns assumptions. Results are given in Table A2.4 below.

- Returns on any asset class (with the exception of cash) were reduced by 1 percentage point.
- Volatilities of all asset classes except cash were increased by 25 per cent.

Table A2.4: Asset return sensitivities

	Probability of achieving funding objective	Downside risk
Baseline scenario	82.8%	£14bn
1 per cent reduction in asset returns	76.4%	£24bn
25 per cent increase in volatilities	77.5%	£28bn

6. Sensitivity to the choice of funding objectives

6.1 In the baseline scenario, the funding objective is to achieve, in 20 years, a funding level of 110 per cent of liability valued on PPF ongoing basis. We have tested the effect of changing the funding objectives in two ways:

- Firstly, by targeting a funding level of 100 per cent instead of 110.
- Secondly, by increasing the timescale over which the objectives are set from 20 years to 25.

Table A2.5: Funding objective sensitivities

	Probability of achieving funding objective	Downside risk
Baseline scenario	82.8%	£14bn
Targeting 100% instead of 110%	89.6%	£14bn
25-year horizon	86.2%	£14bn

7. Sensitivity to assumptions on the economic environment

7.1 On the economic environment we tested three scenarios:

- A credit stress test whereby probabilities of default for all credit rating bands are increased by 20 per cent.²³
- We stressed the level of correlation between insolvency risk and equity return, which increases the number of scenarios exhibiting both a large number of claims and weak scheme funding. Under this stressed assumption the downside risk increases considerably.
- We also simulated the conditions of a 'double-dip' recession. Asset returns were projected forward deterministically over five years in a manner corresponding to a second recessionary episode. Stochastic projections govern asset returns beyond this point. The effect on the probability of meeting the funding objective is minimal. This is primarily due to the length of time available for the Fund to recover from a brief shock at an early stage of the funding horizon. Recovery is also helped by the assumed rapid recovery in asset returns following recession.

Table A2.6: Economic environment sensitivities

	Probability of achieving funding objective	Downside risk
Baseline scenario	82.8%	£14bn
Credit stress-test	81.6%	£17bn
Increased correlation between credit risk and equity markets	80.8%	£19bn
'Double dip' recession	82.4%	£18bn

8. Sensitivity to assumptions on the pension landscape

8.1 The first alternative scenario on the evolution of the pension landscape that we tested is a scenario whereby we assume that, at the beginning of the projection, scheme funding is 15 per cent higher than under the baseline scenario.

Table A2.7: Pension landscape sensitivities

	Probability of achieving funding objective	Downside risk
Baseline scenario	82.8%	£14bn
Initial scheme funding increased by 15%	87.6%	£7bn

²³ Note that, in order for the probabilities of transition to the various credit rating bands to remain equal to 100 per cent, the probability of entering (or remaining in) the lowest band is reduced. This partially offsets the extent of credit stress modelled.

9. Sensitivity to levy assumptions

- 9.1 Under the baseline scenario, the levy is assumed to remain at a constant nominal £700 million, not indexed to inflation. Table A2.8 shows the movement in the probability of success if this profile is reduced to a constant nominal £600 million.

Table A2.8: Levy sensitivity

	Probability of achieving funding objective	Downside risk
Baseline scenario	82.8%	£14bn
Levy constant £600m	80.8%	£17bn

10. Sensitivity to rate of inflation assumptions

- 10.1 The Government intends to reference CPI instead of RPI in the application of annual increases to and some escalation of PPF compensation in payment and deferment respectively. Draft regulations providing for this change in relation to the revaluation of PPF compensation and related matters is currently subject to consultation. For the purposes of estimating the impact of this proposal, were it to be implemented, we have assumed that market-consistent pricing of CPI-linked liabilities will be at a discount to their RPI equivalent and that this will be reflected in both PPF's internal valuation basis and the Section 143 basis. Furthermore, we also assume that PPF can hedge its inflation risk, otherwise we would have to take into account the mismatched position of PPF liabilities to its investment portfolio and incorporate this additional uncertainty into our modelling. We have not changed any assumptions about the value of contributions under scheme recovery plans or the rate of growth of PPF's off balance sheet risk. The future gap between annual RPI and CPI inflation has been assumed to be a constant 0.5 percentage points.

Table A2.9: RPI-CPI sensitivity

	Probability of achieving funding objective	Downside risk
Baseline scenario	82.8%	£14bn
Future inflation reduced by 0.5% (for CPI switch)	87.4%	£9bn

- 10.2 The uplift in probability of meeting the funding objective shown in Table A2.9 does not simply reflect the effect of the CPI switch on initial PPF and scheme funding. The shift to CPI also reduces the value of compensation in respect of benefits accrued by active members beyond the initial period. The uplift is therefore greater than might be inferred from analysis of the sensitivities shown in Tables A2.1 and A2.7.

11. Sensitivity to potential model enhancements

- 11.1 Under the baseline scenario, the PPF investment portfolio remains fixed throughout the 20-year horizon in accordance with the March 2010 Statement of Investment Principles. It is possible, however, to model a more sophisticated assumption incorporating a degree of rational investment response. Specifically, a very strong funding position, particularly in the latter stages of the funding horizon, could be expected to result in the PPF de-risking its investments so as to lock out market risk. The results below were generated by modelling an immediate purchase of a risk-free portfolio in circumstances where PPF funding exceeds, at any stage, that required to meet the funding objective.

Table A2.10: Sensitivity to dynamic PPF investment strategy

	Probability of achieving funding objective	Downside risk
Baseline scenario	82.8%	£14bn
Dynamic investment strategy	83.1%	£14bn

- 11.2 The effects of expected longevity improvements on scheme funding and the PPF balance sheet to 2030 are projected according to the mortality tables adopted as part of the PPF valuation basis. It is possible, however, to extend the stochastic longevity techniques used to identify the funding margin (see 4.3.4) to the evolution of scheme maturity prior to 2030. Table A2.11 below illustrates the effect of this application. Stochastic longevity has a limited impact on the probability of the PPF meeting the funding objective, as the projected scenarios are uncorrelated with investment and credit outcomes.

Table A2.11: Sensitivity to stochastic longevity modelling

	Probability of achieving funding objective	Downside risk
Baseline scenario	82.8%	£14bn
Stochastic longevity modelling	81.9%	£15bn

Annex 3: Risk monitoring framework

1. Summary and constituent risk indicators

- 1.1. The Board monitors a range of risk indicators in order to help inform decision making. The probability of achieving the funding objective and downside risk statistics, taken together, provide a summary of risk to PPF funding. In addition to these, the Board monitors seven indicators relating to individual drivers of risk. These have been chosen on the basis of sensitivity analysis, which shows them to be material in shaping the overall risk environment. Details of these constituent risk indicators are provided below in Table A3.

Table A3: Description of the constituent risk indicators

Indicator	Description
Universe funding level	The ratio of total DB scheme assets to liabilities, as estimated in the monthly PPF7800 release.
Credit risk	An average insolvency probability for the 500 schemes that pose the greatest risk (measured in terms of probability-weighted deficit) to the PPF. Market-implied insolvency probabilities are assigned to scheme sponsors where available.
PPF funding level	The ratio of PPF assets to liabilities on an internal basis.
PPF investments	Realised and expected annual returns on total investments (excluding interest and inflation swap agreements). Past returns are measured over a 12-month period relative to the blended benchmark defined in the relevant Statement of Investment Principles (SIP). Expected returns are stated above LIBOR. These will rise gradually as the PPF transitions to the asset allocation specified in the March 2010 SIP.
Economic outlook	A qualitative view on the risk of a disorderly adjustment in asset prices based on a series of variables reflecting economic fundamentals.
Scheme investment risk	An expected one-year volatility statistic for the aggregate portfolio of PPF-eligible scheme assets, based on latest Purple data and volatility assumptions driving the LTRM.
Recovery plans	The average length of the amortisation period combined with the average level of Technical Provisions relative to s179 liabilities.

