
Pension Protection Fund

LONG-TERM FUNDING STRATEGY UPDATE

July 2017

PROTECTING PEOPLE'S FUTURES

1: Contents

LONG-TERM FUNDING STRATEGY UPDATE - JULY 2017

The sections of this document are:

	Page
Section 2 Foreword	4
Section 3 Review of the funding objective	6
Section 4 Summary of the year's events	9
Section 5 Updated assumptions	15
Section 6 Modelling output – base case	17
Section 7 Sensitivity of base case	23
Section 8 Scenario testing	27
Annex A1 Further detail on modelling	32



2 : Foreword

HANS DEN BOER - CHIEF RISK OFFICER

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 to include the latest financial information and with consideration of the risks to our funding objectives.

Much has happened since we published our last Update. The 2016/17 financial year was characterised by a further reduction in yield on both conventional and index-linked Gilts from an already low level, with equity markets generally moving upwards. While sponsors of Defined Benefit (DB) schemes have continued making substantial deficit reduction contributions, overall the total deficit in the universe of schemes the PPF protects has changed relatively little from last year. We estimate this to be £227 billion on an s179 basis at the end of March 2017.

There were slightly fewer claims on the PPF during 2016/17, and since the average claim amount was also lower, the total claim amount reduced by nearly 50 per cent compared to what we reported last year. Alongside this, a positive development was the settlement agreed in respect of the well-publicised BHS claims which allowed us to write down the provision we made in the previous year. This reflects that the BHS schemes remain in assessment but any funding shortfall taken on by the PPF is expected to be limited given the terms of the settlement agreement.

As in previous years we continued to improve our modelling and updated several of the assumptions that are used in the model. In our most recent Annual Report and Accounts the PPF disclosed a funding ratio of 121.6 per cent, well ahead of last year's ratio of 116.3 per cent. However, the funding level that we use as a starting point for the analysis in this Funding Strategy Update is different, as it also allows for some contingent liabilities that may not materialise. Like last year, this allowance is significant as we have included the British Steel Pension Scheme (BSPS) as a 'Type II Contingent Liability'.

Our Board has continued to review both the assumptions and the outputs of our Funding Strategy, and its view is that both the funding horizon of 2030 and the 10 per cent self-sufficiency margin remain appropriate. Our modelling showed that our probability of success to achieve our self-sufficiency target at the funding horizon is unchanged at 93 per cent, and that our downside risk measure is similarly unchanged at £2 billion.

The PPF also performs stress scenarios to analyse how resilient it is to different economic shocks. Given the outcome of the referendum on the UK's membership of the EU, we conducted modelling of three 'Brexit' scenarios in the second half of 2016. These were not intended to be predictive, or prejudge the exit process, rather they were to help us understand

AS IN PREVIOUS YEARS WE CONTINUED TO IMPROVE OUR MODELLING AND UPDATED SEVERAL OF THE ASSUMPTIONS THAT ARE USED IN THE MODEL. IN OUR MOST RECENT ANNUAL REPORT AND ACCOUNTS THE PPF DISCLOSED A FUNDING RATIO OF 121.6 PER CENT, WELL AHEAD OF LAST YEAR'S RATIO OF 116.3 PER CENT.

the risks facing the PPF given the range of possible outcomes. Even under the most severe of the three, which assumed three years of recession in the UK against a back-drop of global economic contraction for two years, the PPF remained resilient. However, using our long term risk modelling, the scenario did show a drop of 8 percentage-points in our probability of success to achieve our funding target.

As part of our normal annual modelling, we looked at a very different scenario to analyse the impact of an insolvency of a major employer in a particular economic sector (with a large pension deficit) with further contagion to other companies in the supply chain who also are also sponsor to DB schemes with

deficits. Under this scenario the PPF would have a net claim of £11 billion, and this would have a very significant effect on the probability of success. Our modelling shows that a reduction of 19 percentage-points could be possible, with an increase in our downside risk of £12 billion.

These scenarios show that – despite the 93 per cent probability of success and the £6.1 billion excess of asset over liabilities (as reported in our accounts) – significant uncertainties and risks exist that may affect the PPF, and we need to remain vigilant to the developments and emerging risks in the UK economic climate and beyond.

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's mission is to pay the right people the right amount at the right time. To do this we must have sufficient funds to pay members their compensation for as long as it is due. However, the Board faces a number of risks in ensuring the PPF's assets will cover its future liabilities. These risks must be monitored and managed within a robust governance framework. The PPF's funding objective, to be self-sufficient at its funding horizon, is at the heart of its risk management.

The PPF's approach to risk management

The PPF operates within a robust framework of risk management, which we constantly review and improve where appropriate. We aim for a best practice approach in risk management. As in previous years, our Funding Strategy provides 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 the risks currently covered by our risk policies and assessed whether these risks should be explicitly modelled within the Funding Strategy. No new risks have been allowed for in this year's review. Sensitivity and stress testing are also conducted – see sections 7 and 8 for details.

While insurance companies in the UK 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 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 of the PPF 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 the 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 these actions would only be considered in exceptional circumstances.

Rationale for the funding objective

The PPF operates in an environment of continual change. Over the next couple of 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 small compared to the PPF's assets and liabilities. By this point in time we will therefore aim to have an even lower-risk investment strategy. We will be less able to use the 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.

3: Review of the funding objective

Some risks to the PPF will remain when we reach the funding horizon. As long as there are DB schemes, there is a risk of claims from some of these schemes. Longevity risk will continue 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 that we use to assess our liabilities and therefore our funding position reflect our best estimate of the future¹. By 'best estimate' we mean that it is equally likely that the future is better or worse than we expect. Therefore if at our funding horizon our assets were exactly equal to our liabilities we would have only a 50 per cent chance of being able to meet compensation payments in full. The Board deems this level of certainty not high enough. We have therefore added a margin to protect ourselves against the risks to which we would be exposed.

The funding horizon was chosen by the Board 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 at the time showed expected claims at the 90th percentile to be less than 2 per cent of the PPF's liabilities, and relatively stable at this level, around the year 2030. The Board therefore chose 2030 to be the 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

and thus increase the likelihood of meeting compensation payments in full from the 50 per cent best estimate level. 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 both uncertainty in longevity, and claims risk in excess of levy. In other words the margin would be sufficient to meet compensation in full in 90 per cent of modelled scenarios.

Subsequent reviews of the funding margin have explored the inclusion of additional risks to which we are exposed in its calculation, such as operational risk and investment mis-matching risk.

Following the most recent review of the funding horizon and margin the Board decided that both the funding horizon of 2030 and the 10 per cent self-sufficiency margin still remained appropriate to meet future compensation payments with at least 90 per cent certainty. 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.

We are aware that there are a number of other areas which may lead the Board to review the margin in future. The PPF's Statement of Investment Principles (SIP) was updated in 2014 to allow investment in long-term, illiquid assets with hedging properties ('HAIL' assets). In a similar way to holding RPI-linked investments to match CPI-linked liabilities, 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 should consider including investment risk in our self-sufficiency margin when we have greater clarity on what our asset allocation may look like at the funding horizon.

1. The best estimate used for CPI increases is the best estimate of the market's view of the actual outcome. This is distinct from the other assumptions which are best estimates of the actual outcome itself.

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, which is 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. Also, because our investment strategy is expected to be simpler once we reach the funding horizon, many of the risks currently associated with our existing complex investment strategy, such as taking tactical positions, are likely to be substantially 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 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 use an internal model, the Long-Term Risk Model (LTRM), which 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. A number of 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 to 31 March 2017.

Political climate, markets and their impact on scheme funding

There have been many significant developments in the world around the PPF since the last Funding Strategy Update was published in July 2016, including the Brexit vote, the US presidency, the Work and Pensions Select Committee inquiry into the collapse of BHS, a Government Green Paper on the future of DB pensions, and a General Election. Any of these could have a long-term impact on how the PPF operates and how it invests, however there is a great deal of uncertainty in our operating environment.

We continue to monitor such risks closely. As part of our risk management, in which we aim for best practice, we have introduced a new stress testing framework. Under the framework we will examine the possible outcomes of events such as Brexit, and undertake reverse stress testing, which seeks to identify circumstances which could cause the PPF to fail in its mission.

The UK economy grew by 2.0 per cent year-on-year in the first quarter of 2017 up from 1.6 per cent in the first quarter of 2016. The pick-up in growth largely reflected the recovery in manufacturing output after a year of falling production. Average economic forecasts² show GDP growth slowing to 1.6 per cent in 2017 as a whole, and 1.3 per cent in 2018. Brexit means that the outlook for the economy is particularly uncertain.

Despite the pick-up in growth, the number of

company insolvencies in the whole economy rose by 5.3 per cent in the year to the first quarter of 2017 to just under 4000, having been on a downward trend since 2012. However, the number of new claims on the PPF fell in 2016/17 to 44 down from 47 in 2015/16. The value of new claims in 2016/17 was just over £250m.

Scheme funding on a s179 basis for PPF eligible schemes improved a little in the year to 31 March 2017, the ratio of total assets to total liabilities rising from 85.8 per cent to 87.0 per cent³. The improvement reflected a change in actuarial assumptions which raised the ratio by around 1.5 percentage points and the impact of higher equity markets and gilt prices on assets which more than offset the impact of lower gilt yields on liabilities. The FTSE all-share index rose by 17.5 per cent over the year while yields on 15-year conventional and index-linked gilts fell by 40 basis points and 72 basis points respectively.

Sponsors of DB pension schemes made deficit reduction contributions of around £15 billion in 2016, up from around £12 billion in each of the previous two years. These payments compare with a total deficit of schemes in deficit on a s179 basis of £295 billion as at March 2017. The recovery plans for the latest tranche of schemes shows an average plan length of 7.5 years compared with 8.5 years for the equivalent tranche 3 years earlier⁴. It should be noted that the recovery plan length for this tranche would expect to have been reduced by around 3 years over this period had the valuation assumptions played out as anticipated.

2. The Economist poll of forecasters, 17 June

3. The figure as at 31 March 2016 in the 2016 Update was stated as 80%. The difference between the figure in that report and that given here is the result of the introduction of a new data set in November 2016. Figures were subsequently recalculated as at March 2016 using this data. In this way the figures stated here are directly comparable as they use the same data set.

4. TPR's Scheme funding Annex, June 2017 covering Tranche 10 schemes. If a DB scheme is in deficit on a technical provisions basis (taking full scheme benefits and a prudent discount rate) the scheme trustees and sponsors have to agree a recovery plan to eliminate the deficit. Such valuations are carried out every three years with a roughly equal number each year of the three. So that Tranche 10 is roughly comparable with Tranche's 7, 4 and 1.

4: Summary of the year's events

The Purple Book 2016 pointed to further de-risking. The percentage of schemes that were open was unchanged at 13 per cent and has changed little over the last four years. However, out of the schemes that were closed to new members, a higher proportion were also closed to future accrual. In asset allocation, the upward trend in the bond share, and the downward trend in the equity share, of total scheme assets continued. In 2016, 51 per cent of scheme assets were in bonds with 30 per cent in equities and 18 per cent in 'other investments', although some of the rising bond share will also reflect the growing maturity of schemes.

Claims on the PPF and their impact on PPF funding

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

In the year to 31 March 2017 we saw a very slight decrease in the total number of claims for compensation compared to previous year giving another year with a relatively low number of claims. Whilst the number of claims decreased slightly the aggregate claim amount from these schemes, calculated as the total estimated actuarial liabilities less the total value of assets reported as owned by the schemes, reduced by nearly 50 per cent.

In the PPF's Annual Report and Accounts an allowance is made for a number of contingent liabilities, as detailed in Annex S2 of that document. To ensure consistency with the Annual Report and Accounts, an allowance is made for those schemes described as Type II contingent liabilities in the assessment of the long-term Funding Strategy position. The definition of a Type II contingent liability from the Annual Report and Accounts is reproduced below:

Type II contingent liabilities are in respect of eligible schemes where:

- in the Board's judgement, as at 31 March 2017, no insolvency event has taken place, but the Board is nonetheless expecting to receive an insolvency event notice under section 120 of the Pensions Act 2004 from an insolvency practitioner in the future,

- the Board has sufficient data about the scheme to be able to make an estimate of a contingent liability, and
- as at 28 February 2017, the value of the assets was, in the Board's judgement, likely to have been less than the amount of the Protected Liabilities, as defined in section 131 of the Pensions Act 2004.

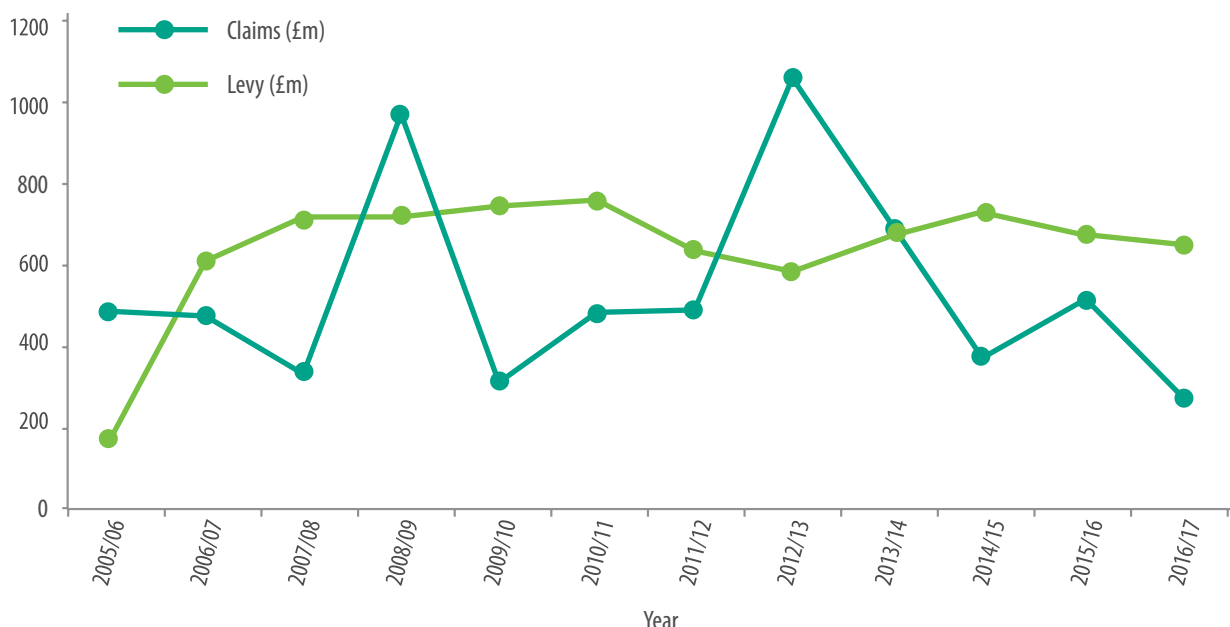
Whereas in the Annual Report and Accounts an allowance as a contingent liability is made we are required to adopt a different approach in our modelling. Such schemes' liabilities and assets are included on the PPF's starting balance sheet position of the model. As such, an allowance has been made for a potential future claim from the British Steel Pension Scheme (BSPS), as well as some other, smaller schemes, in the near future in our modelling. While we do not know what will be the final outcome of the current well-publicised discussions, we are here to protect the members of all DB pension schemes and based on the information available to us, we believe that we have sufficient reserves should this scheme come to us during the coming year.

Allowance for claims and Type II contingent liabilities is reflected in changes in the PPF's funding level over the year to the calculation date. The funding level, allowing for claims over the year, schemes in assessment and schemes that are denoted as Type II contingent liabilities in the PPF's Annual Report and Accounts, has increased from 108 per cent as at 31 March 2016 to 110 per cent as at 31 March 2017. For reference, the funding level excluding the Type II contingent liability schemes was 116 per cent at 31 March 2016 and 122 per cent as at 31 March 2017.

The following chart shows the history of claims and levies made on the PPF, taking into account recoveries, as well as expected levy collections, as published in the Levy Determination, since the PPF's inception. Neither this chart nor chart 6.3 in section 6 includes the allowance for the Type II contingent liabilities described above as these are not realised claims.

4: Summary of the year's events

4.1 History of claims and levies made on the PPF



The number of claims we receive in the coming year will be dependent on economic factors. Scheme deficits have increased in recent years as a result of falling gilt yields and low interest rates. However, if interest rates rise faster than expected, highly indebted companies, particularly smaller ones with restricted access to capital markets, could become insolvent, resulting in more claims on the PPF.

The PPF's investment strategy

We published a new SIP in December 2016, and our approach to investment has remained consistent with these and the previous Principles over the past year. To ensure we have sufficient funds to pay members' compensation for as long as we are needed, the strategy incorporates a diversified portfolio of assets as well as a clearly defined liability-driven investment programme that ensures we control our portfolio risk and use our risk budget effectively.

We have continued to build our exposure to hybrid and alternative assets. These provide diversification benefits, as well as an attractive risk-adjusted return to benefit our members and levy payers. Given our long investment horizons, we are also able to benefit from the liquidity premium of investing in less liquid assets.

Our LDI programme continues to deploy a strategy of matching the interest rate and inflation sensitivity of our liabilities.

Investment insourcing

Now that the PPF is similar in size to the largest pension funds in the UK, we are developing our asset management capabilities to reflect this. During the course of the year we successfully completed the second phase of our investment insourcing project. Having laid the necessary groundwork for our investment operations, we now operate the majority of our LDI trading in-house. This gives us added control, flexibility and efficiency, which has transformed the capability of our investment operation.

Over the next two years, we plan to insource a number of other investment activities that are currently being undertaken by external parties, including cash, foreign exchange and certain elements of our credit portfolio.

4: Summary of the year's events

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). We are considering what EMIR requirements for central clearing and bilateral margining of over-the-counter derivatives will mean for our investment operations. A larger cash reserve will be needed to account for potential rapid changes in associated margin payments and we may have to alter our asset allocation in light of this. Any changes we make will be published in an updated SIP. 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.

The pension protection levy

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

- The Levy Ceiling as set out in legislation (currently just over £1 billion)
- A 25 per cent year-on-year increase in the levy we expect to collect
- A 25 per cent year-on-year decrease in the levy we expect to collect

The final year of the second levy triennium began on 1 April 2017. The levy rules for the levy year 2017/18 remain largely unchanged from the previous year as we seek to keep our approach stable across the three years of a triennium. The total amount we intend to collect in 2017/18 is £615 million, which is the same target as for 2016/17. This reflects that both scheme funding and Experian scores under the PPF-Specific model are expected to remain at similar levels to those which applied when we set our 2016/17 estimate. Other changes for 2017/18 included a mechanism for stakeholders to notify Experian, the PPF's insolvency risk services partner, where the move to new UK accounting standard FRS102 would

otherwise cause an artificial movement in their rating. The rules extend the opportunity to certify impacts from FRS102 where accounts from different years are compared but have been calculated on different bases.

When publishing the levy determination we took the opportunity to encourage schemes to continue implementing risk reduction measures to improve security for members and to reduce their levy bills.

Early in 2017 we consulted on and introduced a new rule for the following levy year to apply to schemes which cease to have a substantive sponsor after a restructuring. Such schemes pose a unique risk to the PPF as they put us in the position of being the first line of defence if their investment strategy fails, when normally there would be an employer backstop. Given this emerging risk, it was necessary for us to get ahead of developments by ensuring we could price this risk.

Our standard methodology for calculating levies, a key element of which is the insolvency risk posed by the sponsor, would not be appropriate for such a scheme. Therefore we proposed a charging methodology based on a commonly used pricing model for valuing put options. This ensures that such a scheme will be charged an appropriate levy, reflecting the true risk it poses, and removing any in-built cross-subsidy from other schemes. The methodology also recognises that a scheme with no sponsor will always pose a bigger risk than an identical scheme which has a sponsor, however weak and should, therefore, always pay at least the same levy.

4: Summary of the year's events

In March 2017 we launched a consultation on the levy rules for the next triennium, starting 2018. The proposals were developed in partnership with Experian following engagement with stakeholders over the last three years. Alongside a number of wider suggested developments, the proposals focussed on two ways in which the PPF plans to develop the approach to measuring insolvency risk.

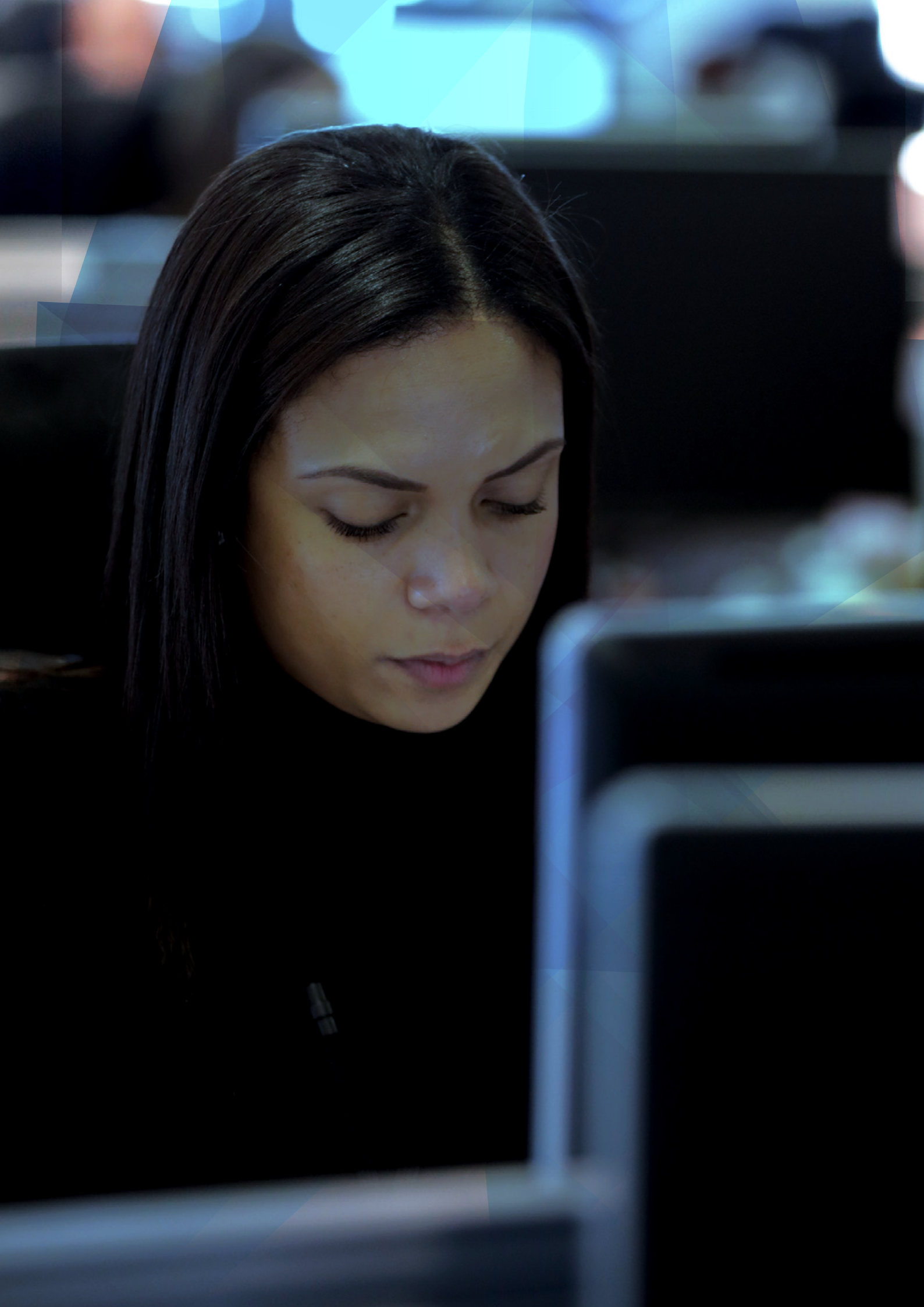
The consultation proposed to revise how employers are allocated to scorecards, introduce two new scorecards and rebuild existing scorecards where the predictive power has been weaker. These changes aim to improve the predictive power and ensure scorecards are better tailored to company size resulting in SMEs and 'not-for-profits' paying levies that better reflect their risks.

The consultation also proposed to adopt the use of credit ratings for some of the largest employers and a specific methodology for regulated financial services entities. This will ensure the best possible assessment of insolvency risk for some of the largest levy payers.

We plan to issue a further consultation document later this year, setting out our final views on these issues as well as proposing the levy bands and rates and the asset and liability stresses used to measure investment risk for the third triennium.

Long service cap

In April 2017 the Government introduced a long service cap, which increases the PPF compensation cap for members by 3 per cent for each full year over 20 years in their scheme. This currently affects a few hundred members. Increased compensation costs do mean an increased cost to levy payers, however the increase in liabilities of the proposed changes would be smoothed over many years, meaning we expect no jump in levies.



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. There is a formal annual review of all assumptions, and some events may also prompt out-of-cycle reviews for some assumptions.

Below we describe the assumptions that have been updated since the previous publication of our Funding Strategy Update in July 2016.

New members in open schemes

The Purple Book 2016 shows that the proportion of schemes open to new members has stabilised at around 13 per cent over the last three years (2014 to 2016), and it was 14 per cent in the two years before that (2012 and 2013). This stabilisation followed a period of rapid decrease – in 2006 the proportion of open schemes was 43 per cent.

We had previously assumed that open schemes would close to new members over the next ten years – this was approximated by assuming that they would all close in exactly five years' time. Given the stabilisation we are observing, we now assume that these schemes will remain open to new members for the foreseeable future.

Accrual in schemes closed to new members

Once a scheme closes to new members, it often allows existing members to keep accruing benefits. Purple 2016 shows that, in 2016, 50 per cent of schemes were closed to new members but open to new accrual. We expect these schemes gradually to close to new accrual. Previously we had assumed that this would happen over the next ten years, which was approximated by assuming that they would all close in exactly five years' time. We have now removed the assumption of sudden closure to new accrual. Given that we now assume that open schemes do not close to new members, there is a fixed cohort of non-pensioners in schemes closed to new members but open to new accrual. As they age and either retire or leave the scheme, accrual will stop naturally.

Change in profiles of schemes

We have updated our assumptions to reflect more up-to-date information on the age profiles within schemes.

Liabilities measured in different bases

Our modelling projects scheme liabilities on a s179 basis, and from that the technical provisions (TP) are estimated. However, some calculations need liabilities on other bases. For example, some schemes are assumed to pay contributions until they are fully funded on a buy-out basis. Asset recoveries from failed sponsors are estimated as a proportion of the s75 debt, which represents the buy-out cost of the liabilities. The buy-out liabilities are estimated using ratios between the buy-out and s179 bases, or between the buy-out and TP bases.

Based on information that schemes submit to The Pensions Regulator, we revised these ratios. The ratio between the buy-out and s179 bases is now 156 per cent (previously 140 per cent), and the ratio between the buy-out and TP bases is now 139 per cent (previously 140 per cent).

Commutation proportion for schemes

The assumption for the commutation proportion is rather immaterial as we assume that members commute their pension on a neutral basis within their scheme. However, even where this is the case commutation within the scheme is unlikely to be neutral on a PPF basis, so there is an impact albeit small.

Due to its low materiality, the commutation proportion assumption had not previously been reviewed. However, for best practice, we added it to the annual assumptions review. We used PPF data accumulated since December 2015 to review the proportion, and we increased it from 10 per cent to 20 per cent.

5: Updated assumptions

Schemes transitioning to a less risky investment strategy as they mature

Our modelling allows for schemes to de-risk their investment strategy as they mature. The maturing process was proxied by the average age of the active population. In the previous setup, a scheme's asset allocation started to transition to a low risk portfolio once the average age of active members reached 55, with the de-risking process lasting for ten years. However, as some schemes do not have active members, we now assume that the de-risking is triggered by the maturity of the scheme as measured by the proportion of pensioner liabilities.

Expenses

To keep the assumption used for expenses consistent with those used in the valuation of the PPF we have increased the loading for expenses incurred by the PPF from the 3.0 per cent of liabilities used in the 2016 valuation to 3.3 per cent of liabilities used in the 2017 valuation.

Mortality

We have updated our mortality base table to be in line with the assumptions used in the valuation. We have also updated our longevity projections to remove one year of stochastic longevity projection from the start of the period as our starting point for the calculations has moved on one year.

Long-term difference between RPI and CPI (valuation of liabilities)

Parts of PPF compensation are indexed by reference to the Consumer Prices Index (CPI). In considering what assumption would be appropriate for future CPI increases, at present there is almost no market in CPI swaps or indeed any other instruments from which CPI prices can reasonably be inferred. Such limited current market pricing information as is available from insurance companies would suggest an assumption of CPI increases being 0.6 per cent a year less than RPI increases. The PPF valuation basis has been updated to reflect this and, for consistency, we have assumed the same in our modelling (compared with a CPI assumption 0.5 per cent a year less than RPI used in 2016). It should be noted that in the valuation of our assets we use a best-estimate for the difference between RPI and CPI. This difference is assumed CPI to be 1.1 per cent a year below RPI.

Impact

The net impact of these changes on our probability of success and downside risk is negative. See section 6 for more detail.

6: Modelling output - base case

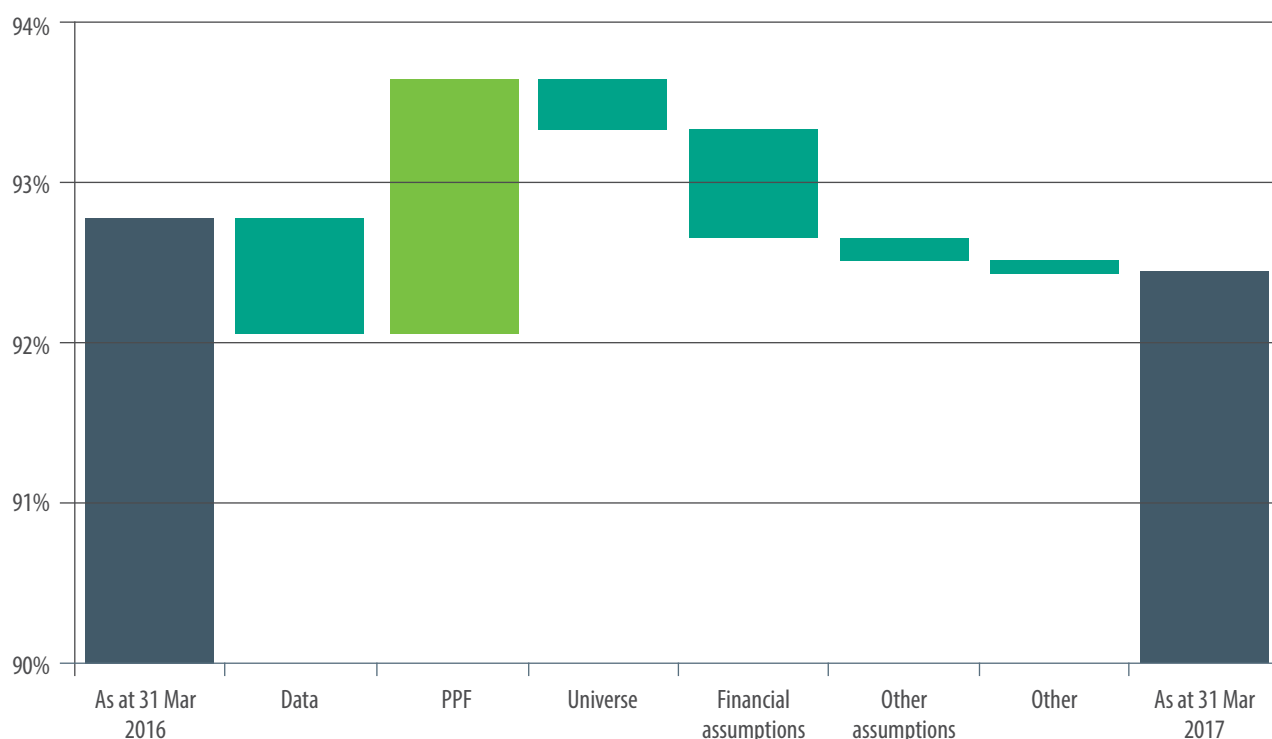
This section considers the model's output in our main run of the model – our 'base case'.

In our base case, the probability of achieving self-sufficiency by the funding horizon has remained unchanged at 93 per cent from 31 March 2016 to 31 March 2017. The downside risk statistic is similarly unchanged at £2 billion.

While there has been no overall change in the reported probability of success over the year there have been competing factors driving this result. Improvement to the PPF's starting funding level over the year (including recognition of the Type II contingent liabilities, as outlined in section 4) had a positive impact on the probability of success. Largely

offsetting this were the impacts from updated data on schemes in the universe and their employers, and a deterioration in the economic outlook in the projections. The following chart reconciles the probability of success at 31 March 2017 with the position one year earlier. The light green bars denote improvement and the dark green 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
As at 31 March 2016	This is the probability of success at 31 March 2016, which was 93 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, allowing for schemes that are denoted as Type II contingent liabilities in the PPF's Annual Report and Accounts, has increased from 108 per cent as at 31 March 2016 to 110 per cent as at 31 March 2017. For reference, the funding level excluding the Type II contingent liability schemes was 116 per cent at 31 March 2016 rising to 122 per cent as at 31 March 2017.
Universe	This is the effect of scheme funding changing over the year. The funding level of the universe as reported in the PPF 7800 index has increased marginally from 86 per cent as at 31 March 2016 to 87 per cent as at 31 March 2017. However, we smooth the funding levels of schemes over a one year period to the calculation date. As a result, there has been a negative impact on the probability of success. See section 4 of the annex for more information.
Financial assumptions	This is the net effect of the various changes to financial assumption discussed in section 5 and changes in financial markets, which acted to worsen the probability of success. The impact of changes to financial conditions at the start of the projection manifests itself mainly through changes to the funding level of the universe and the PPF. This impact relates more to changes in the projected paths of the variables over the period to our funding horizon.
Other assumptions	This includes changes to our assumptions and improvements to the modelling as detailed in section 5, and all other factors not accounted for above.
As at 31 March 2017	This is the probability of success at 31 March 2017, which is 93 per cent.

Are we happy with a 93 per cent chance of success?

It should first be noted that the figure of 93 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 current legislation (for example the current levy cap). In other words we assume that the PPF does not respond to changing circumstances. Levy collected in a particular scenario will though reflect the underfunding and insolvency risks presented to the PPF in that particular scenario.

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 these actions would only be considered in exceptional circumstances.

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 consider pushing 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 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.

6: Modelling output - base case

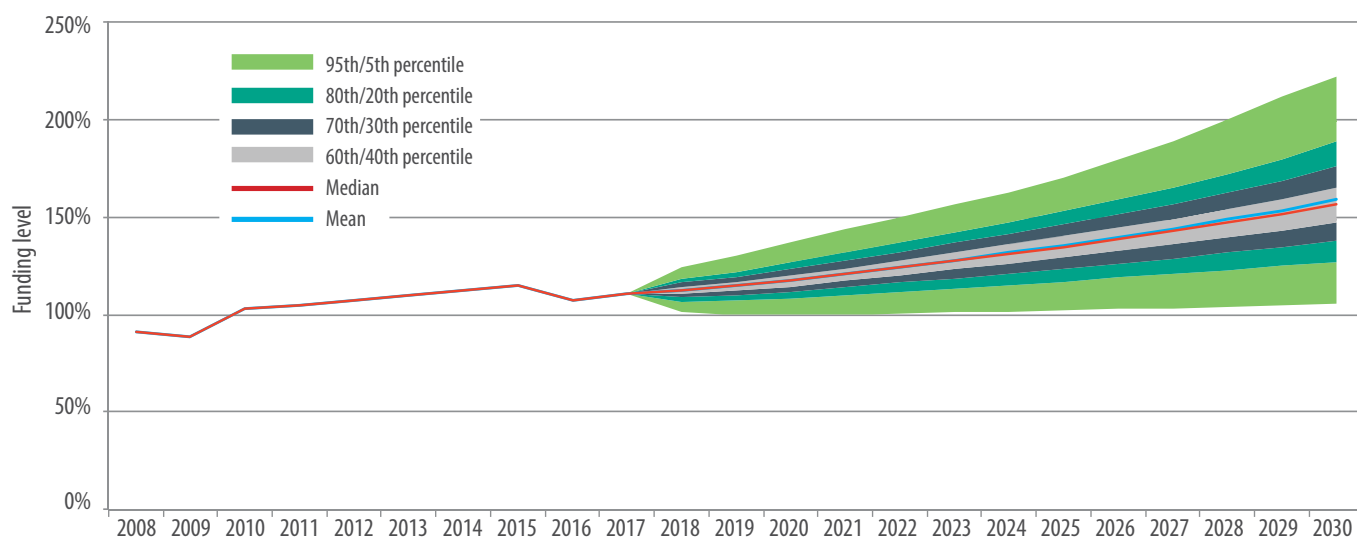
The Board regularly monitors the probability of success and the downside risk in quarterly updates of the modelling. To do this it has devised a Red-Amber-Green (RAG) framework where a green rating indicates that the Board should be comfortable, an amber rating indicates that it should consider pulling 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.

Projections of our funding level

At 31 March 2017 our funding level stood at 122 per cent ignoring the Type II contingent liability schemes discussed in section 4. Whilst 122 per cent is above our target to be 110 per cent funded, this level of funding does not mean that we have achieved our funding objective of being self-sufficient. This is because 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 our base case projection beyond 2017. The starting point of the projection (31 March 2017) does include Type II contingent liability schemes, which has resulted in a decrease in funding level at this time (see explanation in table accompanying chart 6.1). As mentioned above, the assumption in our projections 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. Neither does it allow for the possibility of any reduction to indexation or level of compensation. 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*



*Charts 6.2, 6.3 and 6.4 were updated on 20 July 2017 to correct the colours of the Mean and Median lines.

6: Modelling output - base case

Projections of claims

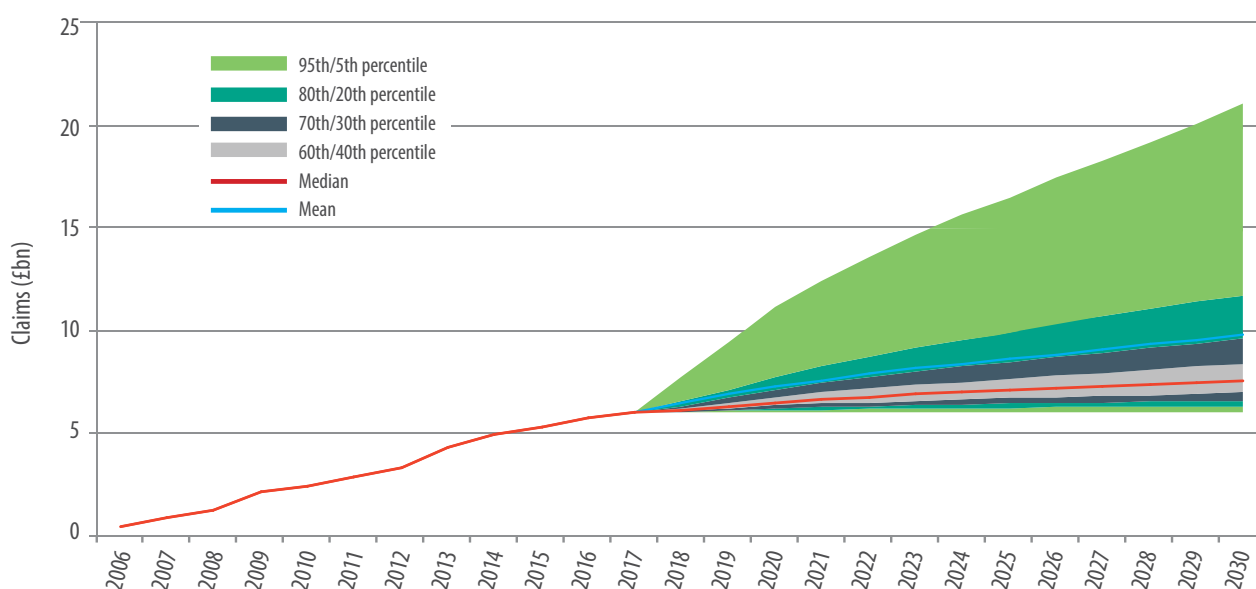
One of the main factors that could lead to a decline in funding, which is largely outside of our control, is the level of claims being made on the PPF in future years. The following fan chart, taken from our base case, shows the cumulative deficit of schemes that make a claim on the PPF, measured at the point at which the sponsoring employer(s) is (are) modelled to experience an insolvency event. In reality there would be a delay before the assets and liabilities actually transferred to the PPF.

The chart includes claims already accumulated to 31 March 2017, but does not include allowance for schemes included in the Annual Report and Accounts as Type II contingent liabilities as these are not realised claims. Similarly no claims from schemes included in the accounts as Type II contingent liabilities are included in the projections as the

assets and liabilities from these schemes have been recognised on the PPF's starting balance sheet for the purposes of the projections.

The projected size of pension scheme deficits and the underlying trend within our base case that deficits will decrease during the period to our funding horizon is a key determinant in the projected 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 a number of these stress tests in section 8.

Chart 6.3: History and projection of cumulative deficits of schemes entering the PPF*



6: Modelling output - base case

Projections of levy

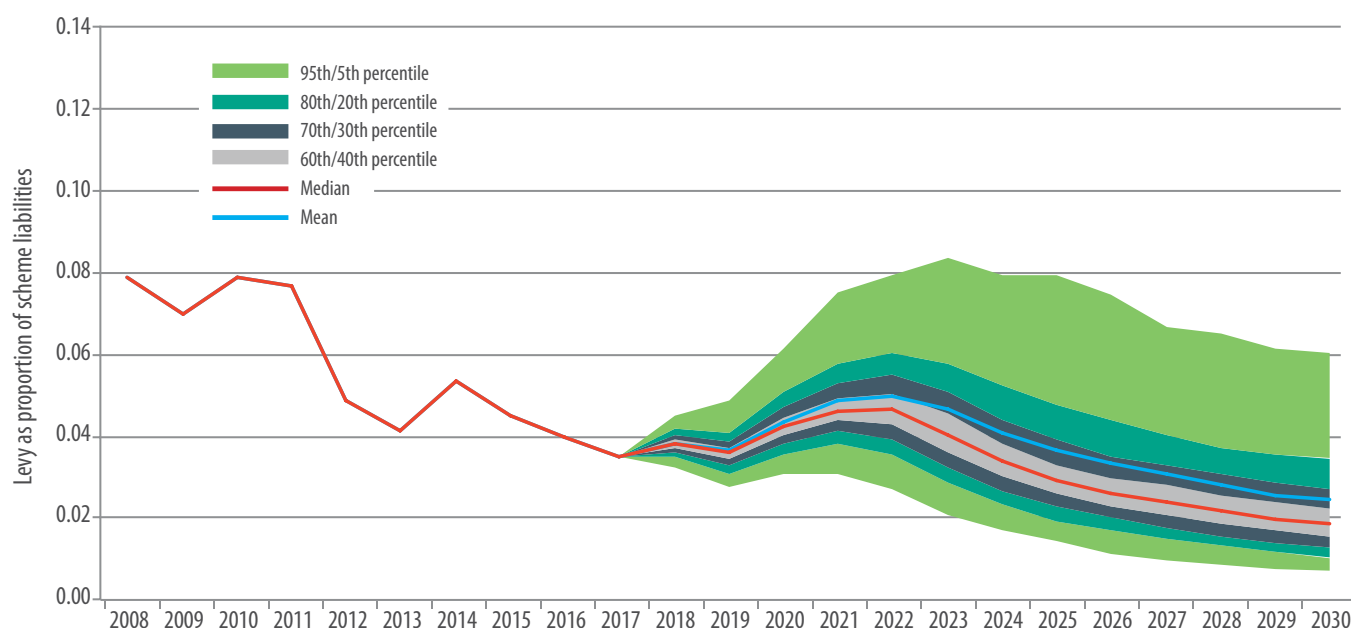
PPF levies are for the most part risk-based, in the sense that they depend explicitly on the size of schemes' deficits and the strength of sponsoring employers. We would therefore expect that as schemes repair their funding deficits the PPF levy will reduce both in absolute terms and as a percentage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

The following chart shows how the levy has changed as a percentage of protected schemes' PPF liabilities to 31 March 2017, and how it is projected to change in future years.

As we assume that the formula underlying the levy calculation is unchanged over time, other than in circumstances where legislative limits would be breached, 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 scheme 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 model interest rates rising in the short to medium term, which will cause liabilities to fall. The averaging means this will impact levies less quickly than scheme liabilities, which has the effect of pushing up the ratio during this period of rising interest rates.

Chart 6.4 History and projection of levy as proportion of scheme liabilities*



6. The historic levy as a proportion of scheme liabilities are based on the PPF 7800 Index as reported at the time.

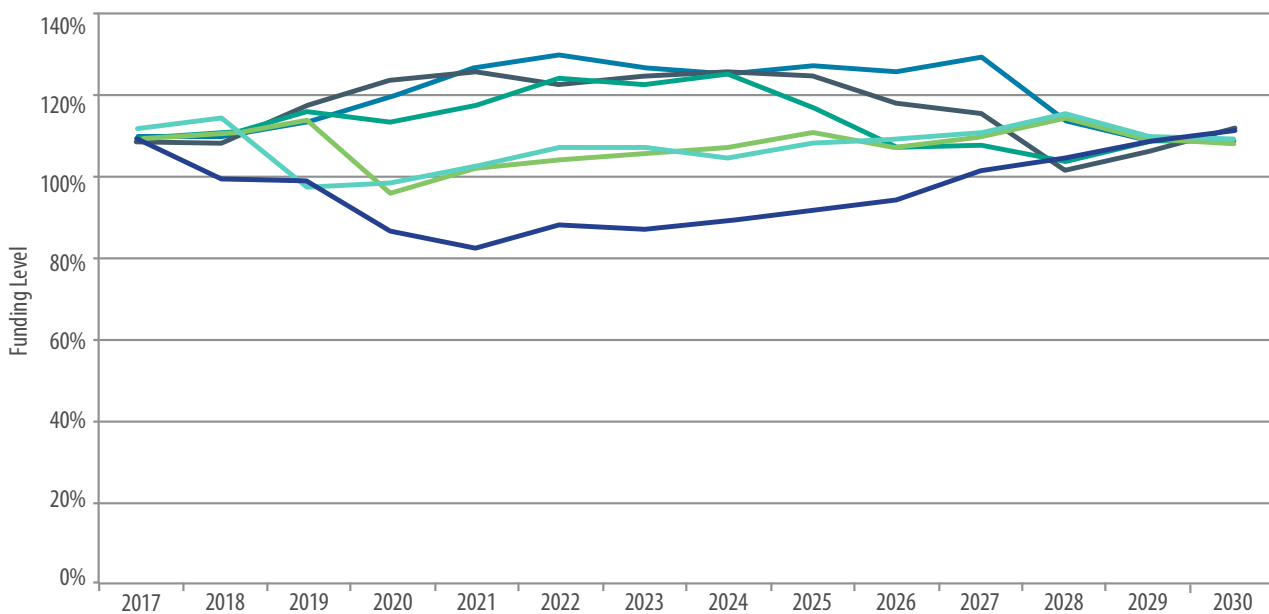
6: Modelling output - base case

Pathways to achieving success

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. There is a slight difference in the starting funding level of these projections due to the way in which we allow for stochastic projections of mortality in our modelling.

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.

There have been some changes to the sensitivities presented in last year's Funding Strategy document. These reflect changes to our assumptions or an investigation of other risks to which we may be subjected.

We have introduced two new sensitivities this year: a sensitivity to show how our probability of success might be impacted if we experienced a very large claim and a sensitivity to explore our resilience in the face of a continuing low interest rate environment.

The large claim sensitivity is purely synthetic and undertaken by adding £5 billion to our assets but £10 billion to our liabilities at the start of the projection, effectively resulting in a £5 billion claim. The sensitivity should not be interpreted as a view on the likelihood of any claim being received by us in the near future but as a desire to understand our resilience were such a claim to arrive.

The continued low interest rate sensitivity holds the shape of the nominal and real interest rate curves through the course of the projections as close to the shape at the start of the projection as our calibration tools allow us. This is achieved by targeting the long and short end of the yield curve to current levels, while still allowing for variation around those targets. In doing this we effectively eliminate the recovery in interest rates that would occur through the mean reversion assumption in the base case calibration. This sensitivity is more akin to a stress test as there is a secondary impact on the total return of other assets such as equity and bonds.

We have changed the sensitivity of a reduction in the gap between RPI and CPI from a reduction from 1.1 per cent to 0.5 per cent to one showing a reduction from 1.1 per cent to 0.6 per cent. This reflects the change to the assumptions used in the LTRM as detailed in section 5. The 1.1 per cent represents the best estimate of the difference between RPI and CPI whereas the 0.6 per cent (previously 0.5 per cent) is the market expectation of the difference between RPI and CPI. We have also changed the sensitivity of the increase in the gap between RPI and CPI to be symmetrical to the reduction in gap sensitivity, showing the impact were the gap to increase by 0.5 per cent from 1.1 per cent to 1.6 per cent.

The sensitivity to explore scheme closure has also been changed to reflect our new assumption, as detailed in section 5. We previously showed a sensitivity where schemes remained open to both new members and accrual. As we now assume that those schemes currently allowing new entrants will continue to do so and that closed schemes will cease accrual only when there are no longer any members accruing benefits, we have changed the sensitivity to one where schemes do close to new members and all accrual immediately.

7: Sensitivity of base case

Table 7.1: results of sensitivity tests

Assumption	Probability of meeting funding objective	Downside risk
Base case	93%	£2 bn
Initial PPF funding reduced by 10 percentage points	-6%	£+5 bn
Size of the PPF increases by 20% (assets and liabilities)	no change	no change
Reduction in asset returns of 1.0% pa (excluding cash and government bonds)	-6%	£+2 bn
Scheme funding levels reduce by 10%	-3%	£+2 bn
Recovery plans 5 years longer	-1%	£+1 bn
Scheme Technical Provisions reduced by 10% (relative to S179 basis)	-3%	£+1 bn
Sponsor credit rating falls by one rating notch	-2%	£+2 bn
PPF levies lower by 10%	-1%	no change
Schemes close to new accruals	+1%	no change
Longevity sensitivity (probability of death in any single year (qx) reduced by 20%)	-5%	£+5 bn
Assumed difference between best-estimate RPI and CPI widens (1.1% to 1.6%)	+2%	£-1 bn
Assumed difference between best-estimate RPI and CPI narrows (1.1% to 0.6%)	-3%	£+1 bn
Simulated large claim	-8%	£+6 bn
Continued low interest rate	-3%	£+2 bn

7: Sensitivity of base case

As described in section 6 there are two main 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 one per cent a year, with a six 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.

As also noted in section 6, the Board monitors the probability of success through a RAG 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. One element of one of our Key Performance Indicators for the year 2016/17 was to highlight when a breach of 87 per cent was likely. The lower bound of the green rating was also taken as 87 per cent for the year. In only one of the sensitivity examples shown above would the rating have fallen from the current green rating to an amber one – the simulated large claim – and in none would a red rating have been reached.

The sensitivities described above, with the exception of the continued low interest rate sensitivity, 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 in 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 or stress testing, as described in the following section.



8: Scenario testing

This section considers how our results differ a number of scenarios.

To explore the extent to which our Funding Strategy is sensitive to a change in the Board's best view of the future we look at stresses to a number of assumptions at the same time. Such stress, or scenario testing can also reveal how resilient the PPF is to different economic shocks.

For recent Funding Strategy Updates we have adopted a system of scenario tests to help explore the possible outcomes should further evidence challenge our view as to the appropriate base case assumptions, with the scenarios chosen intended to reflect potential events which, based on the economic and political conditions at the time, are plausible.

Increased economic uncertainty, largely manifesting from national and international political events over the past year, has led us to report a different range of scenarios this year, details of which are provided below.

In a change from previous years, for each of the scenarios detailed below we have modelled our levy as fixed at £615 million all points to the projection horizon in all scenarios. This is to isolate the impact of the scenarios on the probability of success which may otherwise be mitigated by the automatic levy increase (or decrease in scenario of increasing interest rates) resulting from previous years' assumption of a constant levy scaling factor.

Brexit

In the UK-wide referendum on the UK's membership of the European Union (EU) on 23 June 2016, the British electorate voted to leave the EU. Article 50 was subsequently triggered on 29 March 2017, giving the UK two years to leave the EU and negotiate any exit deal.

Given the extent of uncertainties and the number of different variables in play around any negotiations, over the quarter following the referendum we explored the possible impacts of three distinct downside scenarios on the ability of the PPF to fulfil

its funding objective.

The three scenarios were taken from a variety provided by Moody's Analytics and were not intended to reflect any prediction as to how events will unfold but instead to illustrate a range of potential outcomes and the implications for the PPF.

As the timing of Article 50 being triggered was unknown at that time all scenarios assumed that Article 50 was triggered before the end of Q1 2017. In each case, the UK was modelled as leaving the EU in the first quarter of 2019. From that point on the scenarios diverge with each scenario making different assumptions about the terms of the agreement reached with the EU, together with the legislative, political and economic consequences. Our modelling then projected the implications of each scenario on the financial position of the PPF.

The modelling that was undertaken differs from the stress testing we have previously shown in the Funding Strategy Updates in a number of ways. Firstly, the projections were carried out as at 30 June 2016 rather than 31 March 2017.

Secondly, for this modelling exercise we adopted a fully stochastic approach from the projection date. Our usual approach is to 'force' a future path for a number of years (normally five) and then allow stochastic variation following that period of certainty. The approach adopted for the Brexit scenarios allowed us to better look at a full distribution of outcomes for a range of scenarios.

8: Scenario testing

In order to adopt a fully stochastic approach it was necessary to stipulate a central path for the economic variables capturing the economic environment desired for each scenario, with variation around these central paths. It was not possible to 'hit' the desired paths with the standard models we use for the base case analysis reported in this document. It was therefore necessary for us to use a different set of more advanced models provided by Moody's Analytics and for us to calibrate these models appropriately for each scenario. As these models and calibrations differ from those used for our base case it was necessary for us to produce an alternative base case as at 30 June 2016 using the more advanced models and suitable calibration files. The results of the scenarios have been compared against this alternative base case to allow the impacts under each to be assessed fairly.

We discuss briefly each of the three scenarios below, and detail the impact on the PPF's funding objective together with the main causes.

Scenario 1

UK growth slows to 0.5 per cent in 2017 but then picks up to 1.2 per cent in 2018 and 2019 before settling around 1.7 per cent. The total GDP loss by the end of 2020 is 4.3 per cent compared to the baseline. The Bank of England doesn't raise its key policy rate until mid-2020 with 10-year gilt yields remaining below 1 per cent over 2017 before rising to 3.2 per cent at the end of 2018.

Scenario 2

After two years of recession, the UK begins a slow recovery in 2019. By the end of 2020, GDP is 7 per cent lower than in the baseline. Gilt yields edge above 1 per cent in 2018 while The Bank of England starts raising rates in 2021.

Scenario 3

After three years of recession the UK begins a slow recovery in 2020. The Eurozone also sees three years of recession while the global economy contracts for two years. The Bank of England starts raising rates in 2023 while 10-year gilt yields remain below 1 per cent. In this case, UK GDP at the end of 2020 is almost 12 per cent below the baseline (with Eurozone 10 per cent lower and US 9 per cent lower).

8: Scenario testing

The following table gives the probability of success and downside risk under the alternative base case and the three Brexit scenarios.

Table 8.1: result of Brexit scenarios compared with the alternative base case

Assumption	Probability of meeting funding objective	Downside risk
Alternative base case	92%	£3 bn
Scenario 1	No impact	£+1 bn
Scenario 2	-3%	£+3 bn
Scenario 3	-8%	£+9 bn

Our modelling indicates that scenario 1 would have little impact on PPF funding, with minimal changes to the probability of success and downside risk.

Under scenario 2 the PPF balance sheet would also be resilient and that we would still be on track to meet our long-term funding objectives, though probability of success and downside risk would both worsen. The impact results principally from a deterioration of the PPF funding position, largely due to an increase in the size of claims in the first three years of projection. The effect of larger claims is compounded by the relative underperformance of the PPF assets over the course of the projection under the scenario.

In scenario 3, PPF funding would deteriorate substantially, significantly reducing the probability of success and increasing the downside risk. As in scenario 2 the deterioration in funding is mainly due to large claims during the early years of projection, compounded by weaker investment performance over the projection horizon. The impact of this scenario would move our RAG status from green to amber meaning the Board should consider using one of the levers available to it to restore the chances of us achieving our funding objective. It is worth, however, noting that even under scenario 3 the PPF would on average remain fully funded. At the trough of funding levels, in 2018, PPF funding is still 103 per cent with a surplus of around £1 billion and by 2020, funding would increase to 107 per cent and surplus, to £2.5 billion. This evolution is, however, clearly much worse than under the baseline and either of the other two scenarios.

By undertaking this work and considering a range of possible scenarios we are well positioned to better understand the risks to which we are exposed and how these may evolve. Further work will be carried out in due course as greater clarity on Brexit unfolds and the range of potential outcomes narrows. This will consider both specific emerging risks and the implications for our ongoing modelling work. As with our existing modelling it will continue to inform the PPF's wider strategy.

8: Scenario testing

Large unexpected claims

The concept for this scenario was first explored for the 2015 Funding Strategy Update. We have revisited this scenario due to the financial strain being placed on a number of specific industrial sectors. Under this scenario there are a number of unexpected claims at 31 March 2017 arising from the insolvency of a major employer in the sector. The employer's own scheme has a very large deficit and enters the PPF. There is also a knock-on impact to companies within that employer's supply chain and their associated schemes. The result is recognition of a net claim of some £11 billion on our balance sheet. The size of our liabilities grows by around £27 billion to nearly £73 billion whilst our funding level falls to around 92 per cent (allowing for schemes classified as Type II contingent liabilities). Following these claims the scenario proceeds as per the base case, with the exception of some associated changes to the credit ratings of other companies operating in the same industry sector.

This scenario is similar to the simulated large claim sensitivity test detailed in section 7, but it is sector-focussed and additionally includes an element of contagion. The scenario illustrates that claims of this nature and magnitude are a threat to our ability to meet our funding objective and of the importance for us to monitor, in collaboration with The Pensions Regulator, schemes that present such a risk. The results of this scenario are shown below:

Table 8.2: result of the large unexpected claims scenario compared with the base case ⁷.

Assumption	Probability of meeting funding objective	Downside risk
Base case	93%	£2 bn
Large unexpected claims	-19%	£+12 bn

In the large unexpected claims scenario, the probability of success falls dramatically by 19 per cent. In reality the impact may be worse than this – there could be further falls in funding at the beginning of the assessment period before we are able to direct the insolvent schemes' investment strategies, and also realistically on this scale we would not be able to hedge all the liabilities at once and would need to phase this over time.

In the large unexpected claims scenario the decrease in probability of success would have seen the RAG rating fall from the current green rating to a red one. Under such a scenario the Board should almost certainly be planning to pull one of the strategic levers outlined in section 3.

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.

PRA anchor

In line with previous years we have explored one scenario consistent with that published by the Prudential Regulatory Authority (PRA) in 2016 as part of guidance for insurers under Solvency II (labelled 'PRA anchor').

The 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 again 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 of 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.

A summary of the 2016 scenario is as follows:

⁷. A detailed at the start of this section the base case to which this scenario is compared has used a levy that is fixed at £615 million in all scenarios and at all points in the projection. The same fixed levy assumption has then been used for the stressed scenario.

8: Scenario testing

A rapid deterioration in global demand combined with financial contagion from the global repricing of risk sends shock waves through Britain's economy. The Bank of England lowers its main repurchase rate to zero and expands its asset-purchase program. Despite the additional monetary stimulus, borrowing costs in the UK rise sharply as the economy swiftly sinks into recession. The housing market quickly relapses and residential and commercial real estate values decline putting pressure on the UK banking system. Britain's stock market also suffers large losses. UK productivity growth remains weak, limiting the pace of recovery. Still-restrictive fiscal policy in most developed nations holds back the pace of global recovery, stifling the rate of wealth-generating job creation. Therefore, major central banks keep interest rates extremely low for the stressed period even as moderate inflation pressures gradually start to build.

The PRA anchor scenario has been modelled using an approach in line with that used last year as detailed below:

To model this scenario, we apply a stress for a period of five years and assess the impact on the PPF and the pensions universe. The stress period uses a single set of deterministic economic variables for each of the one million simulations run by the model. Once the stress period has elapsed, we then model the evolution of the PPF and pensions universe in the same way as our normal stochastic approach. We tailor the starting point of the post-stress projections to reflect the economic conditions produced at the end of the stressed period.

We continue to use a modified version of the base case against which the stressed scenarios are compared. The modified base case uses median values of economic variables to give a deterministic five year period, representing a best estimate projection for that period, followed by a stochastic period to the funding horizon and thus comparable in length to those in the stressed scenarios. This is to ensure that the period over which volatility of variables is experienced is the same in the stressed scenarios as in the base case to which they are compared.

We further modify the PRA anchor scenario by 'overlying' the economic stress of the scenario with changes to our assumptions on companies' ability and willingness to contribute into their schemes.

Due to the pressure on businesses in the PRA anchor scenario we assume that companies will take five years longer to clear their deficits.

The following table gives the probability of success and downside risk under the modified base case and PRA anchor scenarios. We also model the levy as fixed for the duration of the projection (in both the modified base case and stressed scenario) as detailed at the start of this section.

Table 8.3: result of PRA anchor stress compared with base case

Assumption	Probability of meeting funding objective	Downside risk
Modified base case	96 %	£-2 bn
PRA anchor	No change	£+9 bn

In the PRA anchor scenario, an initial shock to GDP leads to falls in asset values and a greater number of insolvencies. However, this coincides with a rapid increase in gilts yields, lowering the assessed liabilities of those schemes making a claim. As such, in the first year of the projection whilst claim numbers are substantially increased, the impact of these is slightly muted through lower liabilities.

Following this initial shock is a sustained period of growth. This growth provides higher overall returns over the period to our funding horizon than experienced in the base case, improving scheme assets. Gilt yields show a return to lower levels for this period, increasing the liabilities calculated for schemes. The overall result is little impact on scheme funding levels compared to the base case. When combined with a smaller remaining population of schemes the higher returns experienced over the period also acts to lower insolvency rates. The combination leads to lower aggregate claim amounts than experienced in the base case for this period.

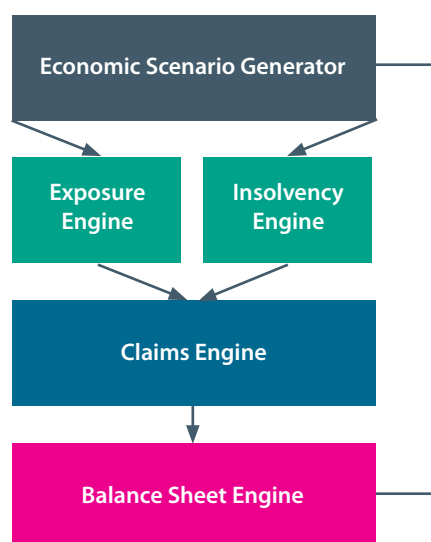
The initial unfavourable shock followed by the relatively favourable conditions under the recovery leads to an insignificant rise in probability of success.

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 the engines 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 (ESG) with the production of two 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 ESG provided by an external provider, Moody's Analytics, and adapted for use by the PPF.

Insolvency Engine

Insolvencies are modelled in the Insolvency Engine by assigning a credit rating to each company (as detailed in section 5) and using transition probabilities to model credit ratings changing over time. We have 500 scenarios for credit risk, with the transition rates varying in each. Each such scenario is mapped to each of the economic scenarios providing one million 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.

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 the s179 basis in force at the time of the calculations, are less than its assets.

Balance Sheet Engine

The aggregate deficits, determined using the PPF's internal funding basis to calculate the value of the transferring liabilities, then feed through 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 projection period 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 one million scenarios that lead to a PPF funding level of 100 per cent with an additional margin for uncertainties after the funding horizon (currently equal to 10 per cent of liabilities) or more at the funding horizon, currently 2030. The downside risk 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.

A1: Further detail on modelling

2. PPF characteristics

Our funding horizon, which is currently 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 2016/17 published in July 2017. As described in section 5 of this appendix, we include on our starting balance sheet (for long-term funding purposes) those schemes that are included in the Annual Report and Accounts as Type II contingent liabilities.

The PPF investment allocation is modelled as set out in the SIP. We make no adjustment for any de-risking of our investment portfolio that might be expected in practice as both we and the DB pensions universe mature. With our SIP including an allocation in long-term, illiquid assets with hedging properties ('HAIL' assets), it is unlikely 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. However, without a clear picture of how our asset holdings may evolve towards our funding horizon we make the simplification that we do have a completely matched investment strategy at that time.

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 ESG creates 2,000 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 (provided by Moody's Analytics) and adjusted where the Board has a different view to our provider's central one. This does not mean that the Board believes our provider's views are incorrect, and indeed Moody's Analytics 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.

Assumption	Adjustment
Scenarios of Consumer Prices Indexation	<p>We take our scenarios of RPI inflation from the standard Moody's calibration. However, we construct our own scenarios for CPI inflation, based on the projections of property returns, interest rates and RPI.</p> <p>We construct scenarios for the real yield on CPI-linked investments by making adjustments to the RPI-linked real yield taken from the standard Moody's Analytics calibration.</p> <p>The adjustment is based on the current and assumed long-term gap between RPI and CPI.</p>
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).

A1: Further detail on modelling

The interest rate projections are calibrated to bond yields observed in the market at the start of the projection. We use standard stochastic models for 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 2,000 scenarios, the assumption is that there is a tendency for the rates to move in the direction of a long-term average value – the target for both the short rate and long rate is 4 per cent at a 100 year horizon. This is to be contrasted with our asset modelling, where we do not assume that markets revert to a long-term average.

As outlined in the table above, 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. Following the structural changes to the model's specification last year no material changes were required to the model following this year's review.

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. In order to better reflect the PPF's view, we calibrate the CPI model in such a way that ensures that for each model run the average forecast inflation wedge hits this target.

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. Scheme deficits will therefore 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.

4. Scheme and sponsor characteristics

For reporting purposes initial funding is taken for each scheme as its average between 1 April 2016 and 31 March 2017. 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 12 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 eight 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 at the next valuation, as has been the trend, 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 destined to be removed concurrently with our funding horizon, with half of schemes completing their recovery plans within a decade.

Recent years have shown an increasing trend in schemes looking to secure their liabilities with an insurer; to buy out. Our modelling reflects this through two channels. The first is that schemes are assumed to buy out if their funding level (measured on a Technical Provisions basis) reaches 139 per cent. Such schemes are removed from the universe.

A1: Further detail on modelling

The second is that sponsors with a strong covenant are assumed to continue making contributions to their schemes even when their technical provisions are fully funded. The assumption here is that such sponsors will actively seek to fund towards buying out the scheme's liabilities. It is the schemes with the highest starting credit rating (rating Aa in our model) that are deemed to have sponsors with covenants of sufficient strength to actively target buying out the liabilities, and this represents around 12 per cent of our universe.

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 51 per cent to around 80 per cent in the long term.

As at the effective date of the most recent Purple book, 31 March 2016, only 13 per cent of schemes were open to new members, down from 43 per cent in 2006. However, this figure has been held constant over the past few years indicating that the rate of scheme closure has significantly slowed, if not ceased. As outlined in section 5 we have changed our base case assumption to now assume that these schemes will remain open to new members for the foreseeable future.

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 currently open to new accrual) that there is a constant age profile over time. We also assume that on closure 20 per cent of liabilities in respect of active members at the time of closure retain a link to salary.

We assume that no new DB schemes are set up that are eligible for PPF protection.

5. Sponsor solvency

For the large schemes we assess the initial creditworthiness of the sponsor(s) by looking up current credit ratings or market implied 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 Moody's Analytics and reviewed within the PPF.

In line with our accounting practices an allowance (contingent liability) has been made in the PPF's Annual Report and Accounts for potential claims in the near future from a number of schemes. To ensure consistency with the Annual Report and Accounts we have also made an allowance for these Type II contingent liabilities as at 31 March 2017 for the assessment of the long-term Funding Strategy position. We are limited in the ways in which we can reflect contingent liabilities with the model and the approach adopted is to include such schemes' liabilities and assets on our starting balance sheet position. The inclusion of this allowance does not, however, mean that the PPF believes a claim from these schemes is a certainty. We carry out sensitivity analysis to determine the impact if these claims do not materialise to better allow us to plan for different outcomes.

In addition, for schemes that we do consider to be 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, even where allowance may not have been made for these schemes in the Annual Report and Accounts, which is more of a snapshot. For the modelling carried out as at 31 March 2017, the results of which are presented in this document, we have allowed for the insolvency of a few schemes for whom insolvency has now occurred post 31 March 2017 as well as some other schemes where there is yet to be an insolvency event at the time of writing.

A1: Further detail on modelling

There also remain some material schemes in assessment where there is a high likelihood that benefits in excess of PPF compensation will be secured with an insurer. Such schemes' assets and liabilities are also included on our starting balance sheet within the model, but the assets are adjusted to exactly match the value of the schemes' liabilities as assessed on our internal valuation basis. As and when benefits for these schemes are secured outside the PPF the assets and liabilities will be removed from the balance sheet. Again we carry out sensitivity analysis to explore alternative outcomes.

6. Assurance and future development

Our internal model is subject to continual refinement and audit. KPMG carried out a review of the model in 2015 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 recommended. A small number of minor recommendations remain to be implemented and we plan to do so over the coming year. Another audit of the LTRM is planned for 2018.

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.

