PPF Long-Term Funding Strategy Update

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2: Foreword

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.

Since the end of the financial crisis, economic conditions have continued to improve, and 2014/15 was another relatively benign year in terms of the number and amount of claims we have received. Nevertheless, we have had three large claims amount during the year. Claims experience, together with both our good investment performance and our continued hedging of interest and inflation risk through our extensive LDI programme, have caused our funding level to increase further to 115 per cent.

However, as interest rates in the UK have continued to come down, the liabilities of the schemes we protect have grown from already high levels. Schemes' investment returns have not sufficiently offset this, so we have seen an overall fall in scheme funding. In addition there has been some deterioration in the credit quality of certain employers. As a result, our probability of success that we calculate using our stochastic 'Long Term Risk Model' showed a decrease from 90 per cent at 31 March 2014 to 88 per cent at 31 March 2015.

This shows that we need to remain vigilant to the risks that the universe of DB schemes present to us. Through our PPF 7800 index we continue to monitor scheme underfunding. This reached a historically high level during the first quarter of 2015, with significant volatility from month to month. We have also developed a new stress scenario to model the impact of several simultaneous insolvency events leading to large unexpected claims on the PPF. While we ensure that our modelling covers a wide range of potential futures, 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.

During the year we updated our model to incorporate a change in the PPF's investment strategy to invest in long-dated illiquid assets. We also updated several assumptions behind the model such as the non-emergence of a liquid market in CPI hedging products, and recognising the differences between the PPF's funding basis and the s179 basis. These changes notwithstanding, the Board's view is that both the funding horizon of 2030 and the 10 per cent self-sufficiency margin remain appropriate.

In summary, we believe our funding strategy remains fit for purpose, 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.

Hans den Boer

Chief Risk Officer July 2015

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 period that it is due. 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. To reflect the importance the PPF places on implementation of best practice as it grows we appointed our first Chief Risk Officer (CRO), Hans den Boer, in February 2015. Hans has a wealth of experience in senior risk management roles around the world and will oversee all of the PPF's risk functions and become a member of the Executive Committee.

Our approach to the PPF's funding strategy however remains as in previous years, providing the impetus for a 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 insurance companies in the European Union are required to identify risks to which they are exposed and consider the capital that should be held against them the PPF is not required to hold capital. However, we carry out a process to determine our funding margin which can be viewed as analogous to this in that it is intended to cover the cost of unexpected risks. In the longer term the fundamental question we need to address remains 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 restrict inflation-linked increases to compensation or to ask government to reduce the level of compensation payments, however it remains the case that these actions 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. Our view remains that 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. It remains the case that 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; we will be 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, we continue to expect 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. Longevity risk will remain as long as the PPF is responsible for paying compensation. There will remain the risk that some failure in the PPF's risk management framework leads to a material financial loss. Also there is the risk that there may not be suitable investment options available with which we can effectively hedge our liabilities, leaving a mis-matching risk. 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, and can attain that funding level at our funding horizon, we should be self-sufficient.

What is self-sufficiency?

The assumptions, apart from one[1], 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 liabilities we would have a fifty per cent chance of being able to meet compensation payments in full. We consider this probability insufficiently high. To increase the chances of providing compensation payments in full we have added a margin to protect ourselves against some of the uncertainties to which we will be exposed.

The Board chose the funding horizon as the time at which future claims on the PPF were expected to be small relative to the size of the PPF itself. While there is no formal definition of 'small' in this context our modelling has shown that expected claims at the 90th percentile to decrease to less than 2 per cent of the PPF's liabilities from around the year 2025. The Board therefore chose 2030 to be a suitable funding horizon.

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 funding horizon) in excess of PPF levies. The margin was calculated such that at the assumed funding horizon it would be sufficient in 90 per cent of modelled scenarios to cover these risks and thus provide compensation payments in full.

Developments since the funding horizon and margin were set have led the Board to consider whether the original horizon and margin remain appropriate. Our commitment to best risk management practice led to the introduction of operational risk in the funding margin. This is 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).

Our fundamental views of the future have also been explored. Over the past year we have reconsidered our assumption that, eventually, a market in CPI-linked instruments will develop. Given current industry opinion on the emergence of such a market, the Board has chosen to assume that no deep or liquid market in CPI-linked instruments will in fact develop.

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1. The exceptional assumption is that used for CPI increases, which is a market-consistent assumption rather than a best estimate assumption.

3: Review of the funding objective

This assumption of non-emergence introduces a further risk into the margin. Our inflation-linked liabilities are linked to CPI but we now assume we will be only able to invest in assets that are linked to RPI. There is thus a risk that these two measures of inflation do not move in tandem so our RPI-linked assets do not exactly track our CPI-linked liabilities.

Following the latest review of the PPF's funding strategy the Board decided that both the funding horizon of 2030 and the 10 per cent self-sufficiency margin still remained appropriate with a 90 per cent level of confidence. It is the Board's view that a 90 per cent certainty of being able to provide members' compensation payments in full strikes 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 around 30 per cent.

As part of our risk management cycle, we will continue to consider whether the risks allowed for in the margin remain appropriate. We are already aware that there are a number of other areas which may lead the Board to review the margin in future. For example, over the past year the Statement of Investment Principles ('SIP') has been updated to allow investment in long-term, illiquid assets with hedging properties ('HAIL' assets) and the PPF has started transitioning to this strategy. Holding such long-term assets will result in an asset allocation at and beyond the funding horizon that does not perfectly match our liabilities at that time. We will consider including investment risk in our self-sufficiency risk margin when we have greater clarity on what our asset allocation may look like at and beyond the funding horizon.

Similarly there are a number of risks which have been considered and which we have chosen to 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 period. By the time we reach our funding horizon, far fewer asset transitions are expected to take place so this risk becomes minimal.

How do we measure progress against our funding objective?

We use two key 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 at the funding horizon 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 on that journey. It is calculated such that in 10 per cent of modelled scenarios our deficit reaches at least that level at some point before we reach our funding horizon.

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. Three such stress tests are described in section 8.

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 Act 2013 introduced a new requirement for the Pensions Regulator to "support scheme funding arrangements that are compatible with sustainable growth for a sponsoring employer" when exercising its duties. Following consultation, the Regulator published its revised funding code and strategy shortly before publication of last year's Update. The consequences of the Regulator integrating this objective into the way it regulates funding remains unclear, and we believe it would be premature for us to anticipate the extent of the impact of a revised code of practice for defined benefit scheme funding. We continue to maintain a close watch on emerging trends in scheme funding and recovery plans, and hold regular risk management meetings with the Pensions Regulator to discuss our findings and other areas of risk to explore further.

The 2014 Budget changes

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 have had 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.

Following subsequent consultation the Government announced that it would continue to permit transfers from DB schemes to DC. There is potential for this to result in a significant shift in assets and liabilities away from DB schemes as people nearing retirement seek greater flexibility. This may have consequences for the risk profile of PPF and we continue to monitor the implications of these transfers.

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 scheme members this change could impact the predicted number of claims on the PPF. The full consequences of these changes will take time to emerge.

Defined Ambition

In 2014 the Government stated its aims 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 2014 that it would introduce a legislative framework defining for first time the terms defined benefit, defined contribution and defined ambition (or "shared risk"). The Pensions Act 2015 came into force in March 2015 and sets out the high level framework. Secondary legislation is required to set out the details. At this stage it is not clear whether schemes of this type will be established and their eligibility for the PPF, so the potential impact on the PPF remains unknown.

Central clearance of OTC derivatives

As part of its LDI strategy the PPF makes extensive use of swap contracts to protect itself against unexpected changes in interest rates and inflation. Such derivative instruments are affected by the European Market Infrastructure Regulation (EMIR). 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 financial parties with swap contracts to commit higher quality collateral such as cash and/or government bonds. These collateral requirements may have an impact upon the PPF's liquidity provisions and expected investment performance going forward.

4: Summary of the year's events

The details of the legislation remain under development particularly for pension funds. This is largely the rationale for the European Commission recommending a further two year exemption for pension schemes to meet EMIR central clearing requirements for certain assets classes (the extension is from August 2015 to August 2017). As we highlighted in 2014, the EMIR proposals potentially have serious consequences for the PPF. We have since taken steps towards operational readiness by procuring the required clearing members and a central counterparty. In 2015 we will take further steps to implement actual operational capacity required to deal with this change.

Changes to the PPF's investment strategy

In 2014 the PPF decided to change its investment strategy, details of which can be found in our revised SIP published in July 2014. The main change is to increase the overall portfolio allocation to illiquid assets to 12.5 per cent. The allocation to equities and global bonds has also reduced somewhat, while the allocation to gilts and cash and alternatives has increased.

Illiquid assets are assets which cannot readily be sold for cash, and all other things being equal, should offer a higher return as a result than very liquid assets; 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 risk 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/or 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 a move away from this assumption may affect our funding horizon, funding margin and definition of self-sufficiency.

Markets and their impact on scheme funding

The UK economy has grown steadily since 2013 with GDP in the first quarter of 2015 some 4 per cent above the pre-recession peak. As a result of robust growth and low interest rates, insolvencies in the economy as a whole have been falling. The number of claims on the PPF has dropped sharply.

However, scheme funding has deteriorated markedly. At the end of the first quarter of 2015, the aggregate funding ratio (assets divided by s179 liabilities) of PPF eligible schemes had fallen to 81 per cent from 97 per cent a year earlier. The worsening reflected a large increase in the value of liabilities, the result of falling gilt yields, which more than offset the rise in the value of assets because of rising equity markets. The fall in gilt yields largely reflected overseas developments such as euro-area weakness.

The Purple Book 2014 gave some indications that the pace of de-risking on the part of companies may have eased. For example, the percentage of open schemes fell only slightly in 2014 to 13%, having been unchanged between 2012 and 2013. There are also indications that some of the major asset allocation trends may be tailing off, for example the switch from equities to bonds.
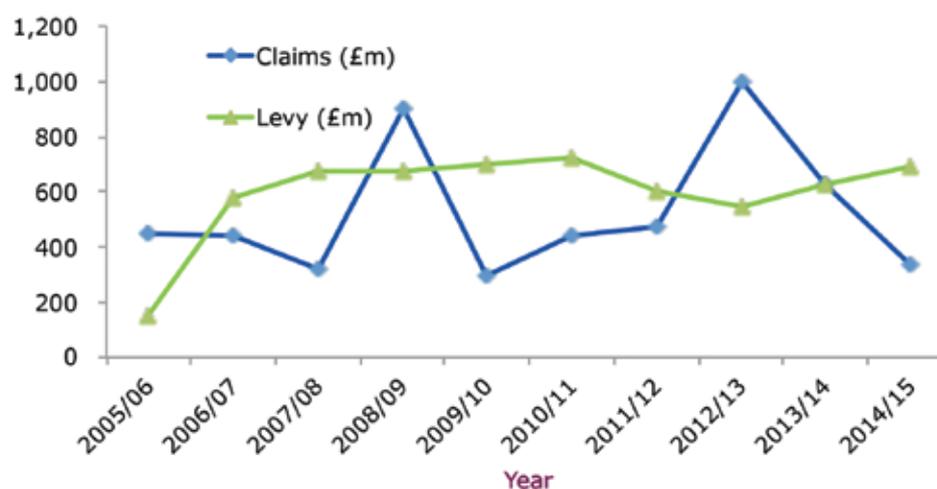
Claims on the PPF

By 'claims' we mean the pension deficits that are brought into the PPF when scheme sponsors suffer insolvency.

4: Summary of the year's events

In the year to 31 March 2015 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, continuing the trends of claims of the previous year. Nevertheless, we have had several large (liabilities over £50 million) and one significant (liabilities over £250 million) claim amount during the year. Also, as noted previously, the funding level of the PPF7800 has worsened over the year. This has led to larger claim amounts.

The following chart shows our current view of the claims made on the PPF taking into account recoveries, as well as levy collections expected as published in the Levy Determination, since our inception.

Chart 4.1: History of claims and levy

Our view remains unchanged from that of last year; 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

During the last triennium (commencing 1 April 2012) 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.

The second levy triennium commenced on 1 April 2015 with the main change in approach being the introduction of a PPF-specific insolvency score for sponsoring employers, provided by Experian.

The Board has set a lower levy estimate of £635 million for 2015/16 with reduced levy parameters as a result.

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 publication of our Funding Strategy Update in July 2014, and these are described below.

Updates to the investment strategy

During the year, the PPF moved to a new investment strategy. The strategic asset allocation now includes a 12.5 per cent allocation in long-term, illiquid assets with hedging properties ('HAIL' assets), with a reduction to other asset classes as a result. This has been reflected in the model by updating both the asset allocation and including expected return and volatility assumptions for the assets that fall into the HAIL category.

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 recovery experience from schemes in assessment, we have reduced the recovery rate from 4.5 per cent to 3.5 per cent of a scheme's section 75 debt amount.

Development of a liquid market in CPI instruments

One of our key assumptions has been that a market will emerge in CPI-linked instruments. This would enable us to better hedge our inflation-linked 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. However, many market participants have expressed doubts as to how quickly a market will emerge, if one emerges at all. We have therefore changed our assumption to one where no liquid market in CPI-linked instruments emerges and where we continue to use RPI-linked instruments to hedge our inflation-linked liabilities.

Recognition of differences between PPF funding basis and s179 basis

Schemes are assessed for entry into the PPF through a s143 valuation. The financial and demographic assumptions for the PPF funding basis are set by the Appointed Actuary in conjunction with the Board of the PPF. A s179 valuation uses the same discount rates as a s143 valuation but has a simplified mortality assumption. In our modelling we use the s179 basis to determine whether the scheme of an insolvent employer enters the PPF.

We have previously assumed that the basis used to determine whether a scheme would enter the PPF (the s179 basis for modelling purposes) and the basis used to determine the size of any claim (the PPF funding basis) were closely aligned, and historically this has been the case. To simplify the modelling process the s179 basis was used for both calculations.

Over time we have witnessed a divergence of the funding basis from the s179 basis. We have therefore updated our modelling assumptions to calculate the size of a claim using the funding basis, recognising that the two bases are no longer equivalent.

5:   Updated assumptions

Changes in profiles of schemes

We have updated our assumptions to reflect more up-to-date information on the age profiles within, and pension increases provided by, schemes. We have also increased the level of granularity of our modelling of the pension increases provided.

Longevity

We have updated our longevity projections to allow for the latest longevity data.

Industry sector correlations

The LTRM models the insolvencies of sponsoring employers in order to project future claims on the PPF. One of the key areas of modelling is the link between insolvency rates and the state of the economy, and how insolvency rates differ between different industries. As the LTRM categorises sponsoring employers into 15 industry sectors, this aspect is captured by specifying:

- the correlations in industry-level insolvency risk between the 15 different industry sectors (inter-sector correlation);
- the proportion of industry-level insolvency risk which explains total sponsoring employer insolvency risk (intra-sector correlation); and
- the correlations of industry-level insolvency risk to UK Equity returns (which is used as a proxy for the health of the economy).

We have updated our assumptions for these three correlations based on analysis of more up-to-date data.

Impact

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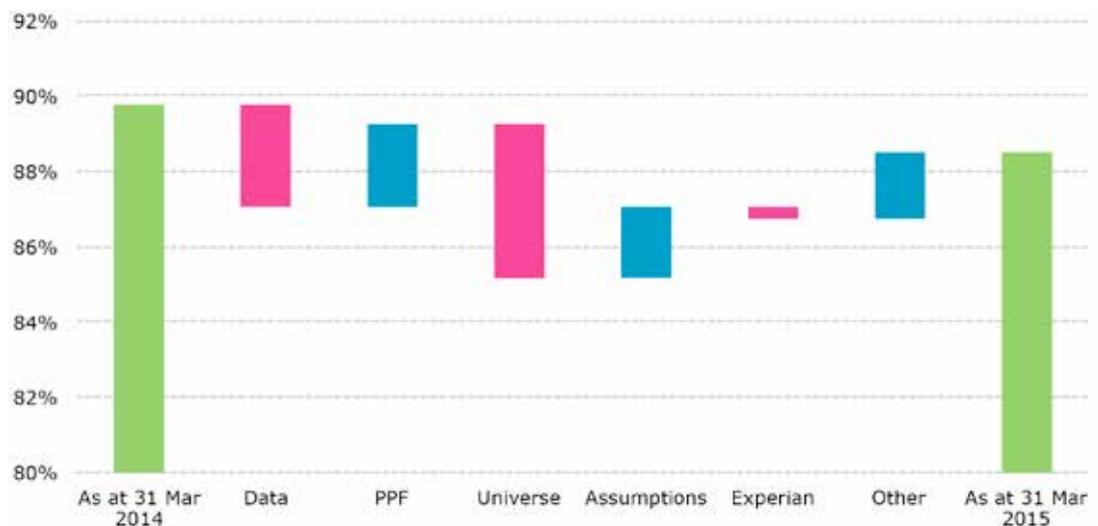
6: Modelling output - base case

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 decreased from 90 per cent at 31 March 2014 to 88 per cent at to 31 March 2015. The corresponding downside risk statistic is correspondingly higher, at £5 billion, compared with £4 billion a year earlier.

The reason for the two per cent decrease in the probability of success is mostly attributable to the combination of an increase in employer insolvency probabilities over the year, causing a decrease in the probability of success of around three per cent, and a decrease in the funding level of the schemes that they sponsor, causing a decrease in the probability of success of around four per cent. These decreases were partially offset by changes to the assumptions (both changes in the financial markets and assumptions used elsewhere in the LTRM) which caused an increase in the probability of success of around two per cent, and an improvement to the PPF's own funding position, causing a further increase in the probability of success of around two per cent.

The following chart reconciles the probability of success at 31 March 2015 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
2014	This is the probability of success at 31 March 2014, which was 90 per cent.
Data	This allows for the change in data over the year, including schemes' valuations, recovery plans and employer credit ratings.
PPF	This allows for the changes in the PPF's funding level over the year. The funding level, including schemes that are virtually certain to come into an assessment period in the near future, has improved from 107 per cent as at 31 March 2014 to 114 per cent as at 31 March 2015. For reference, the funding level excluding the near-certain insolvencies were 113 per cent as at 31 March 2014 and 115 per cent as at 31 March 2015.
Universe	This is the effect of scheme funding changing over the year. The funding level of the universe has decreased from 97 per cent as at 31 March 2014 to 81 per cent as at 31 March 2015
Assumptions	This is the net effect of the various assumption changes discussed in section 5 and changes in financial markets. While the impact of current and expected future market conditions had a small negative impact this was more than offset by the impact of the assumption changes.
Experian	This is the impact of moving to a different provider of insolvency probabilities of schemes.
Other	This includes improvements to the modelling, and all other factors not accounted for above
2015	This is the probability of success at 31 March 2015, which is 88 per cent.

Are we happy with an 88 per cent chance of success?

The probability of success has fallen to 88 per cent from its previous level of 90 per cent in 2014. As noted above, this is predominantly due to a marked deterioration in scheme funding levels over the year, combined with an increase in average employer insolvency probabilities. Nevertheless, we continue to believe that we are on track to achieve our funding strategy over the long term. 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. Though the probability of success has fallen, it has remained in the green zone throughout the past year.

It should also be noted that the figure of 88 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. Either of these levers could be used to improve our chance of success were the Board to decide they were not happy with the current probability; neither has been used in this way in the past.

A third lever available to the Board is to restrict inflation-linked increases to compensation or to ask government to reduce the level of PPF compensation payable. However, these actions are 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 our funding horizon 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.

Ultimately we would like the probability of success to converge towards 100 per cent by the funding horizon. However, to achieve such a level of comfort today, with 15 years of uncertainty ahead of us, 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.

Projections of our funding level

At 31 March 2015 our funding level stood at 115 per cent ignoring the 'imminent insolvencies' mentioned above. The fact that we are 115 per cent funded does not mean that we have achieved our funding objective of being self-sufficient as self-sufficiency is measured at the funding horizon 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 2015. As mentioned above, the assumption is that the PPF does not respond to changing circumstances and so there is 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**
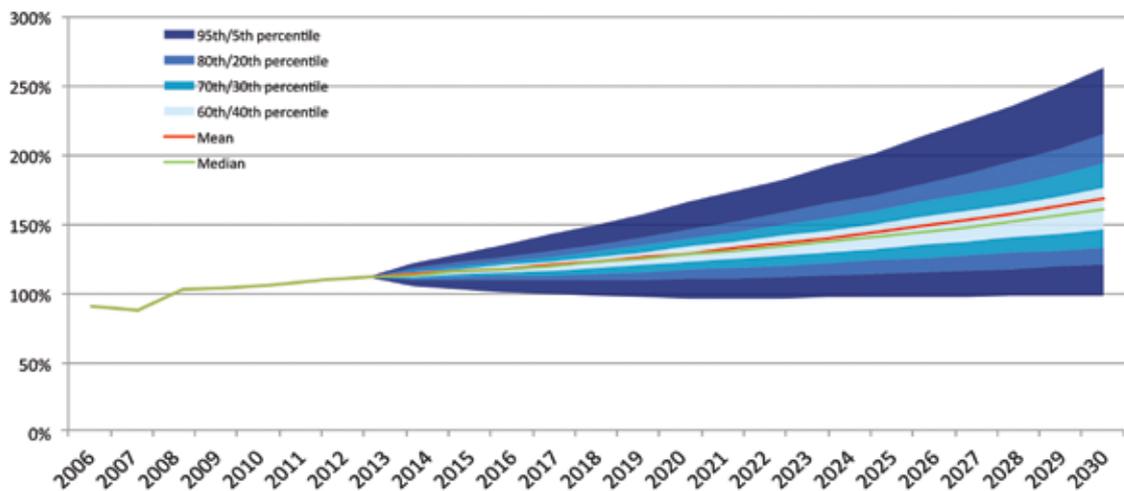
6:   Modelling output - base case

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 historic experience and 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: History and projection of cumulative deficits of schemes entering the PPF
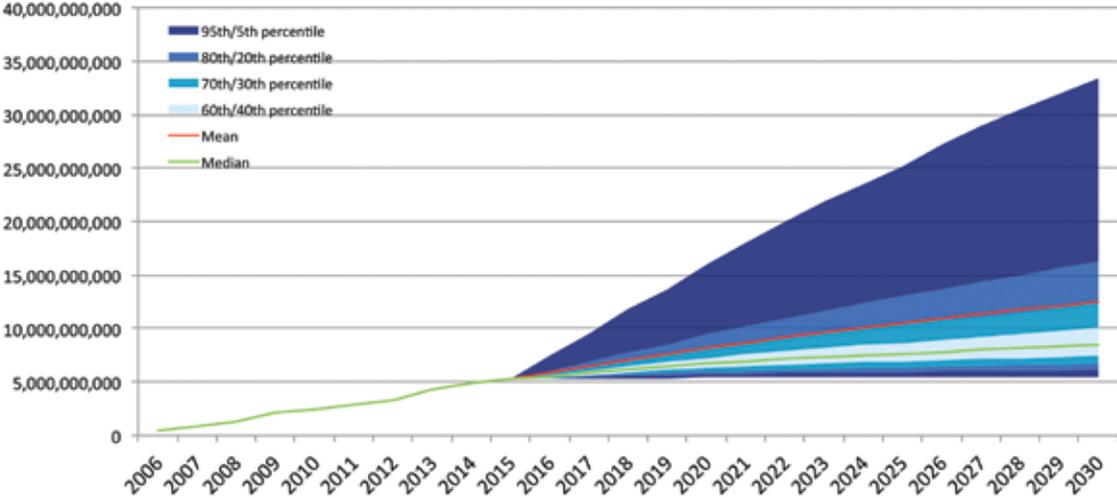
The projected size of pension scheme deficits and the underlying trend within our base case that deficits will decrease during our funding period to 2030 is a key determinant in the future claims experience of the PPF. It is therefore important to assess alternatives to these base case assumptions and 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 has changed as a percentage of protected schemes' PPF liabilities to 31 March 2015, and how it is projected to change in future years.

Chart 6.4: History and projection of levy as proportion of scheme liabilities
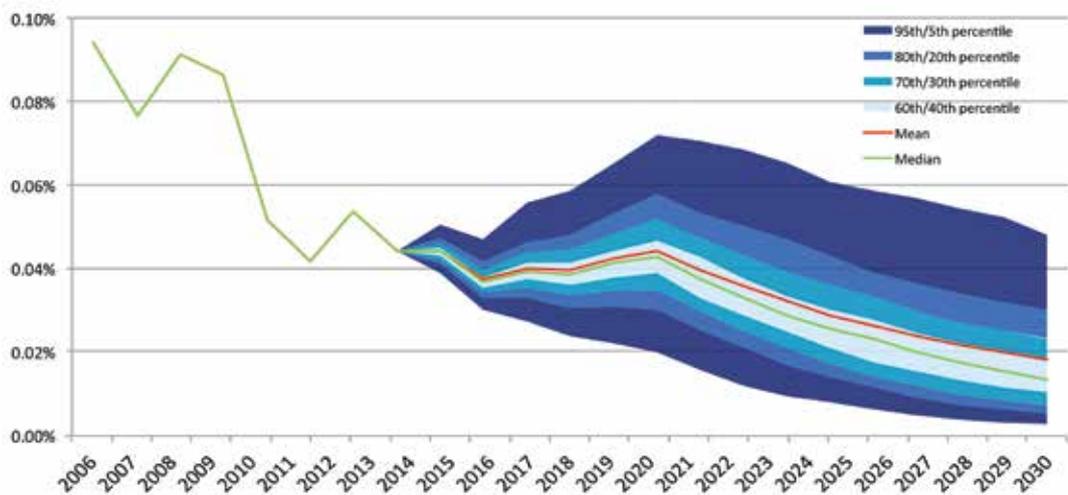
In our model we assume that the formula underlying the levy calculation is unchanged over time, other than in circumstances where legislative limits would be breached. Therefore the shape of the above chart is a function of:

- in the long term, schemes repairing their deficits and thereby reducing their levies and
- in 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.
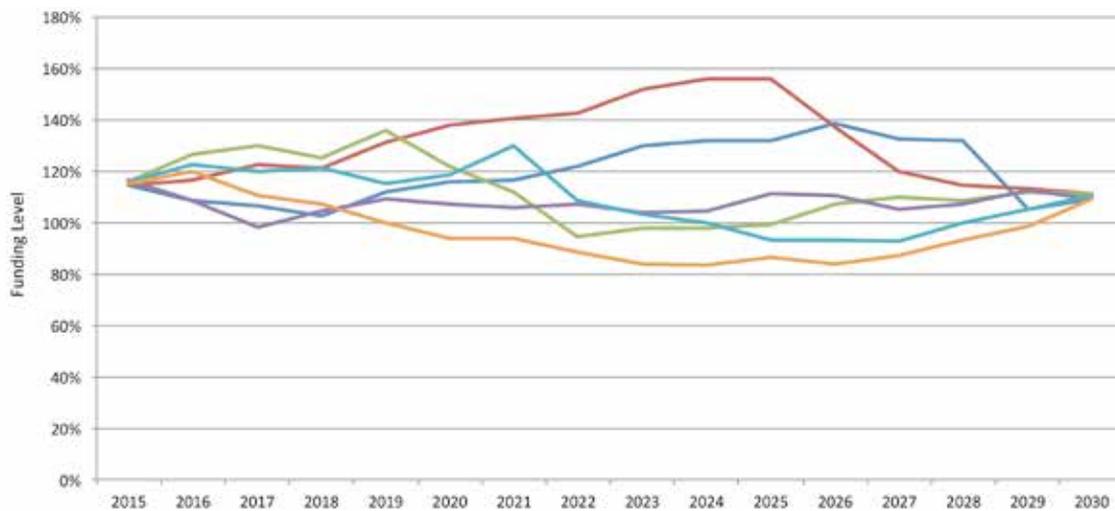
6: Modelling output - base case

Pathways to achieving success

The projections of levy and claims described above, combined with the evolution of the PPF's existing assets and liabilities, combine to give a range of outcomes for the PPF's funding level at the funding horizon. It is this distribution of funding levels at the funding horizon which determines our probability of success. The pathway to the funding horizon can, however, vary greatly from scenario to scenario.

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 per cent at our funding horizon.

Chart 6.5: Example pathways to achieving our funding target

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 2014 levels as described in the July 2014 Funding Strategy document.

We have introduced two new sensitivities this year; a sensitivity to show how the size of the PPF impacts our resilience, and a more extreme sensitivity on asset returns.

We have also changed three of the sensitivities conducted last year. As one of our main risks is from the absolute size of claims we have changed one sensitivity to look at increasing scheme deficits rather than decreasing scheme funding levels. We have also increased the severity of the longevity sensitivity to be in line with the standard formula approach used for Solvency II. Finally, we have provided a sensitivity that shows the link between the certainty provided to members and the cost to levy payers were there the need for an increased funding margin.

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 per cent a year, with a 2 per cent 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. This 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.

7:   Sensitivity of base case

Table 7.1: results of sensitivity tests

Assumption	Probability of meeting funding objective	Downside risk
Base case	88%	£5 bn
Initial PPF funding reduced by 10 percentage points	-3%	£+3 bn
Size of the PPF increases by 20% (assets and liabilities)	+1%	£-1 bn
Reduction in asset returns of 0.25% pa (excluding cash and government bonds)	-2%	£+1 bn
Reduction in asset returns of 1.00% pa (excluding cash and government bonds)	-8%	£+4 bn
Scheme deficits (surpluses) increase (reduce) by 50%	-6%	£+5 bn
Recovery plans 5 years longer	-1%	£+1 bn
Scheme Technical Provisions reduced by 10% (relative to S179 basis)	-4%	£+3 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 sensitivity (probability of death in any single year (qx) reduced by 20%)	-2%	£+2 bn
Assumed difference between RPI and CPI widens (1.1% to 1.5%)	+2%	£-1 bn
Assumed difference between RPI and CPI narrows (1.1% to 0.4%)	-4%	£+2 bn
Increase certainty of being able to provide compensation payments from 2030 from 90% to 95%	Increase in funding margin required is 5%	

8: Scenario testing

This section considers how our results differ under three scenarios

In an improvement to our risk management framework, for the July 2014 Funding Strategy document we 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 somewhat 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, one pessimistic scenario (labelled "Large unexpected claims"), one optimistic scenario (labelled "Strong near-term growth"), and one scenario consistent with that published by the PRA as part of guidance for insurers under Solvency II (labelled "PRA anchor").

In our modelling, for the PRA anchor and strong near-term growth, 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. We tailor the starting point of the post-stress projections to reflect the economic conditions produced by the stress scenario.

We have introduced two improvements to our stress testing methodology for this Update. The first is to reduce apparent volatility between the base case and the PRA anchor and strong near-term growth scenarios where volatility grows from year five onwards. Rather than compare these scenarios to a base case where the volatility grows from the first year we have carried out an a modified base case run where median values of economic variables are taken for the first five years giving a shortened stochastic period comparable to those in the stressed scenarios.

Secondly, for the PRA anchor scenario we also 'overlay' the economic stresses with changes to our assumptions on companies' ability and willingness to contribute into their schemes. We assume that companies will take five years longer to clear their deficits. For the other scenarios we assume the repayment period remains unchanged.

Large unexpected claims

In this scenario there are a number of unexpected claims at 31 March 2015 from a handful of schemes with very large deficits, all of which operate in the same industry. This results in recognition of a net claim of some £6 billion on the balance sheet. The size of the PPF's liabilities grows from around £24 billion to nearly £45 billion whilst the PPF's funding level falls to around 90 per cent. Following these claims the scenario proceeds as per the baseline, with the exception of some associated changes to the credit ratings of other companies in the same industry sector.

This scenario illustrates how resilient the PPF is to the risk of claims of this magnitude and the importance for us to monitor, in collaboration with the Pensions Regulator, schemes that present such a risk.

8: Scenario testing

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.

This year we have decided to again 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 shorter-term view), we believe this provides a useful benchmark for creating a stress which is very economically disruptive, but still plausible.

The 2014 PRA anchor scenario is based on concerns over the sustainability of the U.K.'s internal and external debt positions. This leads to a rapid re-assessment of the prospects for the U.K. economy. This is associated with a devaluation of sterling, and inflationary pressures build up. A tightening of monetary policy exacerbates the situation with contractions in consumption and business investment, combined with a housing market crash.

Stronger near-term growth

In this scenario, the U.K. economy receives a boost from stronger than expected U.S. growth and easing uncertainty over Europe's fiscal and financial concerns. GDP increases faster than expected accompanied by falling unemployment. Though commercial lending rates also rise more quickly than anticipated they remain low enough to support continued investment financing. Markets perform well, inflation stays contained, yields increase slowly and there are few bankruptcies.

With the higher asset returns, scheme underfunding is lower. Insolvency rates are largely unchanged throughout the deterministic period. Levies are lower than the base case, but this is more than compensated by lower claims and high returns on the PPF portfolio, pushing the probability of success up.

We have selected this scenario such that there is around a 10 per cent probability that the economy will perform better than this scenario

Funding metrics

The following table gives the probability of success and downside risk under these three scenarios.

Table 8.1: result of stresses compared with base case

Assumption	Probability of meeting funding objective	Downside risk
Base case	88%	£5 bn
Large unexpected claims	-8%	£+5 bn
PRA anchor	+2%	£+2 bn
Strong near-term growth	+7%	£-1bn

8:   Scenario testing

In the large unexpected claims scenario, the probability of success falls dramatically by eight per cent. In reality we would expect that the impact could be worse than this – there could be further falls in funding at the beginning of the assessment period before we direct the insolvent schemes' investment strategies, and also realistically we would not be able to hedge all the liabilities at once but would need to phase this over time.

The large unexpected claims 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.

In the "PRA anchor" scenario, poor asset returns are more than offset by a significant reduction in liabilities caused by large rises in gilt yields. Although the number of insolvencies increases dramatically, many affected schemes do not enter the PPF because they are overfunded on a s143 basis, and instead buy out with insurers. Claim amounts therefore are low.

The optimistic, strong near-term growth 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.

While we have quoted three stress tests in this paper, it should not be inferred that we believe these scenarios 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 strategy.

A1: Further detail on modelling

This annex gives an 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 calculations 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.
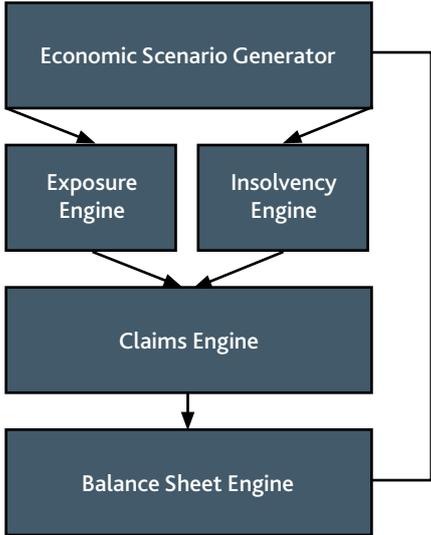
Economic Scenario Generator

The projection process begins in the Economic Scenario Generator with the production of one 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 & 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 benefits (where appropriate) and contributions both from employees and the sponsor.

A1: Further detail on modelling

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. A scheme is deemed to make a claim on the Fund where an insolvency event occurs and the scheme's liabilities, assessed on a s179 basis, are less than its assets.

Balance Sheet Engine

The 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 per cent or more at the funding horizon, currently 2030. The latter is the greatest deficit which is experienced at any time point within the period to the funding horizon measured at the 10th percentile of all scenarios.

2   PPF Characteristics

Our funding horizon of 2030 rests on, among other factors, 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 2014/15 published on 20 July 2015. As described in section 5 of this appendix, 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.

As described in section 5 of the main document, we now make the assumption that a market in CPI-linked investments will not develop in the foreseeable future. Our best estimate is that the rate of CPI will settle at around 1.1 percentage points a year lower than the rate of 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. As a result of our new SIP including an allocation in long-term, illiquid assets with hedging properties ('HAIL' assets), unlike in previous years, we can no longer assume that when we reach our funding horizon 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 second 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 of this appendix.

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 (B&H)) 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. We use a constant term premium model in our calibration. An adjustment is made to the term premium in the standard calibration to alter the excess return on government bonds, over the return on cash, to be in line with our expectations.
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. 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.
Alternative assets	We derive our own projections for hedge funds, commodities, private equity, unlisted-infrastructure and for assets that fall under the 'HAIL' category. 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.

The PPF has its own internal model for projecting CPI. It is a regression model that forecasts the RPI-CPI inflation wedge as a function of projected RPI, house price inflation, and short term interest rates. Every year the CPI model is updated to reflect recent developments in the key drivers of the inflation wedge. There were no significant changes to the model resulting from the most recent calibration. However, in order to better reflect the PPF's view that the long term RPI-CPI wedge is 1.1 per cent, we are proposing to introduce an additional calibration to the CPI model that will ensure for each model run the model's forecast of the average inflation wedge is 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 2014 and 31 March 2015. 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) around ten years on average. We take this information from the Pensions Regulator based upon the most recently submitted funding plans. On average the statutory funding basis results in higher liabilities than the scheme's PPF liabilities – currently around six per cent higher – 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 our funding horizon, 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 2014, only 13 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 five 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 actual or market-implied 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 2015 modelling we have allowed for the insolvency of a few schemes (for whom insolvency has now occurred post 31 March 2105) as well as some other schemes where there is yet to be an insolvency event.

A1: Further detail on modelling

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 were various developments and improvements that we subsequently implemented. At the time of publication of this Update KPMG are undertaking another audit of the LTRM.

There is a committee within the PPF that is responsible for ensuring that the model is kept up to date and monitoring 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 made a number of changes to the methodology of the model that represent a major departure from previous practice or have had a material impact on the results. Details of these changes are given below.

7   Use of different provider for insolvency probabilities of schemes

The LTRM uses the insolvency scores from an insolvency risk service provider to estimate the likelihood of insolvency and project future levels of levy and claims. The failure scores provided have a significant impact on the LTRM because they are used to both determine the credit rating that each company is initially mapped to when projecting insolvency events, and are also used to determine the levy paid by each scheme, both now and throughout the projection period.

From 2015/16, PPF levies will be based on Experian rather than D&B insolvency scores. Changes have been made to LTRM to allow for this new provider.

In addition, rather than directly mapping companies to credit ratings using the insolvency probabilities provided by the insolvency risk service provider as has previously been the case, we now rank employers using the Experian data and then assign credit ratings to the ranked companies according to a distribution specified by the PPF.

8   Direct modelling of our hedging position

For the 2014 update we made the assumption that we would be perfectly hedged. The result of this assumption was that we were able to assume both our liabilities and hedging operations increased in line with cash returns. Since 2014 we have made a number of modelling improvements to allow us to model the hedging operations more directly, and separately from our liability projections. As a result we now have the capability to assume that we are not perfectly hedged, though we do currently retain this assumption.