PPF Long-Term Funding Strategy Update

1: Contents

The sections of this document are:

2:   Foreward

Our funding strategy describes the framework within which we make our financial decisions and how we assess the financial risks to the Fund. Each year we update the strategy with the latest financial information and up-to-date consideration of the risks to our objectives.

In contrast to the financial year 2012/13 which saw record levels of claim amounts at the PPF, the experience in the period April 2013 to March 2014 was much milder. Economic conditions have improved and we have seen a quieter year in terms of claim numbers.

While continuing low bond yields mean that liabilities remain at historically high levels, scheme funding has begun to improve following asset gains.

The PPF's funding position has remained strong over this period, and based on the stochastic modelling work presented in this update we report an increase in the probability of success from 87 per cent at 31 March 2013 to 90 per cent at 31 March 2014. Nevertheless, there are still risks to our long term funding strategy in both the short and longer term.

In the short term, the path to recovery still contains obstacles; for example faster than expected rises in interest rates threaten those companies whose profitability is marginal. We have considered two stresses to test the PPF's ability to withstand more pessimistic conditions over the next few years. We also find it helpful to understand how benign economic conditions could positively impact our probability of success, and have developed a stress scenario on this more optimistic basis.

Looking at the longer term, we ensure that our modelling covers a wide range of potential futures. But, of course we cannot guarantee the outcomes that we predict. In order to test the robustness of our modelling, we ensure that we test how sensitive the output is to a range of changes in key assumptions.

We also need to ensure that the funding strategy objective itself remains appropriate and fit for purpose. During the past year, the Board conducted a review of the funding objective which has resulted in the incorporation of a new risk (operational risk) within the margin. While for the moment our overall margin remains at 10%, and our funding horizon is still 2030, we note that planned developments in our investment strategy will need to be incorporated as part of our next review.

In summary, we believe our funding strategy remains appropriate and we continue to make good progress against it. However, there are clear risks in the current economic climate, and regular monitoring of our position remains essential

Martin Clarke

Executive Director of Financial Risk   July 2014

3: Review of the funding objective

This section considers the principles behind our funding objective and whether our funding objective remains appropriate

The purpose of the PPF

The PPF exists to pay the right people the right amount at the right time. The cornerstone of this objective is that we have sufficient funds to pay members their compensation for the entire lifetime of the PPF. However, the Board faces a number of risks in ensuring that the assets it holds will cover future liabilities. These risks need to be monitored and managed within a holistic governance framework.

The PPF's approach to risk management

The PPF operates within a robust risk management framework which we are constantly seeking to improve. One way to do this is to incorporate best practice from the insurance industry, given that in many ways the PPF resembles a life insurer (the other main risk that we cover being credit risk). One element we are incorporating this year is that we are conducting an ORSA ('Own Risk and Solvency Assessment'). ORSA is part of the Solvency II regulatory framework and applies to insurance companies in the European Union. The ORSA is not a mechanical calculation or approach. Rather, the ORSA is a process for developing a complete and holistic risk understanding, viewed from the management perspective.

The ORSA process requires insurers to identify their risks, assess the potential impact of these risks via sensitivity and stress testing (amongst other tools) and consider what capital should be held against these risks. Any insight from these exercises should then be reflected in the internal model, for example by updating assumptions.

The PPF's funding strategy provides the impetus for a similar cycle of risk identification, evaluation and mitigation. As part of our regular review of the funding strategy, we have considered all risks currently covered by our risk policies and assessed whether or not these risks should be explicitly modelled within the funding strategy. Sensitivity and stress testing is conducted – see sections 7 and 8 for further details.

While the PPF is not required to hold capital, our funding margin can be viewed as analogous to this in that it is intended to cover the cost of unexpected risks. The PPF is required to assess whether or not it is a going concern (as is required by ORSA); moreover in the longer term the fundamental question we need to address is whether or not we have sufficient funds to pay members their compensation. By assessing whether or not we are on track to meet our funding objective, we can test out our ability to meet this goal.

In summary, the funding objective is a central element of the PPF's risk management framework. Having a clearly defined objective allows us to assess how we are performing relative to our overall goal, and whether we need to take action to ensure we remain on track. It also provides a way for the Board to assess the possible impact of expected (or unexpected) changes on the PPF's overall mission. By analysing the impact of a change by reference to our funding objective, we can decide how serious a potential risk is and be guided as to what an appropriate mitigation might be.

The Board has two main levers it can use to address the risk that we have insufficient assets to meet our liabilities. The first of these is to change the levy collected. The second is to alter its investment strategy. The Board also has the power to ask government to reduce the level of compensation payments, however this would only be considered in exceptional circumstances.

3: Review of the funding objective

Rationale for the funding objective

The PPF operates in an environment of continual change. Over the next two decades, we expect that the number of DB schemes will significantly reduce as schemes buy out their liabilities, or enter the PPF. Moreover the funding level for surviving schemes should improve over time, as a result of the scheme funding legislative framework. There will therefore come a point when the levy is no longer an effective tool for managing the PPF's funding position, because the levy we could justify collecting from remaining schemes will be so small compared to the PPF's assets and liabilities. By this point in time we will therefore want to adopt a lower-risk investment strategy, because we are less able to use levy to address any deficit that might emerge as a result of poor asset performance or a poor claims experience. We call this point in time the funding horizon.

When we reach the funding horizon, some risks to the PPF will still remain. As long as there are DB schemes, there is a risk of claims from some of these schemes. Also, longevity risk will remain as long as the PPF is responsible for paying compensation. The questions we need to address are – how material will these risks be? How well funded do we need to be to ensure that, even if the future is worse than expected, we can still pay members their compensation? If we can gauge this funding level correctly, we should be self-sufficient.

What is self-sufficiency?

The assumptions that we use to assess our liabilities and therefore our funding position reflect our best estimate of the future. By "best estimate" we mean that it is equally likely that the future is better than we expect, or worse than we expect. Therefore if at our funding horizon our assets were exactly equal to our best estimate of our liabilities then we would only have a 50 per cent chance of being able to meet compensation payments in full. However, a 50 per cent chance of being able to meet compensation is low, so we have added a margin to protect ourselves against the risks to which we would be exposed.

The target for self-sufficiency is set as a percentage margin over the liabilities, this being held to cover remaining risks after we reach the funding horizon. When the risk margin was introduced, it was set at 10 per cent and was intended to cover two key risks which would remain after the funding horizon: the risk of unexpected longevity improvements and any future claims (beyond the year 2030) in excess of PPF levies. It was calculated such that in the year 2030 (the assumed funding horizon) it would be sufficient in 90 per cent of modelled scenarios to cover both uncertainty in longevity, and claims risk in excess of levy. It was the Board's view that 90 per cent struck an appropriate balance between the security of members and the costs to levy payers. As a point of reference, had the Board chosen a 99 per cent confidence level, the funding margin would have been required to be 30 per cent.

The Board has recently conducted a review of the self-sufficiency margin. The margin was updated to allow for changes in the pensions environment since 2010, latest longevity data, and refinements in the modelling itself. As a result the Board decided that both the funding horizon of 2030 and the ten per cent self-sufficiency margin remain appropriate (with a 90 per cent level of confidence). However, we are aware of a number of areas which may lead the Board to review the margin in future. One is the decision to increase the Fund's exposure to illiquid assets, which may result in illiquidity risk being retained after the funding horizon is reached. Another is whether our assumption that, eventually, a market in CPI instruments will develop remains valid, given current industry opinion on this. We will consider these topics in more detail at our next review.

As part of the review, we also considered whether any additional risks need to be allowed for. The Board has decided to incorporate a third risk into the margin – operational risk; since this risk will remain as long as the PPF is in existence. By operational risk, we mean the risk of loss resulting from inadequate or failed internal processes, people and systems, or from external events, including legal risk (i.e. the definition used under Solvency II).

3:   Review of the funding objective

There are a number of other risks which we exclude from our funding margin. In general, this is because such risks will be minimal by the time we reach our funding horizon. For example, one risk we currently face is transition risk, the risk that when we are moving assets from transferring schemes into the PPF, there are unnecessary costs or the market moves against us during the transition. By the time we reach our funding horizon, far fewer asset transitions are expected to take place so this risk becomes minimal. Also, because our investment strategy is expected to be simpler once we reach 2030, many of the risks currently associated with our current complex investment strategy, such as taking tactical positions, are likely to be heavily reduced.

As part of our risk management cycle, we will continue to consider whether the risks allowed for in the margin remain appropriate.

How do we measure progress against our funding objective?

We use two statistics to monitor progress against our funding objective - the 'probability of success' and the 'downside risk'. The probability of success measures our chance of being self-sufficient in the year 2030 if we continue on our current course with no change to our investment strategy or to the PPF Levy formula. The downside risk is a measure of how poorly funded we might become. It is calculated such that in 10 per cent of modelled scenarios our deficit reaches at least that level at some point before 2030.

To measure these statistics we have developed an internal model that projects the level of PPF assets and PPF liabilities in future years. It generates an extensive range of asset returns, insolvency and longevity scenarios and then projects a range of PPF balance sheet outcomes.

The process of using a large number of modelled scenarios to derive a distribution of outcomes is termed stochastic analysis, or Monte Carlo analysis. It is widely used in the financial services industry and its primary advantage over deterministic or 'single point' forecasts is that having a distribution of outcomes allows us to assess not just our best estimate of the future but also the likelihood of specific variations from that outcome.

As with any financial model, it is important to exercise an appropriate degree of caution when analysing output. Models are not infallible; there is no guarantee that future outcomes will conform to dynamics observed in present and past data. To help assess the level of model and parameter risk we carry out multiple runs to test the sensitivity of the output to changes in key assumptions (see section 7).

As well as testing the sensitivity to changes in individual assumptions we carry out more fundamental stresses to the model by changing various assumptions all at once. Two such pessimistic stress tests are described in section 8 together with, for balance, a stress that is more optimistic than the current base case.

4: Summary of the year's events

This section summarises the events affecting the risks to the PPF over the year.

New statutory objective for the Pensions Regulator

The Pensions Bill 2013 introduced a new requirement for the Pensions Regulator to "minimise any adverse impact on the sustainable growth of an employer" when exercising its duties. The Regulator has subsequently consulted on a revised code of practice for defined benefit scheme funding, a new regulatory strategy and a revised funding policy which, together, set out its regulatory approach to DB schemes and to DB funding. At the time of writing, the Regulator had recently published their revised funding code and strategy. We are currently considering whether any adjustments to our modelling are required to reflect the revised code. We continue to maintain a close watch on emerging trends in scheme funding and recovery plans.

The Budget

The 2014 budget saw the chancellor announce "the most far-reaching reform to the taxation of pensions since the regime was introduced in 1921". From April 2015 pensioners will have the freedom to cash in as much or as little of their defined contribution pension pot as they want, removing the need to buy an annuity. The full consequences of these changes, which are subject to consultation, will take time to emerge.

The government is also considering the appropriate approach to transfers from DB schemes to DC in the light of these proposals. If permitted, a significant shift in assets and liabilities away from DB schemes may have consequences for the risk profile of PPF.

Another important consequence for PPF is the size of the reduction in demand for retirement annuities and the implications for the pricing of these products in the market. As the basis for assessing schemes for entry into the PPF is by reference to the cost of securing annuities for the scheme members such a change could impact the predicted number of claims on the PPF.

Defined Ambition

The government is keen to reinvigorate the provision of workplace arrangements that offer greater security to the member than traditional defined contribution schemes. Following a consultation the government announced in June that it would introduce a legislative framework defining for first time the terms defined benefit, defined contribution and defined ambition (or "shared risk"). A pensions act in 2015 will set out the high level framework with secondary legislation setting out the details. At this stage it is not clear the extent to which the defined ambition schemes will be eligible for PPF protection.

Bridge

The government is bringing in new legislation in 2014 to clarify the distinction between defined benefit and defined contribution schemes. This means that schemes, or certain benefits within schemes, which were previously classified as defined contribution will now be classified as defined benefit. They will therefore be eligible for PPF protection. We do not currently have firm data on the number of schemes or the quantum of liabilities affected; however our view is that the additional risk posed to the PPF is likely to be small.

Central clearance of OTC derivatives

The PPF makes extensive use of swap contracts to protect itself against unexpected changes in interest rates and inflation. Such derivative instruments will be affected by the European Market Infrastructure Regulation (EMIR).

4:   Summary of the year's events

Central clearance of OTC derivatives

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Under EMIR the aim is that any new Over-The-Counter (OTC) derivative trades will need to be passed through a central clearing house, which will require assets to be deposited as margin. The proposal limits the classes of assets that can be deposited as margin and this potentially obliges parties with swap contracts to invest a greater amount in cash and/or government bonds, which may impact upon expected investment performance.

The details of the legislation continue to be confirmed, as does the timetable for the requirement for certain asset classes to be centrally cleared. The proposals potentially have serious consequences for the PPF and we have commenced work to develop our operational readiness for central clearing and reduce our dependence upon swap contracts. These pieces of work are ongoing and as they crystallise will be reflected in our funding strategy.

Changes to the PPF's investment strategy

The PPF has recently decided upon a change to its investment strategy. The main change is to increase the overall portfolio allocation to illiquid assets to around 13 per cent. The allocation to equities and global bonds will also reduce somewhat, while the allocation to gilts and cash and alternatives will increase.

Illiquid assets are assets which cannot readily be sold for cash, and all other things being equal, should offer a higher return; this allows the PPF to take advantage of the fact that our liabilities are very long-term and hence we can tie up some of our assets in illiquid investments. Allowing for this change, the PPF's overall level of investment risk net of illiquidity risk remains within the Board's defined appetite.

As mentioned above, new requirements to centrally clear derivative contracts are expected to increase the cost of our hedging programme. The illiquid assets we intend to invest in have inherent hedging characteristics, i.e. their value will increase and decrease in line with interest rates and inflation much as our liabilities do. The same applies to other assets we already hold. By recognising the hedging characteristics of all of our assets, we are able to reduce the amount of derivative contracts we hold and hence reduce the cost impact of the new requirements.

One consequence of illiquid investment is that if the PPF buys and holds such assets it will continue to have investment risk beyond the funding horizon (as some of the arrangements being considered are very long-dated). At present we assume that once we reach the funding horizon the PPF will carry no investment risk. As mentioned previously, we intend to consider how this change may affect our funding horizon, funding margin and definition of self-sufficiency at our next review.

Markets and their impact on scheme funding

The UK economy has seen strong growth since March 2013, after eighteen months of stagnation, with GDP rising at 3 per cent on an annualised basis. Economists' average growth forecasts for 2014 have also risen steadily. As a result of strong growth and low interest rates, the number of insolvencies in the economy as a whole has been falling, as has the number of claims on the PPF.

The expectation of robust growth and unchanged interest rates has resulted in further equity market gains. This, combined with the impact of higher gilt yields on the present value of liabilities, means that scheme funding on an s179 basis for the universe of PPF-eligible schemes has improved considerably over the past year.

In addition, the Purple Book 2013 showed further pension fund de-risking. The percentage of schemes closed to future accrual rose further, from 26 per cent to 30 per cent, while only 14 per cent were open to new members. Furthermore, the trend away from equities and towards bonds in schemes' asset allocation continued; the equity share in total assets fell to 35 per cent while the bond share rose to 45 per cent.

4:   Summary of the year's events

Claims on the PPF

By 'claims' we mean the pension deficits that are brought into the PPF when scheme sponsors suffer insolvency thus causing their schemes to enter the PPF.

In the year to 31 March 2014 we saw a reduction in the total number of claims relative to previous years, and the rate of claims has been decreasing over the year. Nevertheless, we have had two significant claim amounts during the year. Also, the funding level of the PPF7800 has improved over the year – assets have risen following gains in equities, and liabilities have fallen as gilt yields rose. This has led to smaller claim amounts.

The following chart shows our current view of the claims made on the PPF taking into account recoveries, as well as levy payments received, since our inception.

Chart 4.1: History of claims and levy
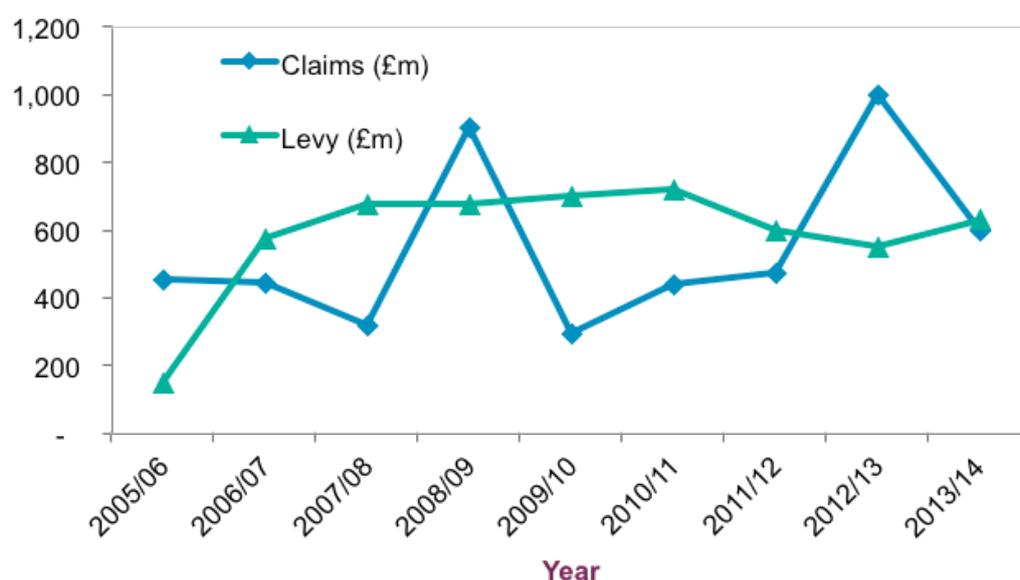
We do not anticipate a dramatic increase in the number and size of claims over the coming months. However, this will be dependent on the path of economic recovery; if interest rates increase faster than expected, highly indebted companies, particularly smaller ones with restricted access to capital markets, could find it difficult to cope, pushing insolvencies up. The picture remains uncertain and we will continue to analyse how our claims experience may develop.

PPF Levy

The Board's strategy for setting levy is to keep the parameters constant throughout the levy triennium unless there is a significant change in risk or one of the following limits is expected to be breached:

- The Levy Ceiling as set out in legislation (currently £0.9 bn)
- A 25 per cent year-on-year increase in the levy
- A 25 per cent year-on-year decrease in the levy

The Board decided to reduce the levy parameters for the year commencing 1 April 2013 as the increase in risk would have pushed the levy beyond the permitted limits. For the following year the Board decided to keep the levy parameters the same.

5: Updated assumptions

This section discusses the model assumptions that we have updated over the year.

The main modelling assumptions are described in Annex A1. Some of these have been updated since the previous update of our funding strategy in October 2013, and these are described below.

Updates to the investment strategy

During the year, the PPF moved to a new benchmark for equities which targeted a lower level of volatility. This has been reflected in the model by updating both the expected return and volatility for equities.

We have also updated the risk and return characteristics for alternative assets (private equity, timberland, farmland, unlisted infrastructure and hedge funds), based on our current views.

Lower recovery rate for claims following insolvency

When a sponsoring employer becomes insolvent, the pension scheme puts in a claim on the employer's assets for the deficit in the scheme. If the scheme then enters the PPF, any assets recovered as a result of this claim also transfer to the PPF. However, the proportion of the total claim recouped is often small. Based on recent trends, we have reduced the recovery rate from 5% to 4.5%.

Development of a liquid market in CPI instruments

One of our key assumptions is that a market will emerge in CPI-linked instruments. This will enable us to better hedge our liabilities, which are linked to CPI rather than RPI. Currently we are forced to use RPI-linked instruments to hedge our inflation-linked liabilities, adjusting our strategy to allow for our best view of the difference between RPI and CPI. While the government has consulted on issuing CPI instruments, the demand does not seem strong. Many market participants have expressed doubts as to how quickly a market will emerge. We have therefore changed our assumption for when a liquid market emerges from 2022 to 2024. We intend to consider the validity of this assumption as part of our next review of the funding objective.

Changes in schemes' investment strategy

We assume that defined benefit schemes will de-risk as they mature, moving away from equity investments and into bonds. Based on discussions with market participants, we have updated our assumptions to allow for a slightly lower allocation to equities for schemes which have de-risked their assets.

Longevity

We have updated our longevity projections to allow for the latest longevity data. This includes a technical enhancement in the way the tables are calculated.

Impact

As discussed in section 6 the net impact of these changes on our funding outputs is slightly positive.
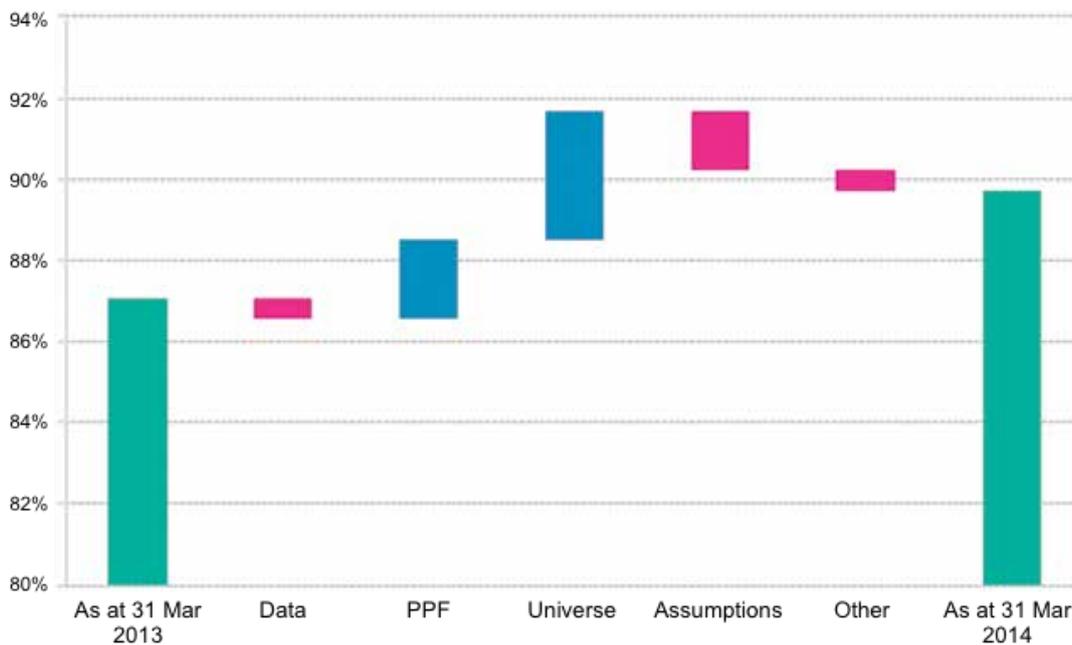
6:   Modelling output - base case

*This section considers the model's output in our main run
of the model – our 'base case'.*

In our base case, the assessed probability of achieving self-sufficiency by 2030 has increased from
87 per cent at 31 March 2013 to 90 per cent at to 31 March 2014. The corresponding downside risk
statistic is improved, at £4 billion, compared with £9 billion a year earlier.

The reason for the 3 per cent increase is mostly down to the improvement in our own balance
sheet over the year (from 110% to 113%). This improvement arose from a good performance on our
investments, and a change to our demographic assumptions. It was mitigated a little by new claims.

The following chart reconciles the probability of success at 31 March 2014 with the position one year
earlier. The blue bars denote improvement and the red bars denote deterioration over the year.

Chart 6.1 Change in probability of success over year

6: Modelling output - base case

The following table explains what the bars represent.

Bar	Explanation
2013	This is the probability of success at 31 March 2013, which was 87 per cent.
Data	This allows for the change in data over the year, including scheme's valuations, recovery plans and employer credit ratings.
PPF	This allows for the improvement in the PPF's funding level over the year, from 106% at 31 March 2013 to 107% at 31 March 2014 (including schemes that are virtually certain to come into an assessment period in the near future). The funding levels excluding the near-certain insolvencies were 110% at 31 March 2013 and 113% at 31 March 2014.
Universe	This is the effect of scheme funding improving over the year.
Assumptions	This is the net effect of the various assumption changes discussed in section 5 and changes in financial markets. While the assumptions changes had a small positive impact this was more than offset by the impact of current and expected future market conditions.
Other	This includes improvements to the modelling, and all other factors not accounted for above.
2014	This is the probability of success at 31 March 2014, which is 90 per cent.

Are we happy with a 90 per cent chance of success?

It should first be noted that the figure of 90 per cent is calculated on the assumption that no adjustment is made either to our investment strategy or to the levy parameters other than where required by legislation. In other words we assume that the PPF does not respond to changing circumstances.

A third lever available to the Board is to ask government to reduce the level of PPF compensation payable, either by increasing the level of cutback or by restricting indexation on pensions. However, this is considered an option of last resort.

It might also be appropriate to review our funding framework in an unfavourable environment. For example if as we approached the year 2030 we found that the level of risk posed to the PPF by eligible schemes was still high relative to the size of the PPF, we would push our funding horizon further out beyond 2030.

Ultimately we would like the probability of success to converge towards 100 per cent by 2030. However, to achieve this level of comfort today we would need to charge a levy running into billions of pounds a year. This would not be in the best interest of levy payers, or indeed be possible under the limits set by legislation.

The Board regularly monitors the probability of success and the downside risk in quarterly updates of the modelling. To do this it has devised a Red-Amber-Green framework where a green rating indicates that the Board should be comfortable, an amber rating indicates that it should consider pulling on one of its strategic levers and a red rating indicates that it should almost certainly be planning to pull one of its strategic levers. The probability of success has been in the green zone throughout the past year.

6: Modelling output - base case

Projections of our funding level

At 31 March 2014 our funding level stood at 113 per cent ignoring the 'imminent insolvencies' mentioned above. The fact that we are 113 per cent funded does not mean that we have achieved our funding objective of being self-sufficient as self-sufficiency is measured in 2030 and there is a material chance that our funding level could decline before that time.

The following fan chart shows the history of our funding level as well as a projection beyond 2014. As mentioned above, it assumes no change to levy or investment strategy in scenarios where the funding level is high or low. This is because the model is used to inform current strategy rather than predict future strategy.
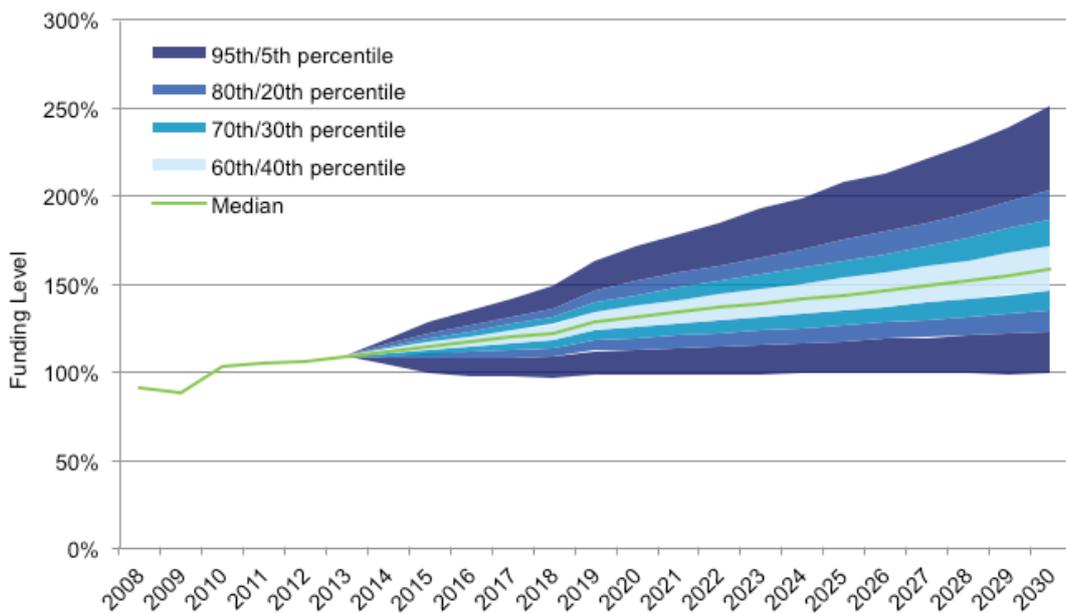

Chart 6.2 History and projection of PPF's funding level

Projections of claims

One of the main factors that could lead to a decline in funding, which is largely outside of our control, is the level of claims being made on the PPF in future years. The following fan chart, taken from our base case, shows the cumulative deficit of schemes that make a claim on the PPF, measured at the point at which they enter the PPF.
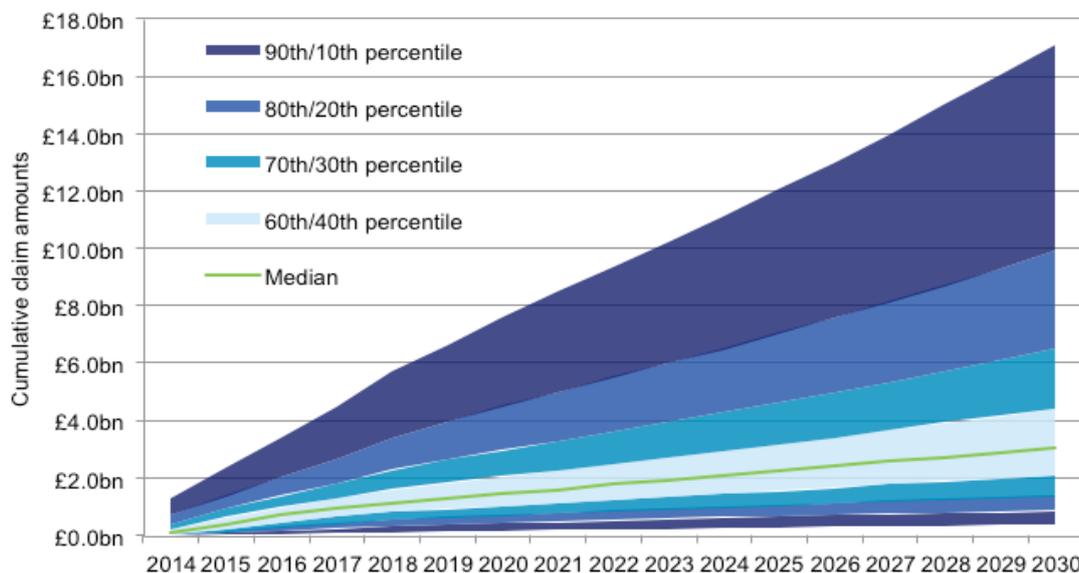

Chart 6.3: Cumulative deficits of schemes entering the PPF from 31 March 2014

6: Modelling output - base case

The projected size of pension scheme deficits and the underlying trend within our base case that deficits will decrease during our funding period to 2030 is a key determinant in the future PPF claims experience. It is therefore important to assess alternatives to these base case assumptions and test the robustness of the PPF's funding to adverse economic outcomes. To assess this, we have carried out various stress tests in which we adjust the assumptions from our base case to reflect different possible views of the future. We describe three such stress tests in section 8.

Projections of levy

PPF levies are for the most part risk-based, in the sense that they depend explicitly on the size of schemes' deficits and the strength of sponsoring employers. We would therefore expect that as schemes repair their funding deficits the PPF levy will reduce both in absolute terms and as a percentage of their liabilities.

The following chart shows how the levy is projected to change as a percentage of protected schemes' PPF liabilities in future years.
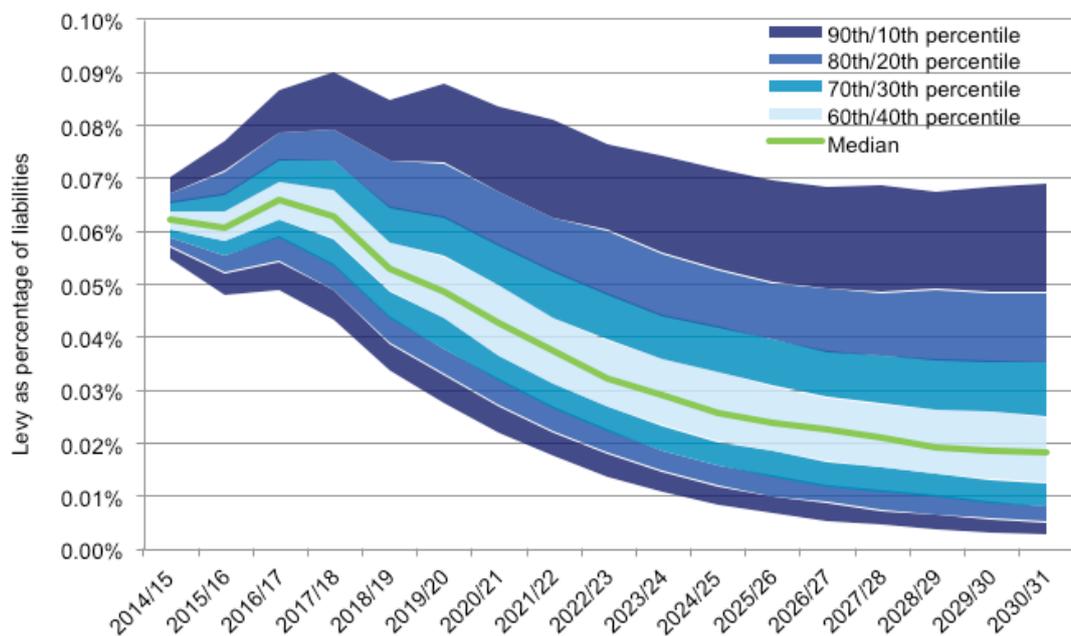

Chart 6.4: Levy as proportion of scheme liabilities

In our model we assume that the formula underlying the levy calculation is unchanged over time, other than in circumstances where legislative limits would be breached. Therefore the shape of the above chart is a function of:

- in the long term, schemes repairing their deficits and thereby reducing their levies (and, in some cases, buying out and leaving the eligible universe) and

- in the short term the fact that the levy is calculated using a "five year average" deficit, whereas the PPF liabilities are calculated on prevailing yields. When a "good" year falls out of the calculation and is replaced by a worse year, the levy rises proportionately. For example we are expecting interest rates to rise in the short to medium term, which will cause liabilities to fall. The averaging means this will impact levies less quickly than PPF liabilities, which has the effect of pushing up the ratio during the rise period.

7: Sensitivity of base case

This section considers how the model's output changes in response to changes in certain key assumptions.

The modelling output has been tested for sensitivity to an extensive range of modelling assumptions. A selection of the more significant sensitivity tests is shown below. These sensitivities are broadly unchanged from their 31 March 2013 levels as described in the October 2013 Funding Strategy document. We have introduced three new sensitivities this year to test two key assumptions used in the model – the longevity assumption, and the difference between the CPI and RPI measures of inflation. We have also added a more extreme sensitivity on asset returns.

Table 7.1: results of sensitivity tests

Assumption	Probability of meeting funding objective	Downside risk
Base case	90%	£4 bn
Initial PPF funding reduced by 10 percentage points	-3%	£+3 bn
Reduction in asset returns of 0.25% pa (excluding cash and government bonds)	-2%	£+1 bn
Scheme funding levels 10% lower	-3%	£+4 bn
Recovery plans 5 years longer	-1%	£+1 bn
Scheme Technical Provisions reduced by 10% (relative to S179 basis)	-3%	£+2 bn
Sponsor insolvency probabilities increased by 20%	-2%	£+2 bn
PPF levies lower by 10%	-1%	£<+1 bn
Schemes do not close to new accruals	-1%	£+1 bn
Longevity stress (reduce each qx by 10%)	-1%	£+1 bn
No market in CPI instruments emerges.	-2%	£+2 bn
Assumed difference between RPI and CPI widens (1.1% to 1.5%)	+3%	£-2 bn
Assumed difference between RPI and CPI narrows (1.1% to 0.4%)	-6%	£+5 bn
No risk margin in our funding target (i.e. we aim for 100% funding rather than 110%)	+5%	No change

The eleventh run in the above table, no emergence of CPI, has the following impacts:

- we have a mismatch between liabilities (CPI-linked) and our investment hedge (RPI-linked) leading to volatility in our funding

- we reflect the above mismatch by having a higher threshold for 'success' (111% instead of 110%)

7:   Sensitivity of base case

- the assumptions used for assessing entry to the PPF are stronger (as insurance companies price CPI-linked annuities higher) which leads to more claims on the PPF.

As described in section 6 there are two strategic levers – our investment policy and our levy – that we could pull should any of these sensitivities become our base case. For example, in the scenario where we reduced expectation of asset returns by 0.25% pa, with a 2% reduction in our probability of success, one option available to the Board would be to adopt a more risky investment strategy to make up the lost (expected) returns. This would come at the cost of a higher downside risk.

The sensitivities described above only look at one risk factor in isolation. However, it is also important to consider the impact of multiple concurrent risks. The overall impact can be greater than the simple sum of the individual impacts. Also, certain risks may be correlated, for example a reduction is asset returns is likely to lead to a decrease in scheme funding levels. It may well occur as a result of a difficult economic environment, which could also lead to a higher rate of sponsor insolvencies. In order to assess the potential impact of probable combinations of different risks, we also perform scenario testing, as described in section 8.

8: Scenario testing

This section considers how our results differ under three scenario tests – two more pessimistic and one more optimistic than our base case.

We have adopted a system of stress tests that help explore the possible outcomes should further evidence challenge our view as to the appropriate base case assumptions.

By looking at stresses to these assumptions we can explore the extent to which our funding strategy is sensitive to a change in the Board's best view of the future. It also reveals how resilient the PPF is to different economic shocks.

This year, we have adopted different stress scenarios from last year. The scenarios we have chosen are intended to reflect potential events which, based on the current economic and political conditions, are feasible.

Modelling methodology

We describe below the three stresses we have looked at, two pessimistic ones (labelled "Inflation shock" and "PRA anchor") and an optimistic one (labelled "Stronger near-term rebound").

Since last year, we have improved the way in which we model stress scenarios. In our modelling, we apply a stress for a period and assess the impact on the PPF and the pensions universe. Once the stress period has elapsed, we then model the evolution of the PPF and pensions universe as per our normal stochastic approach. The refinement we have introduced is to tailor the starting point of the post-stress projections to reflect the economic conditions produced by the stress scenario.

Inflation shock

This scenario contains two key elements – a rise in inflation due to geopolitical issues leading to higher global energy prices, immediately followed by a sharp rise in interest rates in an attempt to control this inflation.

In this scenario, returns on most asset classes fall sharply in the short term before rebounding a couple of years later Higher interest rates mean lower liabilities, offsetting the poor asset returns and leading to lower underfunding. In the short term, claims fall significantly, but quickly catch up with the base case scenario, and stay a little above it for the remainder of the period. The levy calculation includes smoothing and restrictions on how much it can change each year, so levies fall less quickly but for a long period, and settle below the base case. The higher claims (from the medium term) combined with lower levies and poorer asset returns push down the probability of success.

PRA anchor

The Prudential Regulation Authority ("PRA") requires insurers to conduct stress tests. In order to guide them in the calibration of these stress tests, it produces a scenario called the anchor scenario. Stress tests conducted by insurers should be similar in severity to this anchor scenario.

We have decided to use the PRA anchor scenario as part of our stress testing. While there are differences between the stress testing the PPF conducts and that required for insurers (for example the PPF considers the impact of stress tests on its long term funding position whereas insurers look at a one-year period), we believe this provides a useful benchmark for creating a stress test which is very pessimistic, but still plausible.

8: Scenario testing

The PRA anchor scenario is based on a new recession, triggered by re-intensification of euro-zone problems. A long period of economic contraction sees rises in unemployment, reduced available credit as banks struggle, and a dramatic increase in insolvencies combined with stock market falls.

In this scenario, persistently low yields mean high liabilities for pension schemes. This, coupled with poor asset returns, means schemes are very underfunded. In this scenario the large number of insolvencies leads to a large number of claims on the PPF.

Stronger near-term rebound
In this scenario, current fiscal issues in developed economies are resolved quickly, and robust global expansion follows, with the UK economy rebounding strongly. Markets perform well, inflation stays contained, yields increase slowly and there are few bankruptcies.

With the higher asset returns, scheme underfunding is lower. Insolvencies are also lower. Levies are lower than the baseline, but this is more than compensated by lower claims and high returns on the PPF portfolio, pushing the probability of success up.

Funding metrics
The following table gives the probability of success and downside risk under these two scenarios.

Table 8.1: result of stresses compared with base case

Assumption	Probability of meeting funding objective	Downside risk
Base case	90%	£4 bn
Stronger near-term rebound	+5%	£-5 bn
Inflation shock	-4%	£-2 bn
PRA anchor	-22%	£+15bn

In the pessimistic "Inflation shock" scenario, higher interest rates mean lower liabilities, offsetting the poor asset returns in the immediate aftermath of the inflation shock and leading to lower underfunding. In the short term, claims fall significantly, but quickly catch up with the base case scenario, and stay a little above it for the remaining of the period. The levy calculation includes smoothing and restrictions on how much it can change each year, so levies fall less quickly but for a long period, and settle below the base case. The higher claims (from the medium term) combined with lower levies and poorer asset returns push down the probability of success.

In the "PRA anchor" scenario the poor state of the economy leads to unprecedented numbers of claims, and claim amounts are very high due to poor scheme funding. Statutory restrictions on year-on-year increases to levy mean that increases in levy cannot offset the increase in claims. The poor asset returns also impact the PPF investments.

8: Scenario testing

It is perhaps reassuring to note, from the figures set out above, a reduced probability of success of 86 per cent in the pessimistic "Inflation shock" scenario. Whilst this is below the base case, it is still in the Green zone as defined in the PPF Board's RAG warning system. Were a similar pattern of events to occur, the Board could aim to restore the PPF's funding position through an increase in the amount of investment risk taken and/or an increase in the levy.

Nevertheless, the severe impact of the pessimistic "PRA anchor" scenario emphasises the fact that the PPF's funding objective is not impervious to future events. It is important that we remain alert to the possibility of such risks materialising.

The optimistic scenario has a higher probability of success than our base case. The purpose of investigating such scenarios is to test the circumstances in which the PPF runs the risk of building up excessive surplus. The Board has a balance to strike between the interests of levy payers and security for members, and were this particular stress to be adopted as the base case then the Board might consider reducing the PPF levy, or else moving to risk-free investment strategy sooner than currently anticipated.

The downside risk depends on the severity of extreme situations, and is normally higher when volatility is high. In the base case, volatility grows from the first year. In the stressed scenarios, the first five years are deterministic, so volatility develops only after that. This explains why the downside risk is smaller in the 'Inflation shock' scenario than in the base case.

When considering these or other stress scenarios, it is important to note that a strong funding position in the medium term is no guarantee that the funding objective will be met in the long term. Conversely, it is possible to recover from a poor funding position in the medium term, if conditions are favourable in the years immediately preceding the funding horizon. Indeed, our modelling illustrates that the path to the funding objective often contains highs and lows, rather than being a smooth trajectory. The following chart illustrates the funding position over time for a number of different economic scenarios, all of which reach a funding level of 110% in 2030.
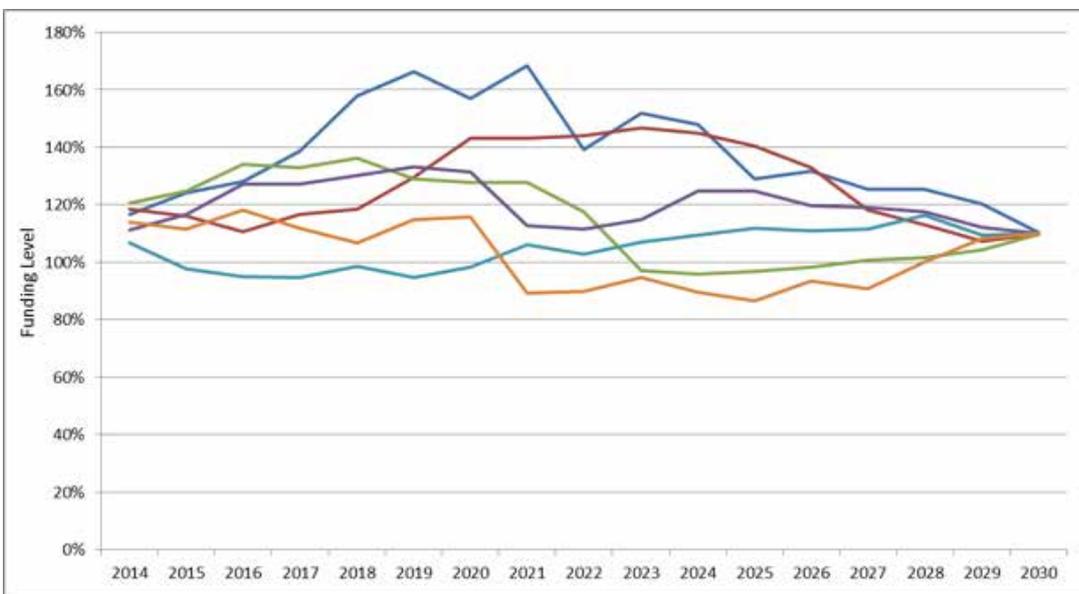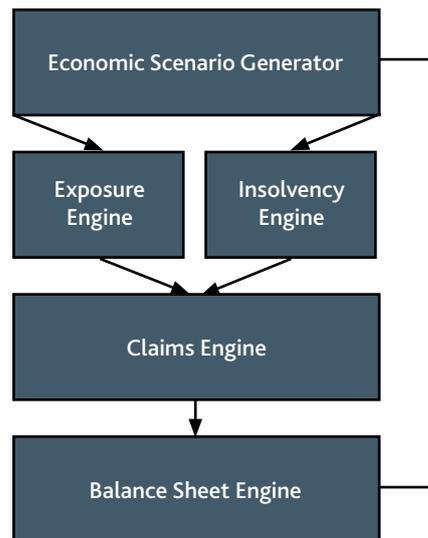

While we have quoted three stress tests in this paper, it should not be inferred that we believe these are particularly likely to occur, and nor have we based any strategic decisions on these outputs. They serve as a comfort check on the robustness of our funding.

A1: Further detail on modelling

This annex gives a detailed overview of the model and its various components.

1   Overview of our model

Our internal model consists of a series of component models, variously written in VBA, Excel or S+ as appropriate. Each engine covers a different feature of the calculation and are linked together in mimicry of the chain of events that ultimately lead to the PPF having assets or liabilities on its balance sheet. The following diagram shows how our model is built up from its constituent parts.

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        ┌─────────────────────────────────┐
        │   Economic Scenario Generator   │───┐
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             │                    │            │
             ▼                    ▼            │
      ┌────────────┐        ┌────────────┐     │
      │  Exposure  │        │ Insolvency │     │
      │   Engine   │        │   Engine   │     │
      └────────────┘        └────────────┘     │
             │                    │            │
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        ┌─────────────────────────────────┐   │
        │          Claims Engine          │   │
        └─────────────────────────────────┘   │
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        ┌─────────────────────────────────┐   │
        │       Balance Sheet Engine      │───┘
        └─────────────────────────────────┘
```

Economic Scenario Generator

The projection process begins in the Economic Scenario Generator with the production of a thousand economic scenarios. Each scenario is a set of projected paths for asset prices, interest rates, bond yields and inflation rates. These are obtained from an Economic Scenario Generator (ESG) provided by an external provider, Barrie and Hibbert, and adapted for use by the PPF.

Insolvency Engine

Insolvencies are modelled in the Insolvency Engine by assigning a credit rating to each company and using transition probabilities to model credit ratings changing over time. We have five hundred scenarios for credit risk, with the transition rates varying in each. Each such scenario is mapped to each of the economic scenarios (providing 500,000 scenarios in all).

Exposure Engine

Scheme funding is modelled in the Exposure Engine, which captures how assets move in response to asset returns and sponsor contributions and how schemes' PPF liabilities move in response to changes in nominal and real interest rates. We model benefits paid out to pensioners, and an allowance is made for accruals of new benefit and contributions both from employees and the sponsor.

Claims Engine

The output of the Insolvency Engine and Exposure Engine feed through into the Claims Engine which produces the distribution of claims on the Fund and projected levy from eligible schemes.

A1: Further detail on modelling

Balance Sheet Engine

These aggregate deficits then feed through into the Balance Sheet engine which projects the returns on the PPF's investments and investment hedge, and models levy collections, PPF expenses and the payment of PPF compensation. The result is a distribution of PPF balance sheet outcomes over a chosen horizon that takes account of all primary funding risks.

It is this last engine from which our key risk metrics – the probability of success and the downside risk – are derived. The former is the proportion of the 500,000 scenarios that lead to a PPF funding level of 110% or more in the year 2030. The latter is the greatest deficit which is experienced in the period to 2030 measured at the 10th percentile of all scenarios.

2   PPF Characteristics

Our funding horizon of 2030 rests on assumptions about the rate of scheme closure and the strength of recovery plans. Other things being equal, the slower the rate of scheme closure or the lower the deficit contributions, the later our funding horizon should be.

Initial PPF liabilities are calculated according to the PPF valuation basis. For a description of this basis, see the PPF Annual Report and Accounts 2013/14 which is being published alongside this report. As described in section 5 below, we include on our starting balance sheet (for long-term funding purposes) those schemes which we consider virtually certain to enter an assessment period in the near future.

We make the assumption that a market in CPI-linked investments will develop over the next decade and settle at a level where the market-implied rate of CPI is around 0.9 percentage points a year lower than the market-implied rate of RPI. This assumption affects the yields used in the projected PPF valuation and S143 bases from 2019.

The market-implied rate of inflation is the difference between yields on fixed interest investments and equivalent index-linked investments. The difference between market-implied RPI and CPI (of 0.9 percentage points) is slightly lower than our assumption for the real world gap between RPI and CPI because we assume market participants are willing to pay a larger 'inflation risk premium' for CPI than RPI.

The PPF investment allocation is modelled as set out in the Statement of Investment Principles. We make no adjustment for any de-risking that might be expected in practice, other than an implicit assumption in our valuation basis that by the year 2030 we will have a completely matched investment strategy with no expectation that we will outperform our liability benchmark.

Schemes' PPF levy payments are modelled taking into account the main features of the New Levy Framework. For this purpose we assume that the failure score used to calculate a scheme's levy rate will evolve in a manner consistent with the evolution of the sponsor's credit rating as described in section 5 below.

3   Economics and investment returns

The Economic Scenario Generator creates 1,000 scenarios for every relevant asset class. The main statistics of the distributions – the mean, the standard deviation, and the correlation with other asset classes – are taken from the standard calibration of the ESG (Barrie & Hibbert) and adjusted where the Board has a different view to B&H's central one. This does not mean that the Board believes B&H's views are incorrect, and indeed B&H are keen to stress that the standard calibration of their tool is not the most appropriate for all purposes.

The following table shows the adjustments the Board makes.

A1: Further detail on modelling

Assumption	Adjustment
Term Premium	The term premium is the additional return that an investor receives over and above a short-dated asset, required for investors to hold assets with a longer period to maturity. In this context we consider short-dated cash holdings to be the short-dated asset.

The standard calibration of the B&H ESG gives an excess return on government bonds, over the return on cash, that is different from that which we wish to use. We therefore adjust the ESG to give us a term premium of around 0.3 per cent.

It does not have a significant impact on our results. |
| **Scenarios of Consumer Prices Indexation** | We take our scenarios of RPI inflation from the standard B&H calibration. However, we construct our own scenarios for CPI inflation, based on the projections of property returns, interest rates and RPI.

As described above, we assume that a market in CPI-linked investments develops over the next decade. We construct scenarios for the real yield on CPI-linked investments by making adjustments to the RPI-linked real yield taken from the standard B&H calibration.

The adjustment is based on the current and assumed long term gap between RPI and CPI and an assumed risk premium to reflect investors' preferences for CPI and RPI linked instruments. |
| **Alternative assets** | We derive our own projections for hedge funds, commodities, private equity and unlisted infrastructure. We use standard statistical techniques to arrive at projections for these asset classes that have the desirable statistical properties (i.e. mean return, standard deviation and correlation with other asset classes). |

The interest rate projections are calibrated to bond yields observed in the market at the start of the projection. We use standard stochastic models of interest rates – the extended 2-Factor Black-Karasinski model for nominal interest rates, and the 2-Factor Vasicek model for real interest rates.

Both of these models assume mean reversion. In other words, while there is a random movement in interest rates over time and across the 1,000 scenarios, the assumption is that there is a tendency for the rates to move in the direction of a long-term average value. This is to be contrasted with our asset modelling, where we do not assume that markets revert to a long-term average. Projections of RPI inflation are calibrated to the difference between the yields on short-dated fixed interest and index-linked bonds at the start of the projection. As described in the table above, we calculate CPI based on RPI, with the long-term difference between the two measures being around 1.1 per cent.

The volume of insolvencies is assumed to exhibit a degree of correlation with equity market conditions. When equity markets deteriorate, sponsor insolvency rates generally move upward, and vice versa. So 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.

As described above, the economic scenarios form a set of projected paths for asset prices, bond yields, inflation and risk-free rates. In accordance with good practice, the PPF carries out stress testing. A stress test is similar to a sensitivity test (as described in section 7 of the main report) but one in which more than one of the parameters – or indeed all of the parameters – are varied from their base case levels. We illustrate three tests that we have investigated recently in section 8 of the main report.

A1: Further detail on modelling

4 Scheme and sponsor characteristics

For reporting purposes initial funding is taken for each scheme as its average between 1 April 2013 and 31 March 2014. We use a smoothed funding level to reduce the volatility of the funding metrics as reported each quarter. Since this might mask the true risk following a sharp rise or drop in funding, we also check that the figure does not deviate too far from an unsmoothed measure.

Schemes' contributions are determined by their recovery plans which target full funding on a statutory funding basis over a period of (currently) 9 years on average. We take this information from the Pensions Regulator based upon the most recently submitted funding plans. The statutory funding basis results in higher liabilities than the scheme's PPF liabilities – currently around 15 per cent higher on average – largely because PPF compensation is provided at a lower level than full scheme benefits.

We assume that schemes' current funding plans will weaken slightly at the next valuation (this has been the trend in recent years) but will then remain in place over the longer term, with any new emerging deficit being re-spread. This means that in a scenario without any significant adverse experience, deficits are entirely removed before 2030, with half of schemes completing their recovery plans within a decade.

Schemes are assumed to reduce the risk associated with their investment strategies over time. The proportion of scheme assets assumed to be invested in long-maturity bonds gradually rises from an initial 40 per cent to around 80 per cent in the long term.

As at the date of the most recent Purple book, 31 March 2013, only 14 per cent of schemes were open to new members, down from 35 per cent in 2006. Our base case assumption is that schemes close to new accruals of benefit over the next decade which, for simplicity of modelling, we treat as sudden closure in five years' time. This is not a particularly significant simplification in our view.

The rate of active member withdrawal is set at a constant 5 per cent a year. This is a simplification of reality in which members closer to retirement typically withdraw from service at a lower rate. We assume (for schemes open to new accrual) that there is a constant age profile over time.

We assume that no new DB schemes are set up that are eligible for PPF protection. We also explicitly model schemes as winding up if they have no active members and reach a given level of funding.

5 Sponsor solvency

For the large schemes we assess the initial creditworthiness of the sponsor(s) by looking up current credit ratings. For the smaller schemes we use the failure scores provided for levy purposes and map these to a hypothetical credit rating. We model credit ratings as changing over time, the probabilities of transition being provided by Barrie & Hibbert and reviewed within the PPF.

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 schemes they sponsor will be disproportionately high compared with the size of their operational balance sheet, making the sponsor covenant weak. This likely trend is not expressly captured in our modelling work.

For schemes that we consider are virtually certain to enter the PPF in the very near future but have not yet experienced an insolvency event we bring them onto the PPF balance sheet with immediate effect for the assessment of the long-term funding strategy position, if not for the Annual Report and Accounts which is more of a snapshot. For the March 2014 modelling we have allowed for the insolvency of a few schemes (for whom insolvency has now occurred) as well as a handful of other schemes some of which have not yet had an insolvency event.

6   Assurance and future development

Our internal model is subject to continual refinement and audit. KPMG carried out a review of the model in May 2012 based upon the information that we provided to them. The conclusion was that the model is fit for purpose although there are various developments and improvements that we are intending to make over the coming years.

There is a committee within the PPF that is responsible for ensuring that the model is kept up to date and monitors the implementation of model improvements. We maintain a model development list in order to continually refine the model's capabilities and ensure it remains up-to-date for changes both within the PPF and in the wider pensions universe. Over the past year, we have focussed on making changes which improve the efficiency and reliability of model runs. We have not made any major changes to the methodology of the model.