

Consultation Document

The Pension Protection Levy: A New Framework

Combined Annex

Please note that the annexes provided in this document contain a significant amount of technical material and may not be accessible to all.

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Annex A: The Proposed New Levy Framework

1 Overview

The Current Levy Formula

- 1.1 Legislation requires that the estimated total levy collected from eligible schemes is at least 80 per cent based on risk factors (including underfunding and insolvency risk). This portion is termed the risk-based levy (RBL). The remaining 20 per cent (maximum) is collected via the scheme-based Levy (SBL), which is calculated for each scheme as a percentage of that scheme's liabilities.
- 1.2 The RBL is currently based on the likelihood of a scheme making a claim on the PPF and the potential size of that claim. The insolvency and underfunding measures, however, are highly volatile and are strongly correlated to overall economic conditions. For instance, aggregate pension scheme funding, as estimated by the PPF 7800 index, moved from an aggregate deficit of £192.2 billion at 31 March 2009 to a surplus of £52.7 billion at 31 March 2010. With the extent of risk posed by PPF-eligible schemes varying each year, it is necessary to scale every scheme's RBL by a standard factor so that the total matches the sum required by estimated total levy. This adjustment function is performed by the levy scaling factor (LSF).
- 1.3 The current RBL formula is as follows:

$$\text{RBL} = \text{Underfunding Risk (U)} \times \text{Insolvency Risk (P)} \times \text{Levy Scaling Factor (LSF)} \times 80\%$$

- 1.4 A number of additional parameters affect the distribution of the levy across schemes, including the levy cap and the underfunding risk taper. These are reviewed each year by the Board alongside the levy estimate and the LSF.

The Proposed New Levy Formula

- 1.5 To maintain simplicity, the proposed RBL formula is similar to the current specification. There would, however, be significant changes to the ways in which underfunding and insolvency risks are calculated.

$$\text{RBL} = \text{Underfunding Risk} \times \text{Insolvency Risk} \times \text{Scaling Factor}$$

- 1.6 A bottom-up approach means that risk would be priced at the level of individual schemes. The Board would collect the sum of all individual levies, rather than adjust the levy scaling factor in each year to reach the desired levy estimate. Individual levies would be independent from changes in other

schemes' risk profiles; a scheme's individual levy would fall if its risk decreases and would rise if its risk increases.

1.7 The key features of the proposed new formula include:

- A framework that is fixed for a period of three years, so that a scheme's levy bill would change during this period only if its risk characteristics change. This approach would support greater predictability and stability in individual scheme levies.
- A new measure of funding would be calculated in such a way that market movements would be averaged over five years to reduce volatility in assessed funding levels, and thereby scheme levies, between years. We would, however, continue to recognise contributions to improve funding in the year after they are made.
- Allowance for investment risk would be built into this new underfunding measure in the form of a funding stress to ensure that the levy reflects a scheme's risk to PPF. The stress applied would be built into the PPF's roll forward methodology based on standard scheme return data supplied through the Exchange system.
- Schemes with liabilities of more than £1.5 billion would be required to perform their own analysis of the impact of stresses on their assets, and report the results. Individual certification of investment risk would also be an optional alternative to the standard approach for all schemes. Schemes most likely to benefit from carrying out their own analysis would be those making use of derivative instruments to manage risk.
- New insolvency probabilities that are aligned with the market's view of risk and benchmarked against external practice, resulting in a narrower range of probabilities used. This would improve fairness by better reflecting the underlying risks to the PPF in a way that is consistent with market measures and our own historical claims experience.
- There would be fewer insolvency bands, with measurement averaged over one year. The levy would be less sensitive to short-term changes in the D&B Failure Score of the sponsoring employer(s). Taken together with the new insolvency probabilities, this will rebalance the levy so that funding becomes as significant as insolvency risk in determining levies.
- To keep the levy affordable and to maintain incentives to improve funding, insolvency probabilities would continue to be capped and the risk-based levy (RBL) capped relative to liabilities.

2 Levy Profiles

- 2.1 Figures A1 and A2 provide illustrative examples of the levy profile for a hypothetical scheme with liabilities of £100,000 and credit risk corresponding to PPF levy bands 1 and 5 respectively for the new formula and the current formula for 2010/11.
- 2.2 Under the current formula, each of the 100 D&B Failure Scores corresponds to a different levy profile. The proposed formula groups these D&B Failure Scores into bands. Hence the impact of the new formula on a scheme depends on the position of the sponsor's D&B Failure Score within a band. If, for instance, the scheme's sponsor has a D&B Failure Score towards the bottom of the range covered by a levy band, then the scheme has a better chance of experiencing a reduction in levy under the new formula. This effect is illustrated by the grey lines in Figures A1 and A2.
- 2.3 Figure A1 suggests that a scheme with an average D&B Failure Score for band 1 (a relatively strong sponsor – indicated by the solid black line) is likely to pay more under the proposed formula than the current formula for levels of funding up to around 95 per cent. This result is based on the scheme having average investment risk. However, if the hypothetical scheme had a lower investment risk (indicated by the green line), their levy is likely to be lower under the proposed formula for all levels of funding.
- 2.4 Figure A2 shows that a scheme with an average D&B Failure Score for band 5 (a relatively weak sponsor) and average or low investment risk would be likely to pay a lower levy under the proposed formula.
- 2.5 In summary, this analysis shows that by moving to the proposed new formula, emphasis would be shifted away from insolvency risk and towards underfunding risk. In 2010/11, a scheme with an insolvency probability of 0.03 per cent would need to be as low as 21 per cent funded to pay as much risk-based levy as a 120 per cent overfunded scheme with an insolvency probability of 3 per cent.

Figure A1: Levy Profile for Scheme with Strong Sponsor (Levy Band 1)

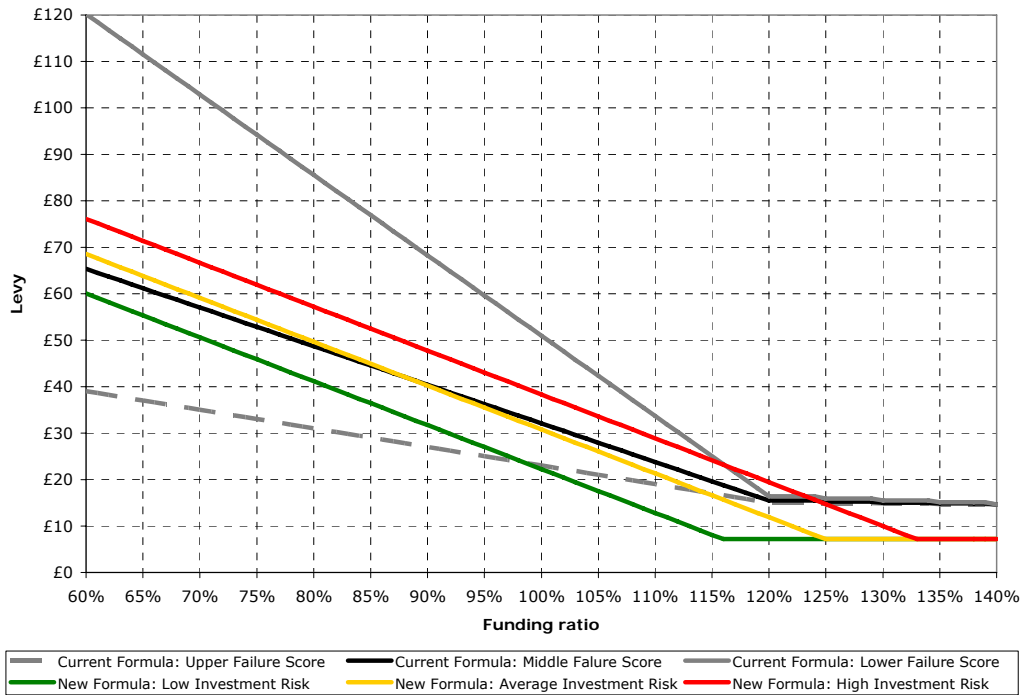
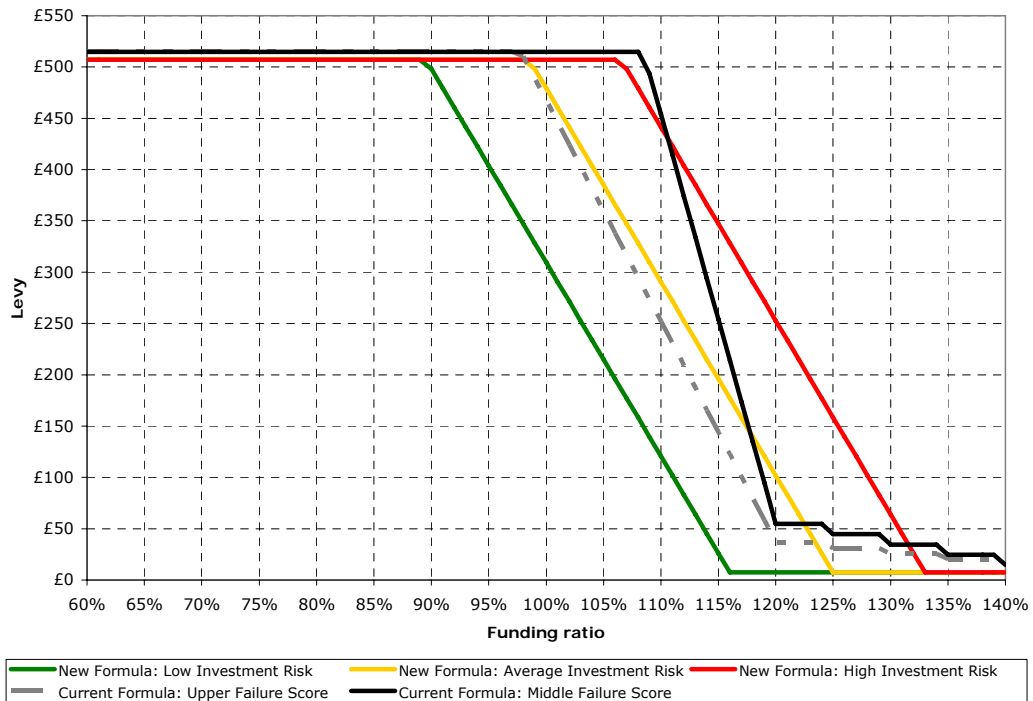


Figure A2: Levy Profile for Scheme with Weak Sponsor (Levy Band 5)

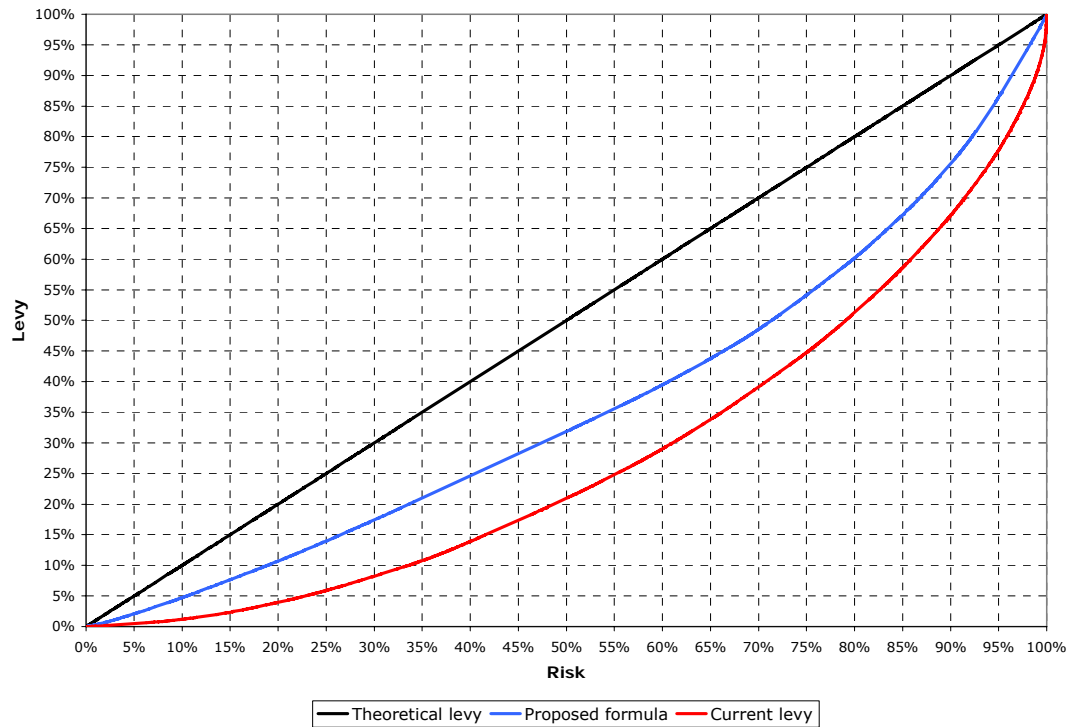


3 Impact on Fairness of Levy Distribution

- 3.1 The Steering Group agreed that a fair levy is one where the levy charged to each scheme is proportional to the level of risk that the scheme poses to the PPF. In their report for the PPF, 'Evaluating the fairness of the Risk-Based Levy', David McCarthy and Anthony Neuberger of Imperial College set out a model which values expected future claims through credit default swap prices (CDS).¹ They use this to arrive at a levy formula which reflects risk on this basis. In the following analysis, this theoretically fair levy has been used as a benchmark against which to measure the fairness of alternative levy designs.
- 3.2 The degree of fairness provided by a levy formula can be assessed by plotting its Lorenz curve and measuring how close it is to the perfectly fair position with the Gini coefficient. The Lorenz curves for the theoretically fair levy, the proposed levy and the current levy are presented in Figure A3.
- 3.3 Under a perfectly fair levy, each scheme pays according to its risk. Therefore a group of schemes which represent a certain proportion of total risk should pay the same proportion of total levy. For example, 50 per cent of the levy should be paid by schemes which present 50 per cent of the risk. This is the case for the theoretical levy, and so its Lorenz curve is diagonal, plotting equal values for cumulative risk and levy.
- 3.4 In the case of a sub-optimally fair levy, the cumulative proportions of risk and levy will differ. Schemes representing a large proportion of the risk may be paying a small proportion of the levy. The Lorenz curve in this case will not lie along the diagonal, but instead plot these unequal values. The further the Lorenz curve is from the diagonal, the more unequal the distribution.
- 3.5 It is evident from Figure A3 that the proposed formula is fairer than the current formula. Under the current formula, schemes representing 25 per cent of total risk pay only 5 per cent of total levy. Under the proposed formula, this proportion is nearer 15 per cent.
- 3.6 The fairness of a distribution is summarised using a Gini coefficient. This statistic summarises the distance of the Lorenz curve from the diagonal. A lower Gini coefficient indicates a fairer distribution. The Gini coefficient for the current formula is 44 per cent compared with 28 per cent for the proposed formula.

¹ David McCarthy and Anthony Neuberger, Evaluating the fairness of the Risk-Based Levy (July 2010). The use of CDS prices to measure risk is discussed further in Annex E.

Figure A3: Lorenz Curves for the Current and Proposed Formulae²



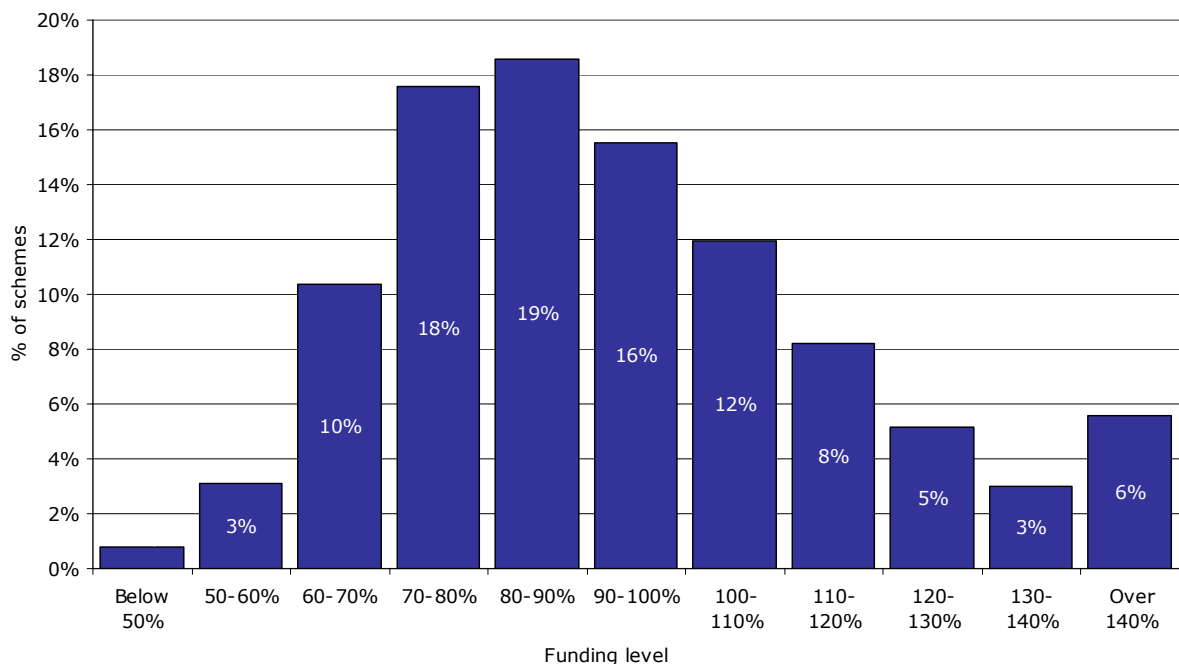
² Note that this analysis is performed on the dataset and assumptions described in Annex B.

Annex B: Impact Analysis

1 Description of the Data Set

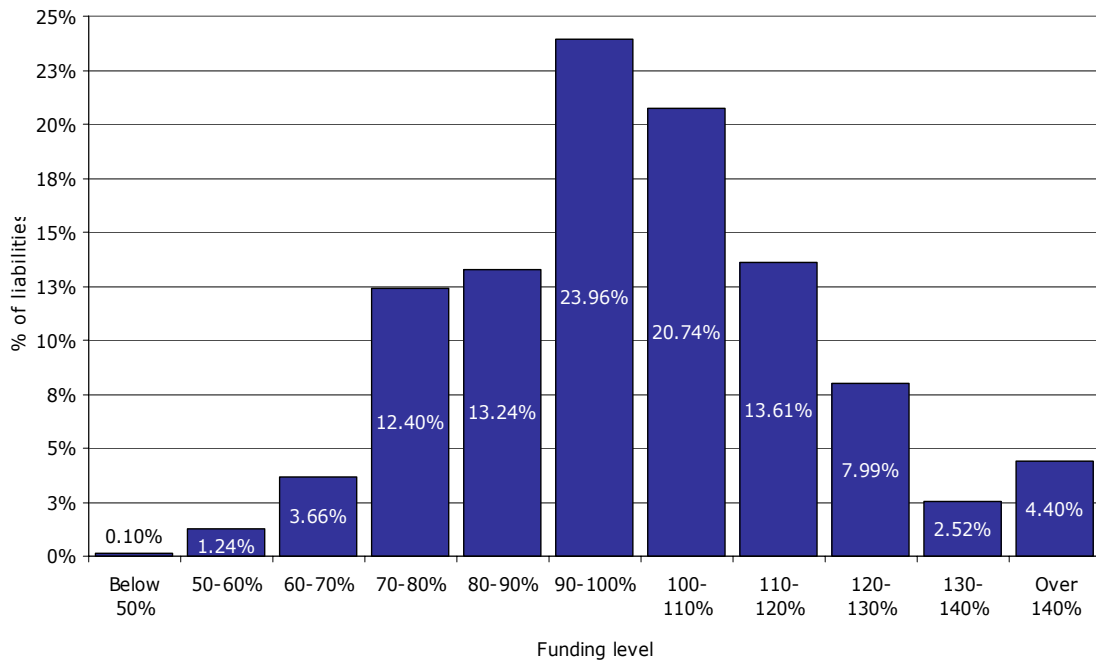
- 1.1 The data set used in the impact analysis is that used for the 2011/12 levy scaling factor calculation and includes schemes' liabilities, assets and asset allocation. Scheme funding calculations are performed on a s179 basis and exclude contingent assets and deficit-reduction contributions. All scheme data are taken at 31 March 2010.
- 1.2 Scheme funding and sponsor creditworthiness are therefore significantly improved in comparison to the 31 March 2009 dataset used for the preliminary impact analysis presented to the independent Steering Group in March 2010.³
- 1.3 Figures B1 and B2 show the distribution by funding ratio of schemes and liabilities respectively.

Figure B1: Distribution of Schemes by Funding Level as at 31 March 2010



³ The feedback document from the Steering Group is available at: http://www.pensionprotectionfund.org.uk/DocumentLibrary/Documents/levy_development_supporting_Mar2010.pdf

Figure B2: Distribution of Liabilities by Funding level as at 31 March 2010



Distribution by PPF Levy Band

1.4 Table B1 below reiterates the key features of the proposed approach to banding insolvency risk under the new levy formula, namely:

- A reduction in the number of individual insolvency probabilities;
- A narrower overall range of insolvency probabilities; and
- The inclusion of a broader measure of insolvency risk that includes a margin for risk.

Table B1: Definition of PPF Levy Bands

PPF Levy Band	D&B Failure Score		API		PPF Levy Rate
	Maximum	Minimum	Maximum	Minimum	
1	100	97	<0.075%	-	0.20%
2	96	90	<0.16%	≥0.075%	0.50%
3	89	69	<0.47%	≥0.16%	1.10%
4	68	42	<1.40%	≥0.47%	1.60%
5	41	6	3.00%	≥1.40%	4.00%
6 (capped)	5	1	3.00%	3.00%	4.00%

1.5 Distribution of schemes and liabilities for the 2011/12 levy year by PPF levy bands is shown in the following two charts.

Figure B3: Distribution of Schemes by Levy Band

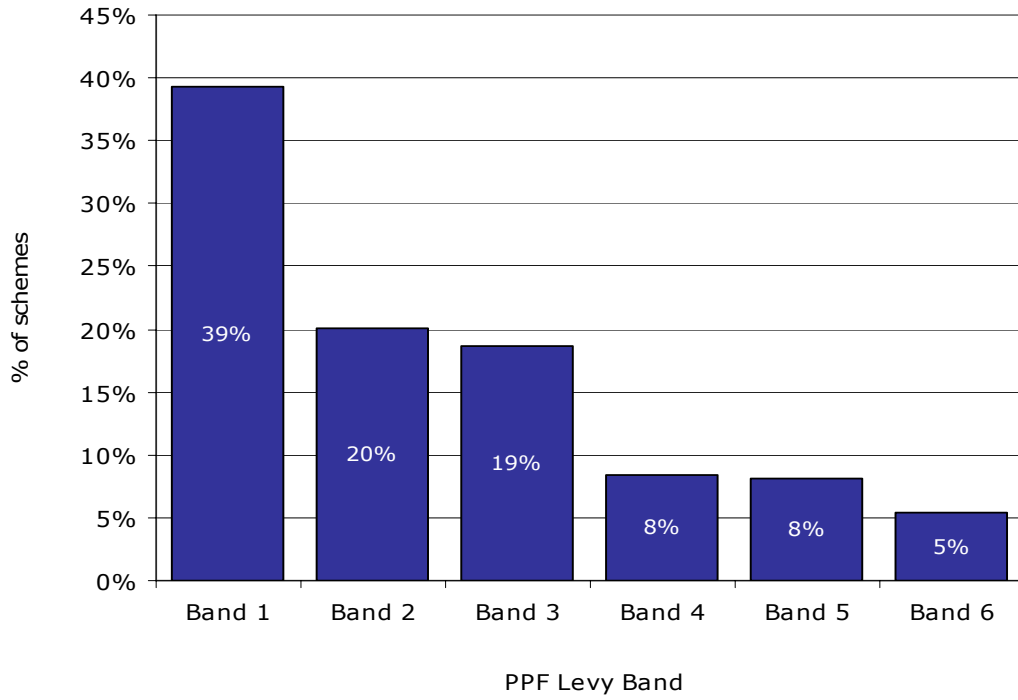
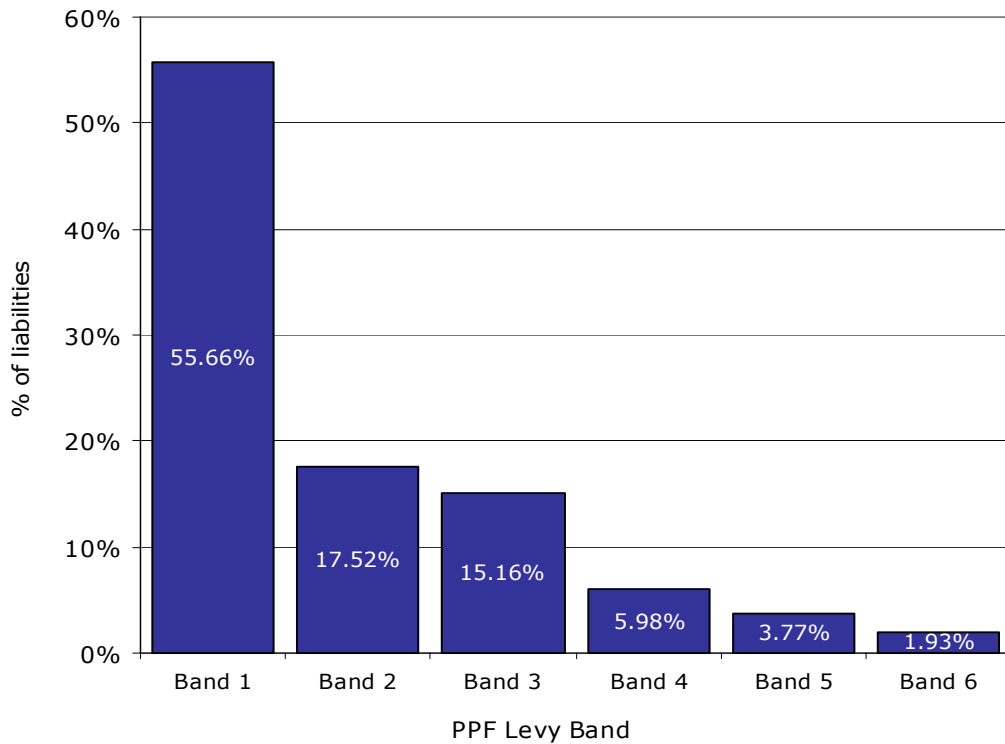


Figure B4: Distribution of Liabilities by Levy Band



1.6 Nearly 40 per cent of schemes fall into the first levy band. These schemes tend to be large, collectively constituting more than 55 per cent of total liabilities. In comparison, schemes in the worst credit band (band 6) together represent less than 2 per cent of total liabilities.

2. Impact Analysis

Overview

2.1 A primary objective of the new levy formula is to better align scheme levies (as assessed by the PPF), both now and in the longer term, to the risk they pose. To achieve this, the overall effect of the new approach is to emphasise funding over covenant in calculating schemes’ levy bills. This would provide schemes with a greater opportunity to proactively reduce their levy.

2.2 As this impact analysis shows, the expected impact of the new formula on schemes according to their funding and insolvency risk profiles is as follows:

- Schemes with strong funding positions generally gain as a result of the proposed new levy formula. Schemes that have very high levels of funding would see decreases in their levy across all insolvency bands;
- Schemes with strong employers (levy bands 1 and 2) but weak funding would tend to pay more, reflecting the risk across the cycle these schemes pose to the PPF; and
- Schemes with weaker employers (levy bands 4 to 6) would pay less, with the exception of those that are very poorly funded.

2.3 For the purpose of the impact analysis, scheme funding is assessed on a stressed value basis. Schemes’ funding levels are ranked according to the funding position measured after the stress scenarios. This is essentially a ranking of scheme funding adjusted for investment risk.

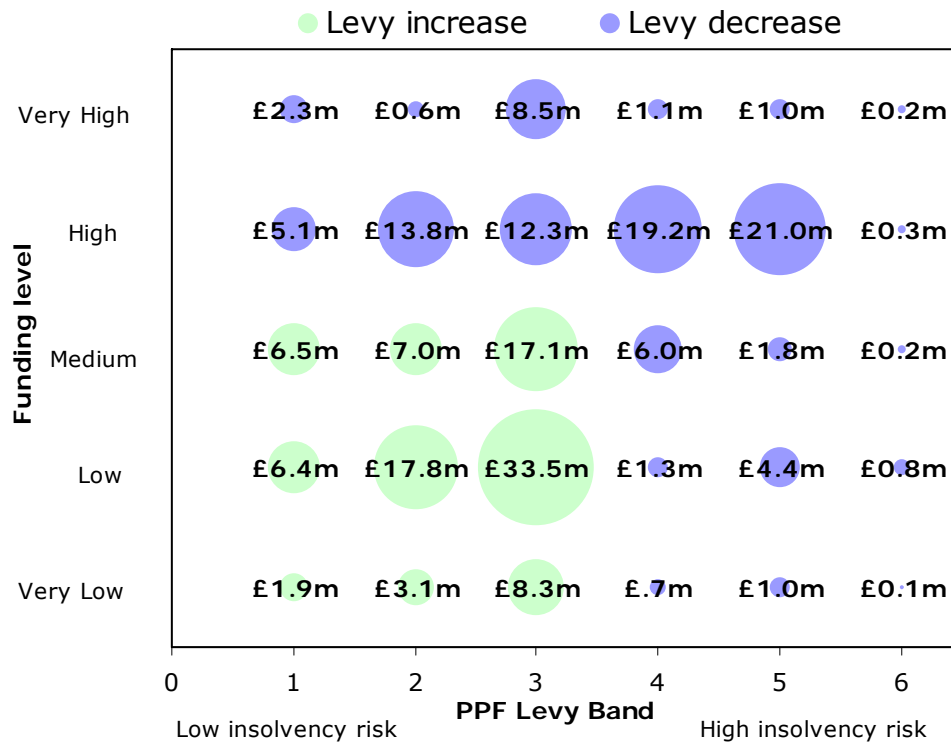
2.4 As defined in Table B2, each funding level category represents 20 per cent of all schemes. For example, the “very low” scheme funding category corresponds to the bottom 20 per cent of funding ratios under stressed conditions, “low” corresponds to the next 20 per cent and “very high” to the top 20 per cent. Table B2 relates these categories to stressed and point-in-time funding levels.

Table B2: Definition of Funding Level Rating

Funding level rating	Range of stressed and smoothed funding levels	Point-in-time funding level as at 31/03/2010
Very low	Less than 50%	67%
Low	50% to 59%	78%
Medium	59% to 70%	90%
High	70% to 85%	103%
Very high	Greater than 85%	135%

- 2.5 The preliminary impact analysis was performed with reference to the 2010/11 levy. This was based on scheme data as at 31 March 2009. To understand how the impact of the proposed levy formula might vary over time, a second impact analysis was performed on the basis of the funding levels as at 31 March 2010.
- 2.6 The findings of the impact analysis in reference to 2010/11 scheme data are summarised in Figures B5 to B7. For all strengths of scheme covenant, poorly-funded schemes would pay more whereas well-funded schemes would pay less. In summary, the 2010/11 impact analysis shows that the new formula had the effect of increasing the importance of funding relative to strength of scheme's covenant.

Figure B5: Impact of New Formula, Compared to 2010/11 (in £millions)



- 2.7 Figure B6 below shows this change in levy as a percentage of what schemes would have paid in 2010/11. The largest decrease in levy in relative terms would be experienced by very well-funded schemes with poor covenant. This group would pay 95 per cent less than in the current framework for 2010/11.

Figure B6: Impact of New Formula, Compared to 2010/11 (as percentage change in levy)

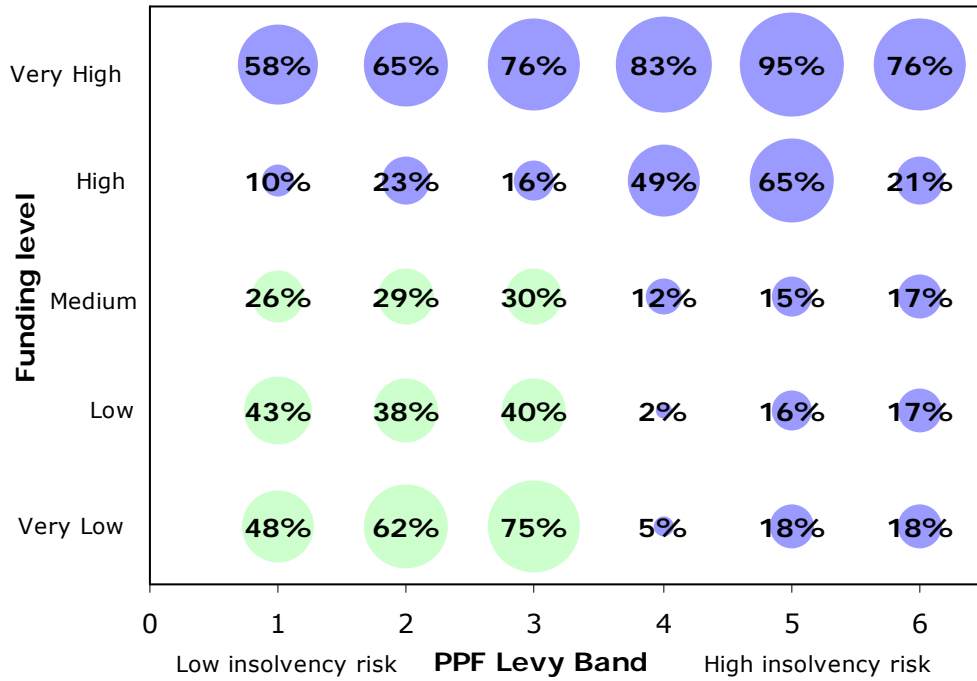
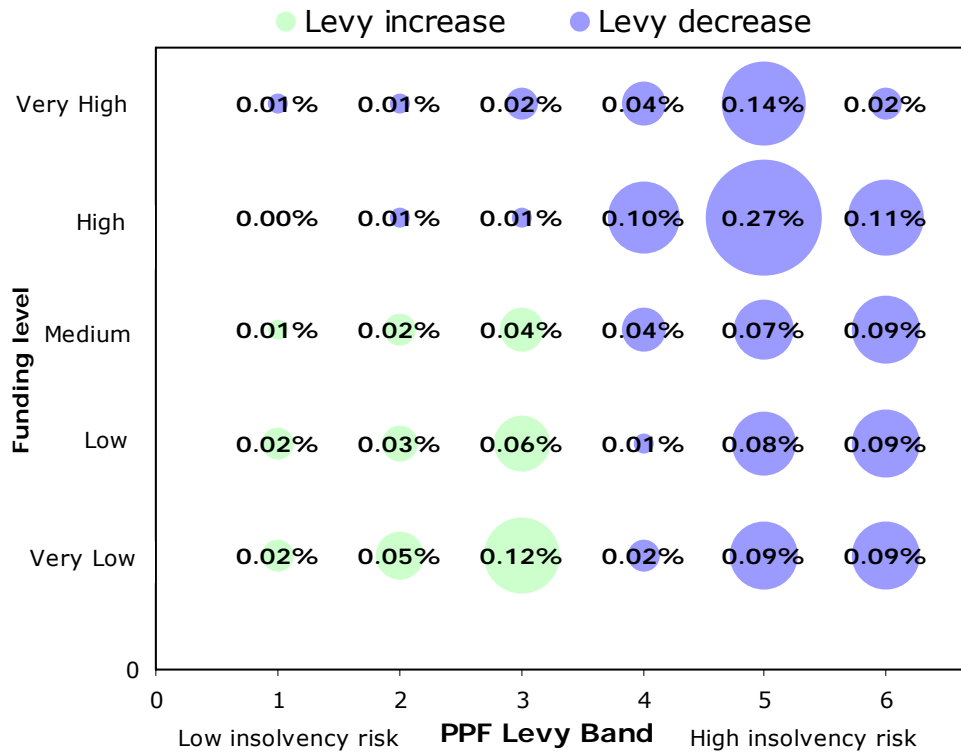


Figure B7: Impact of New Formula, Compared to 2010/11 (as percentage of liabilities)



- 2.8 Tables B3 and B4 below show the proportion of total levy paid by each group of schemes, defined by PPF Levy Band and scheme funding level, under the current and new formulae as applied to 2010/11 data.

Table B3: Total Levy paid by Funding and Levy Band groups for 2010/11, current formula (£million)

<i>Funding Level</i>	PPF Levy Band						Total
	1	2	3	4	5	6	
<i>Very Low</i>	3.9	5.0	11.1	15.4	5.4	0.6	41.4
<i>Low</i>	14.8	46.7	84.0	54.7	28.0	4.7	232.9
<i>Medium</i>	24.9	24.3	57.8	48.7	11.8	1.1	168.7
<i>High</i>	49.8	60.9	75.0	39.1	32.2	1.6	258.6
<i>Very high</i>	3.9	1.0	11.1	1.3	1.1	0.2	18.5
<i>Total</i>	97.3	137.9	239.0	159.1	78.5	8.2	720.0

Table B4: Total Levy paid by Funding and Levy Band groups for 2010/11, new formula (£million)

<i>Funding Level</i>	PPF Levy Band						Total
	1	2	3	4	5	6	
<i>Very Low</i>	5.8	8.1	19.4	14.6	4.4	0.5	52.9
<i>Low</i>	21.2	64.5	117.5	53.4	23.7	3.9	284.1
<i>Medium</i>	31.4	31.4	74.9	42.7	10.0	0.9	191.3
<i>High</i>	44.7	47.0	62.7	20.0	11.2	1.2	186.8
<i>Very high</i>	1.6	0.3	2.6	0.2	0.1	0.1	4.9
<i>Total</i>	104.7	151.4	277.1	130.9	49.4	6.6	720.0

- 2.9 The findings of the impact analysis with reference to 2011/12 scheme data are summarised in Figures B8 to B10. These charts show that the schemes that would gain most from the new levy formula are those with relatively weak covenants and those with very high funding ratios and most with high funding levels. The fact that well-funded schemes tend to gain regardless of their insolvency probability illustrates the emphasis the new formula places on scheme funding. The marginal increase in levy for schemes with the weakest funding and sponsors reflects those schemes with high investment risk. In these cases, a return-seeking allocation adversely affects funding levels measured on a stressed basis.

Figure B8: Impact of New Formula, Compared to 2011/12 (in £millions)

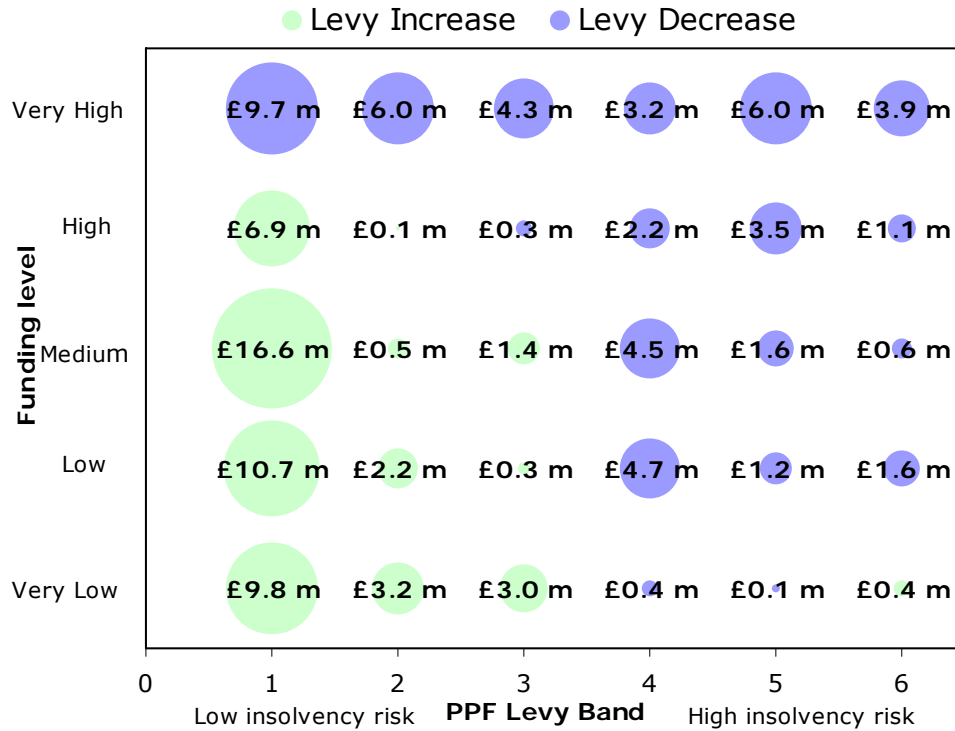
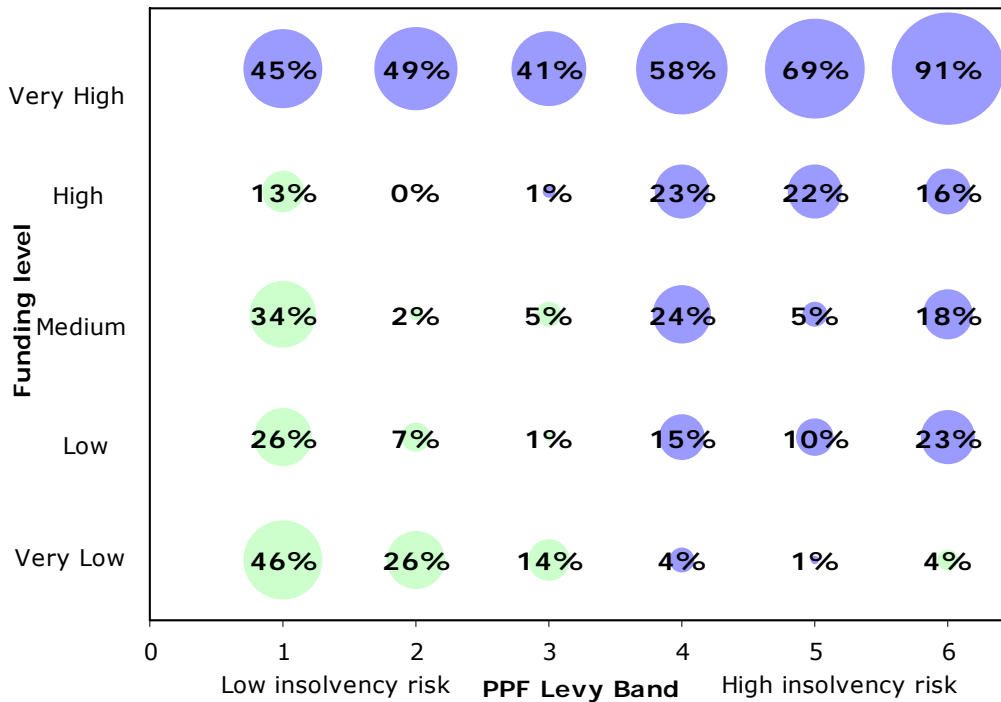
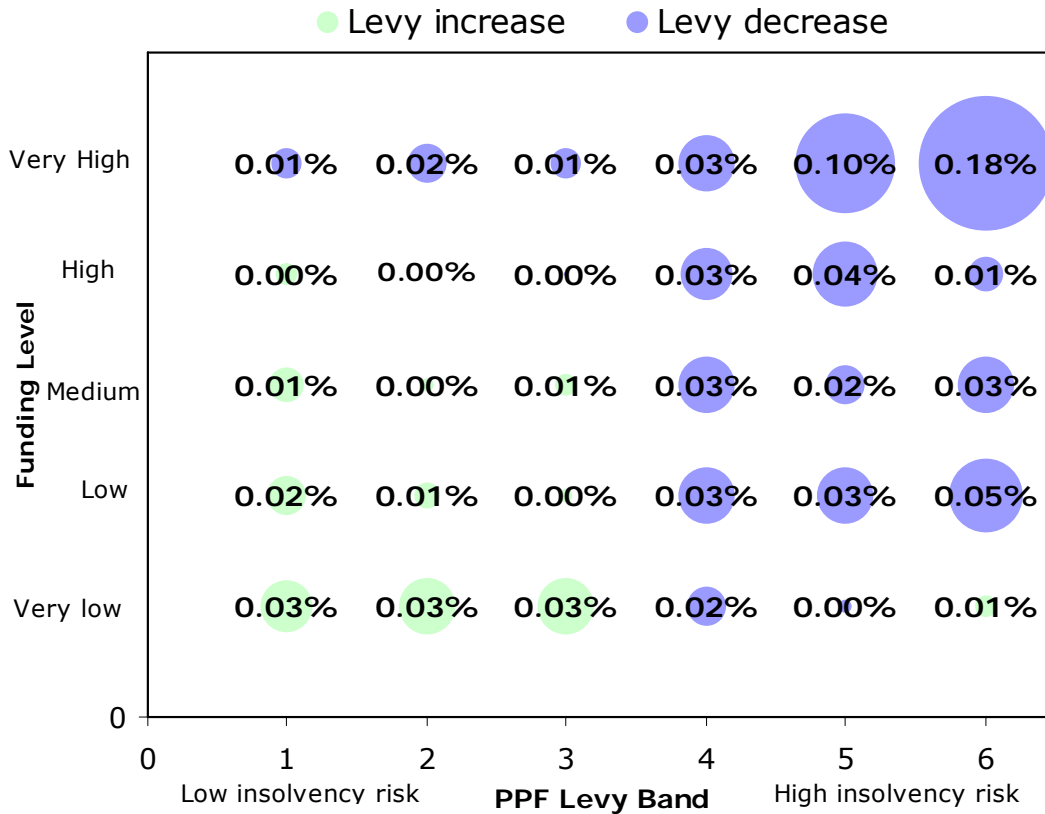


Figure B9: Impact of New Formula, Compared to 2011/12 (as percentage change in levy)



2.10 Measured in liability terms, the impact of the proposed formula relative to scheme size is much greater for the winners than for the losers (see Figure B10). For example, schemes in the top three levy bands with low funding levels collectively experience a substantial increase in absolute levy. When measured in terms of scheme liabilities, however, this impact is only around 0.03 per cent. In comparison, the reduction in levy for lowest-rated schemes with the strongest funding is almost 0.2 per cent of their liabilities.

Figure B10: Impact of New Formula, Compared to 2011/12 (as percentage of liabilities)



2.11 Tables B5 and B6 show the total levy that each group pays under the current formula for 2011/12 compared to what they would pay with the new formula. For example, very well-funded schemes would pay £30.0 million in total compared to £63.1 million with the current formula.

Table B5: Total Levy paid by Funding and Levy Band groups for 2011/12, current formula (£million)

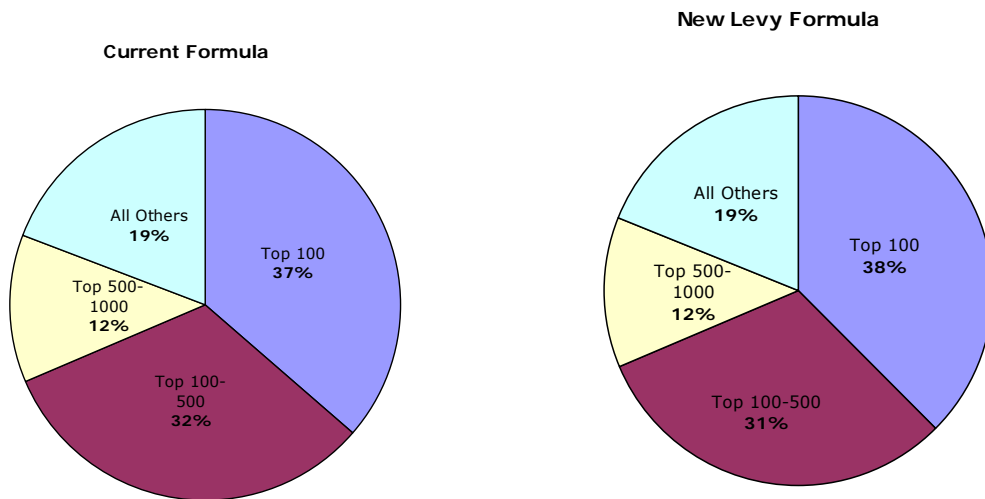
PPF Levy Band							
<i>Funding Level</i>	1	2	3	4	5	6	Total
<i>Very Low</i>	21.1	12.1	20.9	9.7	11.0	9.5	84.3
<i>Low</i>	41.3	33.0	28.5	31.2	11.8	6.9	152.8
<i>Medium</i>	49.4	29.9	29.0	18.4	29.9	3.4	160.1
<i>High</i>	55.1	27.8	23.9	9.6	16.1	7.2	139.7
<i>Very high</i>	21.8	12.3	10.4	5.5	8.7	4.3	63.1
<i>Total</i>	188.8	115.1	112.7	74.5	77.6	31.2	600.0

Table B6: Total Levy paid by Funding and Levy Band groups for 2011/12, new formula (£million)

PPF Levy Band							
<i>Funding Level</i>	1	2	3	4	5	6	Total
<i>Very Low</i>	30.9	15.3	23.8	9.3	10.9	9.9	100.0
<i>Low</i>	52.0	35.2	28.8	26.6	10.7	5.3	158.5
<i>Medium</i>	66.0	30.4	30.4	13.9	28.4	2.8	171.9
<i>High</i>	62.1	27.9	23.6	7.4	12.6	6.1	139.6
<i>Very high</i>	12.1	6.3	6.1	2.3	2.7	0.4	30.0
<i>Total</i>	223.0	115.1	112.8	59.5	65.2	24.4	600.0

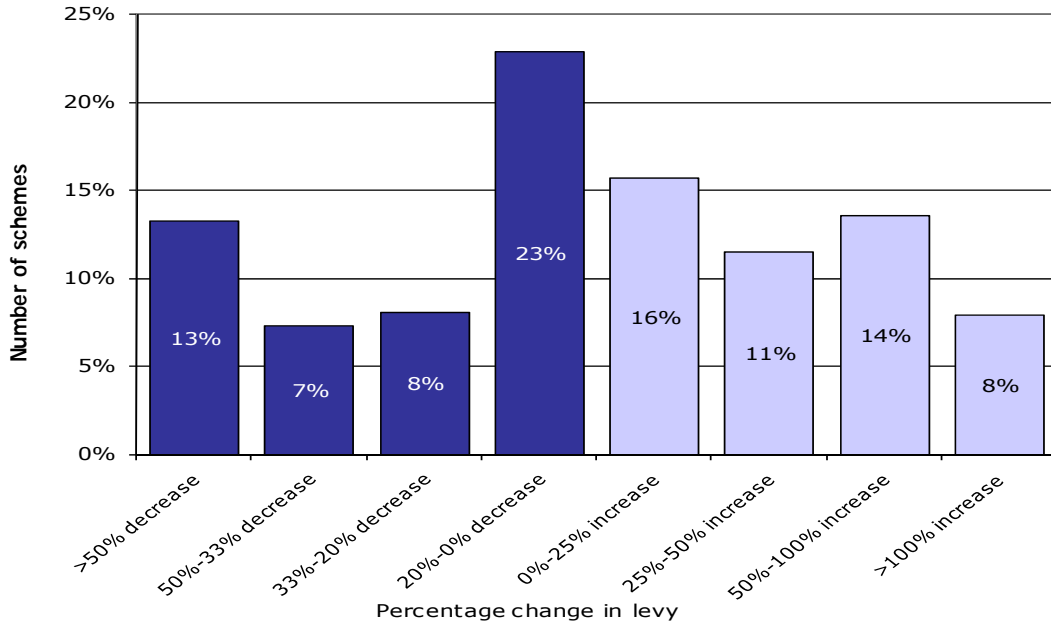
2.12 Figures B11 and B12 below show that the proportion of the levy paid by the groups of schemes, by reference to size, is similar under both the current and new formulae. The top 100 schemes pay 37 per cent with the current formula, compared to 38 per cent with the new formula, while the top 100-500 pay 32 per cent and 31 per cent respectively.

Figures B11 and B12: Distribution of Current and New Formulae



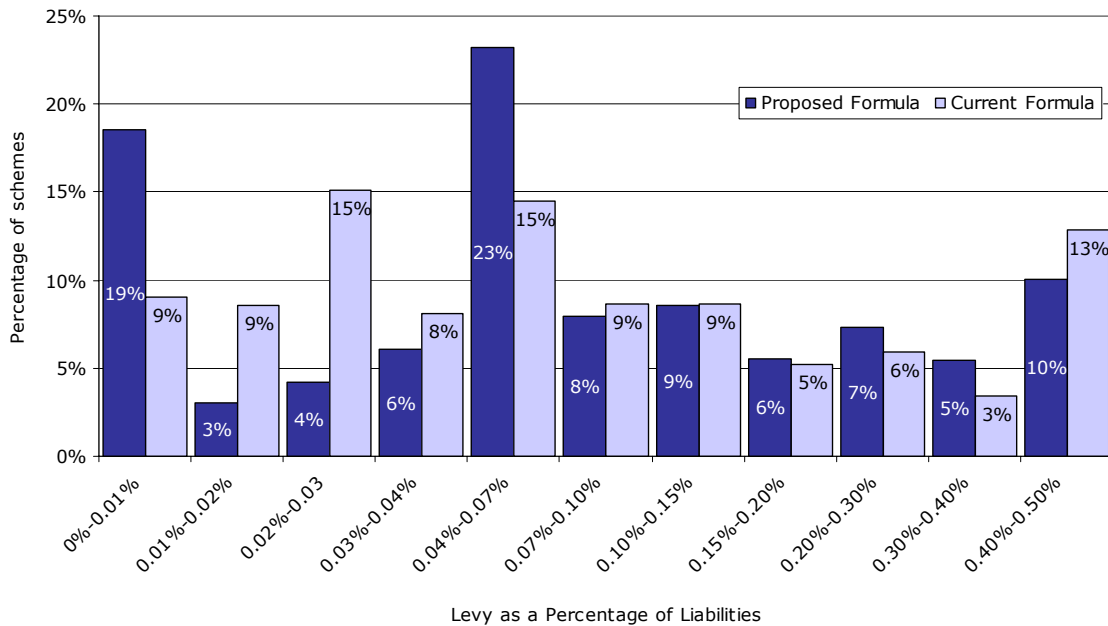
2.13 Figure B13 shows us that 13 per cent of schemes see their levy halved, while 8 per cent of schemes will see their levy bill double. This is because those that would pay more under the proposal are generally schemes which currently pay a very low levy due to a strong D&B Failure Score. The switch of emphasis towards funding, in many cases combined with the presence of significant investment risk, produces a number of cases who see their levy rise from a relatively low base. A large proportion of schemes (39 per cent) experience a change of between -20 per cent and + 25 per cent.

Figure B13: Distribution of Schemes by Change in Total Levy



2.14 Figure B14 shows that the new formula makes the levy moderately more affordable. Fewer schemes pay between 0.4 per cent and 0.5 per cent of their liabilities in levy. Under the new formula there would be more schemes paying no RBL. These schemes would also benefit from a reduced SBL.

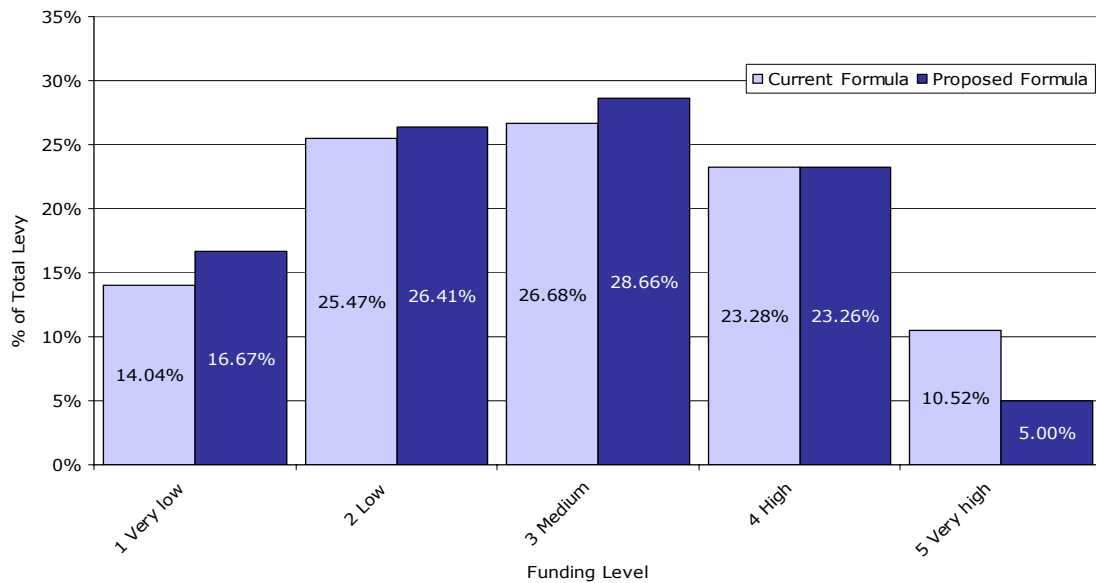
Figure B14: Levy Distribution as a Percentage of Liabilities



2.15 Figure B14 also indicates that under the proposed formula there is likely to be a decrease in the percentage of schemes paying a levy of between 0.01 and 0.04 per cent of liabilities. This reflects that schemes with average to poor funding levels and strong covenants would pay more levy under the proposed formula. It also helps to explain the significant increase in the percentage of schemes paying a levy of between 0.04 and 0.07 per cent of liabilities.

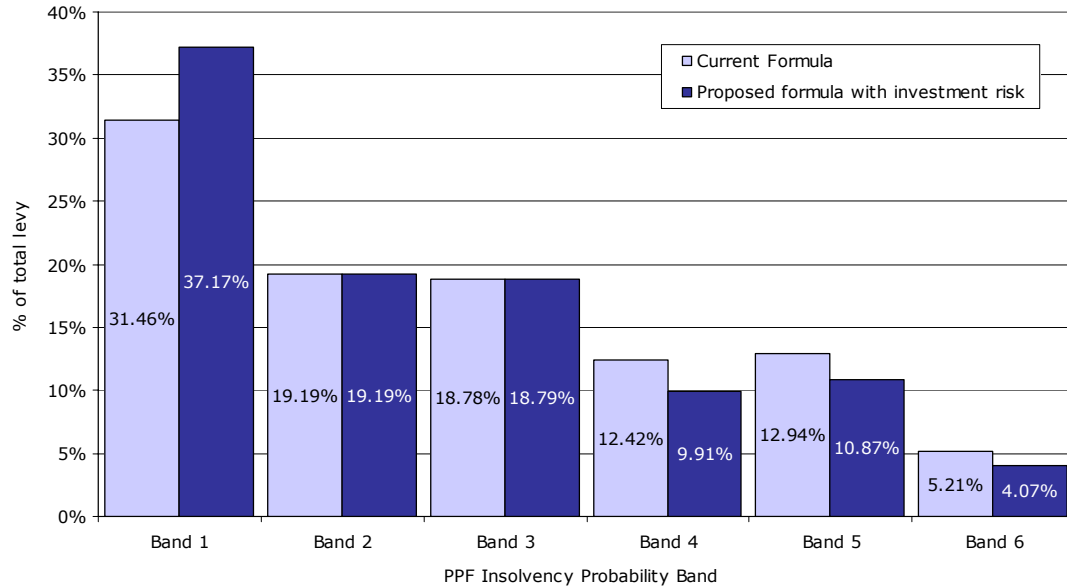
2.16 Figure B15 below shows that the contribution to the total levy by those with very strong funding positions is expected to halve under the new formula.

Figure B15: Levy Distribution by Funding Level



2.17 The new levy formula entails the addition of a risk margin to the insolvency probabilities derived by D&B Failure Scores. This produces levy rates that better align with market rates and PPF experience. Schemes with weaker covenants will benefit as a result of this change. The incorporation of this risk margin in the proposed levy formula is likely to result in those with the strongest covenant paying more levy, as shown in Figure B16.

Figure B16: Levy Distribution by Levy Band



The Inclusion of Investment Risk

2.18 Figures B17 and B18 provide a measure of investment risk based upon asset allocation information available at the 31 March 2010 measurement date.

Figure B17: Distribution of Schemes by Scheme Investment Risk

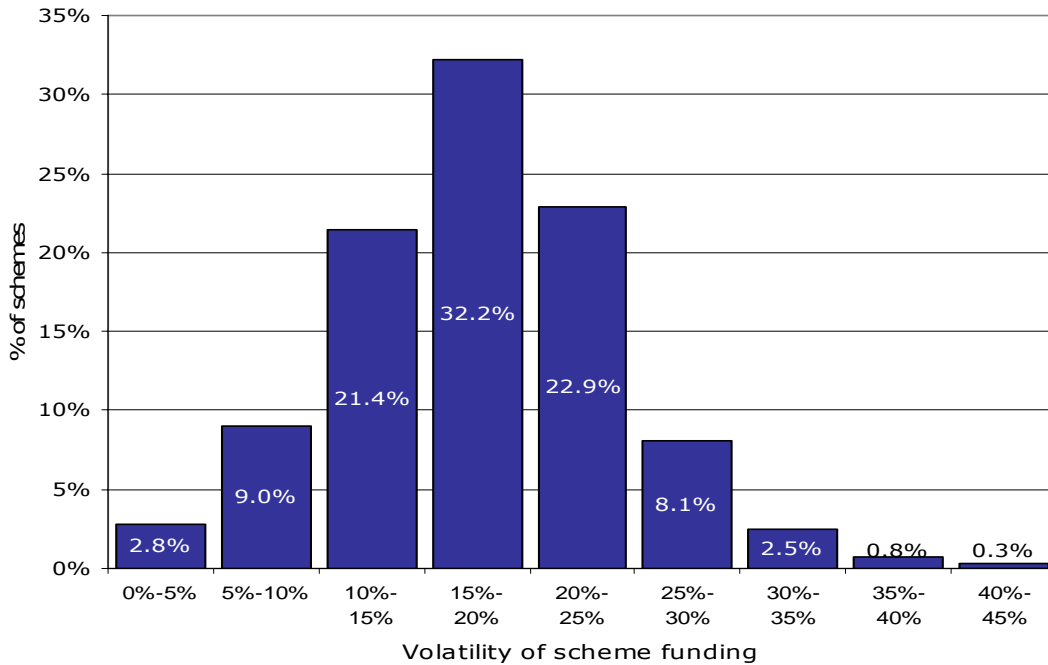
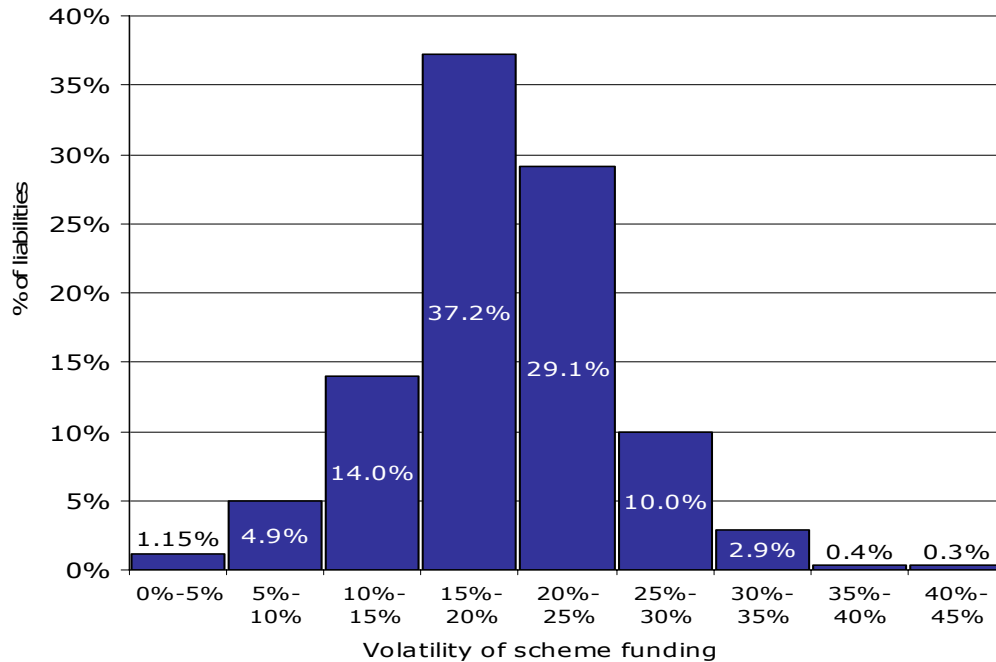


Figure B18: Distribution of Liabilities by Scheme Investment Risk



2.19 Figure B17 also shows that funding volatility is greater than 25 per cent for around 12 per cent of schemes. Funding volatility is less than 10 per cent for a further 12 per cent of schemes. Using this as a measure of investment risk, however, potentially mis-states risk for some schemes due to its inability to identify subtle differences in investment approach and distinguish cases in which derivatives are employed. The proposed approach as part of the new levy framework enables a more accurate quantification of investment risk and, for the largest 100 schemes, allows for the levy to recognise appropriately these derivative strategies.

2.20 Analysis based on a theoretical modelling of fairness shows that the inclusion of investment risk would improve the fairness of the levy as individual bills would more accurately represent the risk schemes pose to the PPF.⁴ Under the proposed formula, a well-funded scheme with well-matched assets and liabilities could be able to pay a lower levy than a similarly well-funded scheme with assets that deteriorated markedly in relation to its liabilities under stressed circumstances. A levy formula with no response to investment risk is unable to account for the risk of a future deficit arising from poorly-matched assets.

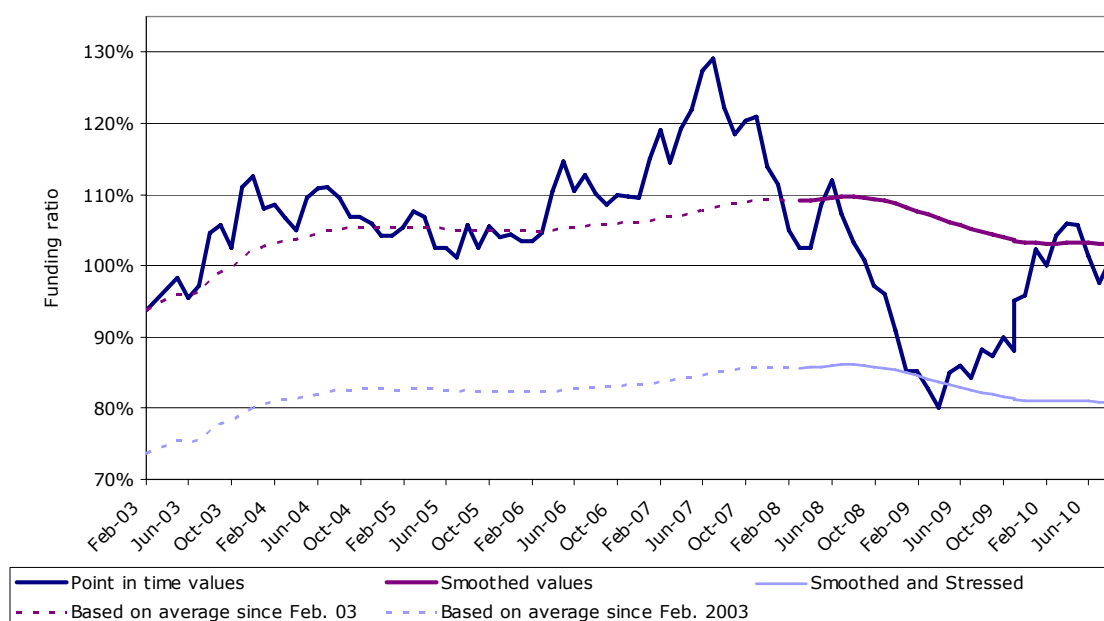
Smoothing Assets and Liabilities

2.21 The method we propose for smoothing funding is to value scheme assets and liabilities (on the basis of the latest s179 valuation) according to retrospective five-year averages for the relevant indices. This method gives full credit to deficit-reduction contributions and deals with block transfers as in the current formula.

⁴ This was one of the conclusions of McCarthy and Neuberger, Evaluating the fairness of the Risk-based Levy (July 2010).

- 2.22 The five-year smoothing horizon is chosen in order to adjust for the impact of the economic cycle on financial markets. Five years approximates the average cycle length for the UK economy since 1958.⁵
- 2.23 The default stresses applied by the PPF would be set so that there would be an 84 per cent level of confidence that the stresses that could actually occur would be adequately captured.
- 2.24 Figure B19 displays the effect of smoothing on aggregate funding levels and shows the lower level of volatility this measure introduces.⁶

Figure B19: Effect of Smoothing and Stressing on Funding Ratio



- 2.25 Figures B20 and B21 show the distribution of schemes and liabilities by funding level. Funding level is measured under three bases: point in time funding as at 31/03/2010 (blue bars), smoothed funding (claret bars) and stressed funding (lilac bars).
- In the dataset the average scheme funding as at 31 March 2010 is 100 per cent.
 - As at 31 March 2010, scheme funding appears better than the five year moving average which is 93 per cent.
 - After smoothing and applying the stresses, average scheme funding falls to 73 per cent. The average margin for investment risk is 25 per cent and average volatility is 20 per cent.

⁵ As derived from OECD Business Cycle analysis, the average cycle length for the 11 UK cycles in the period is 4.6 years, although there is variation in the length of individual cycles.

⁶ Smoothed data from February 2008 is based on 5-year moving average; Feb. 2003 – Feb. 2008 is the average since start of series.

- Very poorly funded schemes (below 50 per cent on stressed value basis) are mainly small schemes. These schemes represent 19 per cent of the scheme population but only 7 per cent of total liabilities.

Figure B20: Distribution of Schemes by Funding Ratio

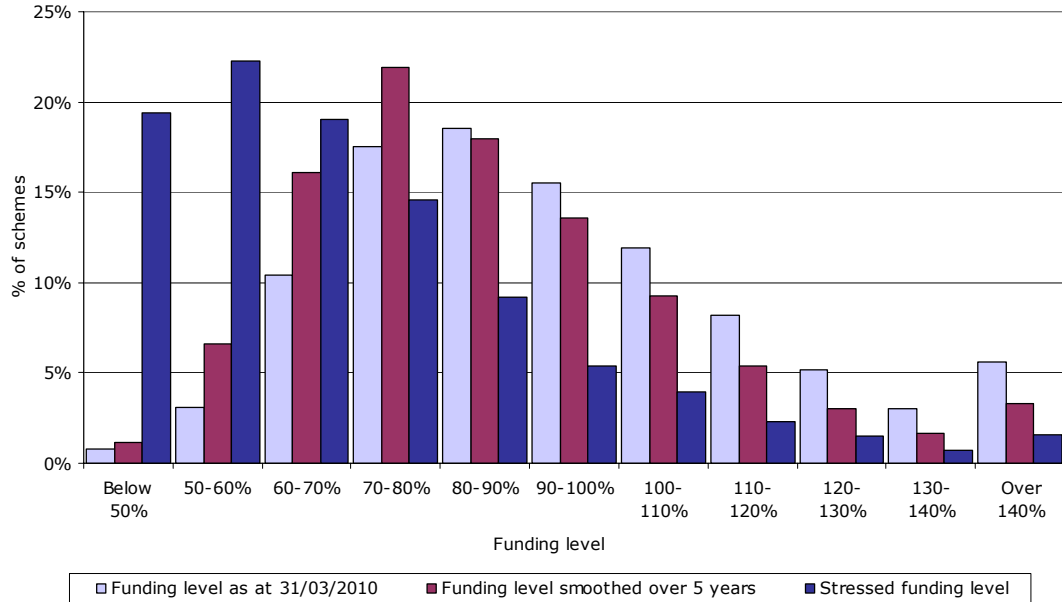
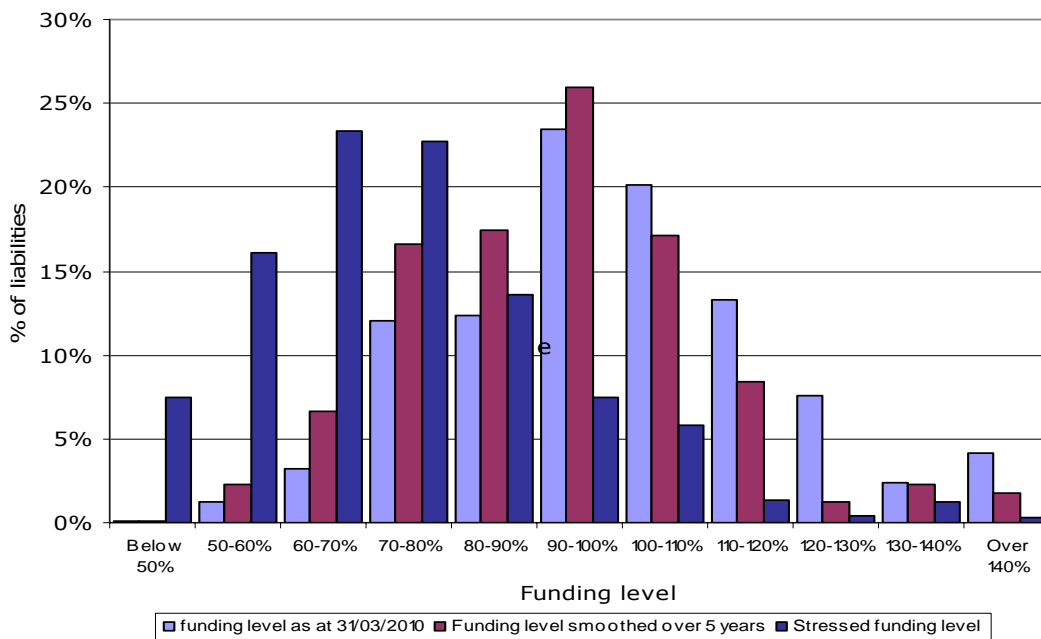


Figure B21: Distribution of Scheme Liabilities by Funding Ratio



Annex C: Stability Analysis

1 Overview

- 1.1 The new levy formula has been applied to scheme data for the levy years 2008/09 to 2010/11. Over this period, the year-on-year change in the total levy ranges between minus 11 per cent and plus 11 per cent (see Table C1). The intention is to simulate what would have happened to the total levy raised by the PPF had it adopted the new formula in 2008-2011.
- 1.2 To understand how individual scheme levies would have changed, we analysed scheme data for levy years 2009/10 and 2010/11. This suggests that the proposed formula produces greater stability in individual levies than the current formula.
- 1.3 This analysis does not include the effect of averaging levy bands, which would be expected to further reduce volatility of levies at aggregate and scheme levels.

2 Description of Data Set

- 2.1 Latest scheme s179 valuations were rolled backwards/forwards on the basis of the most up-to-date asset allocation data to derive point-in-time funding estimates at 31 March 2009 and 31 March 2010.
- 2.2 Smoothed funding estimates for the levy years 2008/09, 2009/10 and 2010/11 were calculated on the basis of five-year averages for relevant market indices. Market data between 31 October 2002 and 31 March 2010 were required for this process.
- 2.3 Changes in the values of total scheme assets and liabilities due to differing values for the relevant market indices used in the five-year smoothing approach are shown in Table C1 below.

Table C1: Changes in Total Scheme Assets and Liabilities between Levy Years, 2008/09 to 2010/11

Period	Change in total scheme assets	Change in total scheme liabilities
2008/09 to 2009/10	+3.6%	-2.5%
2009/10 to 2010/11	+5.5%	+7.6%

3 Analysis of Stability - Aggregate Levy

- 3.1 Table C2 below shows the risk-based levy (RBL) and total levy generated by applying the proposed levy formula to the scheme funding data described in

section 2. The total levy declines 11 per cent from 2008/09 to 2009/10 and rises by 11 per cent from 2009/10 to 2010/11.

Table C2: Fluctuations in the RBL and Total Levy under the New Formula

Year	RBL (£M)	Total Levy (£M)	% Change in Levy
2008/09	638.5	674.9	
2009/10	561.8	598.3	-11%
2010/11	625.3	661.8	+11%

3.2 There would have been a fall in total levy from 2008/09 to 2009/10, largely attributable to a change in the assumptions guiding the s179 basis (A3 to A4), which acted to strengthen measures of scheme funding. An increase from 2009/10 to 2010/11 would have resulted due to a material increase in funding and credit risk.

3.3 The change in levy between 2008/09 and 2009/10 provides limited information because the same D&B Failure Scores were used for both levies. The change between 2009/10 and 2010/11, however, incorporates changes in D&B Failure Scores in addition to changes in funding. A decomposition of these effects is presented below in Table C3.

Table C3: Components of RBL Changes

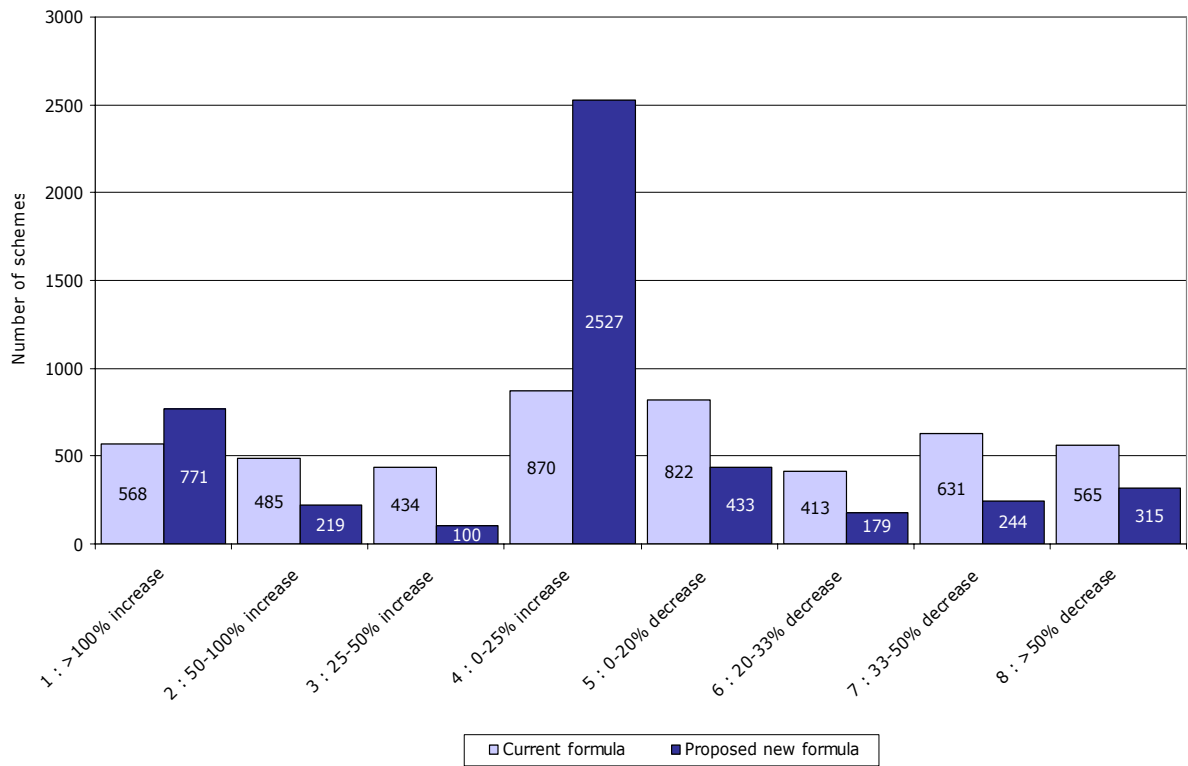
Year	Parameters	RBL (£)	% Change	Cause of Change
2009/10	Risk-Based Levy	561.8		
2010/11	RBL with 2009/10 D&B Failure Scores	635.0	13.0%	Change in scheme funding positions
2010/11	Risk-Based Levy	625.3	-1.5%	Change in D&B Failure Scores

4 Analysis of Stability – Individual Levies

4.1 The following analysis compares movements in individual levies under the current and proposed formula between the 2009/10 and 2010/11 levy years. In calculating levies under the new formula, we set the levy parameters to achieve a total levy collection of £675 million in 2008/09. Levies for 2009/10 and 2010/11 were then calculated according to parameters fixed at these values. For levies under the current formula, the total collection was fixed at £675 million across the three levy years with the scaling factor varying to accommodate changes in aggregate scheme risk. As would have been expected for the choice of year selected (which would have seen an 11 per cent rise in total levies due to the impact of the recession on scheme funding), more schemes see an increase than a decrease in levy.

4.2 Figure C1 below shows that overall, at a scheme level, the proposed new levy formula also yields greater stability compared to the current formula. Note particularly that under the proposed new levy formula there is a spike in the number of schemes experiencing a zero to 25 per cent increase in their levy bill. This increased stability derives from the use of smoothed funding data and banded insolvency risks.

Figure C1: Increases and Decreases in Levy at Scheme Level



Annex D: Impact of including investment risk on scheme asset allocation

1 Background

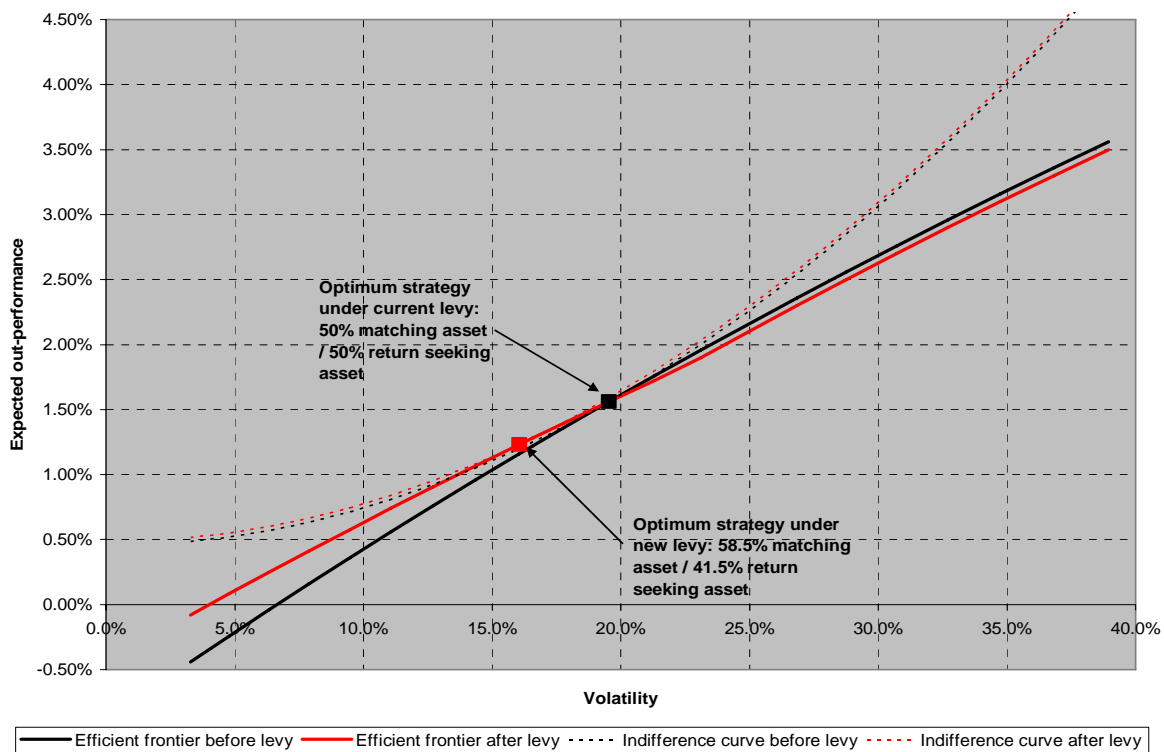
- 1.1 Incorporating investment risk in the levy formula might, in principle, be expected to provide schemes with an incentive to reduce the level of risk in their portfolio to lower their levy, for example by diversification, or through replacing return-seeking assets such as equities with matching assets such as bonds. In doing so, however, the scheme may have to accept lower returns on its investments.
- 1.2 This analysis seeks to assess the extent to which it would be rational for schemes to de-risk in response to the proposed levy, based on a theoretical modelling of schemes' asset allocation decision. A key message of this analysis is that a transparent explanation of any change in incentives reduces the chance of a disproportionate adjustment in scheme behaviour.

2 Summary of the Analysis

- 2.1 To estimate the impact, we assumed that all trustees behaved rationally and were faced with a simple trade-off between the volatility of their scheme's funding level (i.e. risk) and the potential outperformance of their assets over their liabilities (i.e. return). This outperformance potential derives from the risk premium believed to apply to return-seeking assets such as equities. At the same time, return-seeking assets do not match liabilities and produce volatility in the scheme's funding level.
- 2.2 We also assumed that the investment strategy pursued by schemes prior to the introduction of the new levy formula was optimal in terms of striking the right balance between risk and return from the trustees' point of view. This assumption enables us to infer pension scheme trustees' preferences between risk and return.
- 2.3 We then calculated new optimal asset mixes after taking into account the impact of the levy on the return of the schemes' assets. Our findings are that the inclusion of an investment risk factor in the levy:
 - Has little effect on a scheme's investment strategy when its sponsor is strong because in this case the risk-based levy is small relative to the potential asset out-performance;
 - Has a more significant impact when the sponsoring employer is weak; and,
 - Has limited overall impact on aggregate scheme investment strategy, as most large schemes exhibit a low sponsor insolvency probability.

- 2.4 Figure D1 below shows how the levy affects pension schemes' efficient frontier when an investment risk factor is introduced into the formula. The analysis presented relates to a relatively weak employer with a relatively high levy as a proportion of scheme assets. For such a scheme, the introduction of the new formula reduces the marginal increase of return per unit of risk taken (i.e. the slope of the efficient frontier) for low and moderate levels of investment risk. This reduction in marginal benefit derives from an increase in levy as investment risk rises. As more risk is taken, the levy becomes capped and there is no increase in levy with further investment risk, the slope of the efficient frontier remains as before. The scheme's relative preference between risk and return (represented by the slope of the dashed indifference curve) is constant and so a lower risk strategy is chosen.
- 2.5 We have graphed efficient frontiers only for schemes sponsored by weak employers because the efficient frontier barely changes when the employer is strong i.e. when the levy is small compared to investment out-performance.
- 2.6 In the case where the scheme's levy is capped even at very low levels of investment risk, the efficient frontier is shifted without any change in its slope. As a result, capped levy payers would make the same investment choice before and after the introduction of investment risk into the levy formula.

Figure D1: Effect of the Levy with an Investment Factor on Trustees' Investment Decision



- 2.7 Table D1 below shows the modelled change in optimal asset allocation by levy band. Schemes in Band 1, those with the lowest levy as a percentage of scheme assets, are modelled as only marginally increasing their allocation to matched assets (by 0.5 per cent). These schemes are assumed to pay uncapped levies.

Multiplying the change in asset allocation by the proportion of total scheme assets provides a 0.3 per cent shift in total scheme assets towards matching assets. Applying the same approach to the other levy bands would produce an aggregate shift in scheme assets of 1.2 per cent.

Table D1: Change in Optimal Asset Allocation by Levy Band

Levy band	% total scheme assets in band (a)	% assets reallocated to matching investments (b)	% uncapped schemes (c)	Aggregate Re-allocation (a*b*c)
Band 1	57%	0.5%	100%	0.3%
Band 2	18%	1.0%	100%	0.2%
Band 3	16%	2.5%	95%	0.4%
Band 4	6%	3.5%	90%	0.2%
Band 5	4%	8.5%	50%	0.2%
Band 6	0%	8.5%	50%	0.0%
			Total	1.2%

3 Conclusion

- 3.1 Results of this analysis suggest that the introduction of investment risk as a factor in the risk-based levy formula would not affect schemes' investment strategies to a significant degree.
- 3.2 To the extent that the new formula would change schemes' optimal asset allocation, the largest effect would be on uncapped schemes with weak covenant (bands 5, 6). These schemes would have the most incentive to pursue lower risk investment strategies as a result of the new formula.

Annex E: Derivation of Levy Rates for Insolvency Risk

1. Principles

- 1.1. The Steering Group agreed that fairness of the levy could be defined as: "...fair value for a good or service is the price at which two willing parties would accept to exchange this good or service. Applying this definition to the levy, fairness is achieved if the bill of each scheme matches the cover it receives."
- 1.2. This means that the levy could be considered as fair if:
 - A. It did not exceed the cost of obtaining protection equivalent to that provided by the PPF through other means (e.g. insurance contract or credit derivative).
 - B. The hierarchy and relative size of individual levies are consistent. If, for scheme A, it would cost twice as much as for scheme B to get PPF-equivalent protection from financial markets or an insurance company, then scheme A's levy should be twice that of scheme B.
- 1.3. These two conditions imply that we need to estimate the premium that a commercial organisation would charge to provide PPF-equivalent protection.

2. Options Considered

- 2.1. In a hypothetical scenario where the PPF does not exist, schemes could, in principle, consider alternatives for an equivalent outcome. In the case of a scheme that is in deficit and takes no investment risk, the trustees of the scheme could obtain PPF-equivalent protection in two ways:

Option (i): By buying an insurance policy against the failure of the sponsor.
- 2.2. In their pricing, the insurers will look at the expected claim amount (deficit times expected insolvency probability) plus the cost of capital required to cover the risk.
- 2.3. For the PPF, the pricing of credit risk, rather than being directly derived from the cost of transferring the risk, becomes the sum of expected default risk and the cost of servicing the capital. In setting the insolvency risk rates for the levy, the price of PPF insurance could be approximated by the following formula:

Cost of Insuring Risk = Expected insolvency probability + (unit cost of capital multiplied by capital required to cover the risk)
- 2.4. We have taken the table of current assumed probabilities of insolvency (2008/09 -2010/11) recommended by D&B as the measure of expected insolvency probability.

- 2.5. The second component is identified using 10 per cent as an estimate of the unit cost of capital for the PPF, based on an external assessment of our risk profile.⁷
- 2.6. As an illustration, Table E1 shows how the levy rates are affected if a higher unit cost of capital is used.

Table E1: Levy Rates for 10 and 15 per cent Cost of Capital by Levy Band

PPF Levy band	Levy rates assuming 10% cost of capital	Levy rates assuming 15% cost of capital
1	0.20%	0.28%
2	0.50%	0.70%
3	1.10%	1.50%
4	1.60%	2.20%
5	4.00%	4.80%
6	14.20%	14.80%

- 2.7. The required amount of capital comes from the standardised risk weights established by the Basel Committee on Banking Supervision for holding senior unsecured corporate debt. This gives the unit capital charge depending on the rating of the issuer.

Table E2: Basel Risk Weighting of Corporate Claims⁸

Credit assessment	AAA to AA	A+ to A-	BBB+ to BB-	Below BB	Unrated
Risk weight	20%	50%	100%	150%	100%

- 2.8. The Basel II table was calibrated on a 99.9 per cent confidence level and the insolvency rates in the Basel approach are 1-year insolvency probabilities (as are the CDS-implied probabilities discussed in option (ii)). The amount of capital required per pound of credit exposure is 8 per cent of the risk-weight (this is the Tier 1 capital requirement).
- 2.9. For our purposes, we have used the BBB+ to BB- category for bands 3, 4 and the Below BB category for bands 5 and 6.
- 2.10. For Band 1, therefore, the levy rate is calculated as:

Average D&B probability + (Unit cost of capital x 8% x risk weight for band 1)

$$0.04\% \quad + \quad (10\% \quad \times \quad 8\% \times \quad 20\%) \quad = \quad \mathbf{0.20\%}$$

⁷ The levy rates are not especially sensitive to the precise cost of capital used, and the PPF used 10 per cent as a reasonable estimate. Earlier analysis estimated that the cost of capital would be 9 per cent - see Future Development of the Pension Protection Levy (November 2008), Annex D, p.45. This estimate compared the PPF's cost of capital to that of monoline insurers - it is reasonable to assume that the cost of capital has increased since 2008.

⁸ Basel Committee on Banking Supervision, International Convergence of Capital Measurement and Capital Standards: A Revised Framework (June 2006), p.23

- 2.11. The full set of proposed levy rates is presented in Table E3 below. The average D&B probabilities are drawn from the table of assumed probabilities used by the PPF to assign probabilities to D&B Failure Scores for the years 2008/09 to 2011/12. Before finalising the applied levy rates for 2012-13, we would ask D&B to advise on an appropriate table.

Table E3: Proposed Levy Rates on an Insurance Basis

PPF Levy Band	1	2	3	4	5	6
Average D&B probabilities	0.04%	0.10%	0.30%	0.80%	2.80%	13.00%
Cost of Capital	0.16%	0.40%	0.80%	0.80%	1.20%	1.20%
Recommended Levy Rate	0.20%	0.50%	1.10%	1.60%	4.00%	14.20% (capped at 4%)

Option (ii): By transferring the covenant's risk to financial markets.

- 2.12. This can be achieved by buying a credit default swap (CDS) on the sponsor. The notional amount will be the exposure to the scheme sponsor's default risk adjusted for the recovery rate on the debt underlying the CDS contract. This is equivalent to the product of the CDS-implied insolvency probability and the pound exposure to the scheme sponsor's default risk. The CDS-implied insolvency probability includes a risk premium as well as the expected loss.
- 2.13. CDS-implied insolvency probabilities are calculated by equating the present value of the premium to the present value of the expected losses for the contract seller.
- 2.14. If the 1-year CDS price is π , the t -year risk-free interest rate is i , the recovery rate is R and the CDS-implied probability is p , then we have:

$$\pi = \frac{p \times (1 - R)}{1 + i}$$

Hence the CDS-implied probability is: $p = \frac{(1 + i) \times \pi}{1 - R}$

- 2.15. David McCarthy and Anthony Neuberger have estimated the historical average of the 1-year CDS-implied insolvency probability for us.⁹ They used CDS data provided by Markit, the market leader for the provision of CDS prices. Markit provided 10 years (between 2000 and 2010) of daily prices of contracts by industry, rating and terms spanning from 6 month to 30 years.
- 2.16. The data is generally of good quality save for the period covering the financial crisis (end of 2007 to middle of 2009) where prices were affected by the dislocation of the credit market. Over this period there are anomalies in particular for the Aaa rating category and the financial sector. There are also

⁹ David McCarthy and Anthony Neuberger, Evaluating the fairness of the Risk-Based levy (July 2010)

concerns about the liquidity of some contracts. The most common maturity of a CDS contract is between 3 and 10 years. Contracts of other maturities are less often traded. Therefore it is likely that data on 6-month and 1-year CDS are, in effect, extrapolated from longer contracts.

- 2.17. In assessing the practicality of using CDS-implied rates, we looked at the effect of including data from the period 2006-2010, which broadly relate to the financial crisis. The different rates are produced in Table E4.

Table E4: CDS-implied Rates with Different Datasets

Levy Bands	CDS-implied rates (data 2000-2010)	CDS-implied rates (data 2000-2006)
1	0.67%	0.31%
2	1.17%	0.64%
3	1.73%	1.43%
4	4.32%	4.02%
5	6.77%	4.81%
6	16.14%	12.76%

- 2.18. Using CDS-implied rates would therefore require some judgment as to which dataset should be used for their calculation. While the resulting rates would reflect directly observed pricing, the availability and quality of data would play a large role in producing these.
- 2.19. Moreover, prices may embed premiums that relate to factors such as liquidity and counterparty risk. These factors mean that the levy rates could be affected by market expectations and idiosyncratic risks relating to CDS-sellers.

3. Impact of Different Options

- 3.1. Both options produce a scale of levy rates which are closer to the PPF claims experience than the current table of insolvency probabilities. These are shown below in Table E5.

Table E5: Comparison of Levy Rates and Probabilities

PPF Levy Band	1	2	3	4	5	6
PPF Claims Experience	0.25%	0.75%	0.90%	1.40%	5.00%	14.00%
Average D&B probabilities	0.04%	0.21%	0.43%	0.94%	1.68%	13.00%
CDS-Implied Rates	0.67%	1.17%	1.73%	4.32%	6.77%	16.14%
Basel II rates	0.20%	0.50%	1.10%	1.60%	4.00%	14.20%

- 3.2. Due to the effect of the scaling factor, higher levy rates would not necessarily result in higher levy bills. Table E6 shows the effective levy rates after an adjustment for the different scaling factors that would apply.

Table E6: Insolvency Probabilities, adjusted for effect of Scaling Factor

PPF Levy Band	1	2	3	4	5	6*	Scaling factor (indicative)
Recommended (Basel II)	0.14%	0.36%	0.78%	1.14%	2.85%	2.85%	0.45
CDS implied	0.21%	0.37%	0.52%	1.07%	2.13%	2.13%	0.20
D&B Average	0.07%	0.35%	0.70%	1.54%	2.75%	4.92%	>1.0

**Capped probabilities*

- 3.3. Both options would produce a compressed range of rates compared to the current table, which is highly granular and produces a scale that ranges from 0.01 per cent (D&B Failure Score =100) to 29.3 per cent (D&B Failure Score = 1, if uncapped). Within Band 1, for example, the applied probability increases seven-fold between 100 and 97; we have not observed this disparity between sponsoring employers with D&B Failure Scores 100 and 97 in our claims experience.
- 3.4. Our recommended scale of levy rates is not the narrowest compared to all three measures, with a multiple of 71 between Band 1 and (uncapped) Band 6. This compares to multiples of 24 and 325 for CDS and D&B approaches respectively.

Table E7: Ratio of Levy Rates

PPF Levy Band	1	2	3	4	5	6 (uncapped)
Recommended Levy Rate	x1.0	x2.5	x5.5	x8.0	x20.0	x71.0
CDS Implied Rates	X1.0	x1.7	x2.6	x6.5	x10.1	x24.1
Average D&B probabilities	X1.0	x5.3	x10.8	x23.5	x42.0	x325.0

Annex F: Example of Actuarial Roll forward

1. Introduction

This example uses a simplified situation to illustrate the key differences between the current and proposed approaches to how assets and liabilities would be transformed, first by smoothing and then applying the stresses. For this purpose, we have applied and extended the methodology set out in the Transformation Appendix to the 2010/11 Levy Determination.

All yields, index values and annuity factors are hypothetical.

2. Scheme Data

At 31 March 2012, a scheme with only pensioner members and no matching insurance contracts has submitted the following data on Exchange:

Effective date of latest s179 valuation: 31 December 2009
Total assets: £5m
Breakdown of assets: 100% UK quoted equities
Liabilities in respect of pensioners: £6m (all relating to pre 97 service)
Average age of pensioners: 68
s179 assumptions used for this valuation: A5

We refer here to the hypothetical s179 assumptions guidance at 31 March 2012 as A2012.

3. Market data

	FTSE All-Share Total Return Index	FTSE All-World ex UK Total Return Index	s179 post-retirement discount rate
31 December 2009	5,000	5,500	4.5% per annum (derived by reference to A5)
31 March 2012	6,000	7,000	4.0% per annum (derived by reference to A2012)
Five year daily arithmetic average (1 April 2007 to 31 March 2012)	5,250	6,000	4.25% per annum (derived by reference to A2012)

4. Calculations

Pensioner liabilities are calculated using the following s179 annuity factors at age 68:

Discount rate of 4.5% p.a. and mortality consistent with A5:	14.3
Discount rate of 4.0% p.a. and mortality consistent with A2012:	15.0
Discount rate of 4.25% p.a. and mortality consistent with A2012:	14.6
Discount rate of 3.59% p.a. and mortality consistent with A2012:	15.6

Step 1: Converting the value of the pensioner liabilities at the valuation date

Current approach: £6m x (15.0/14.3) =	£6.29m
Proposed approach - smoothed: £6m x (14.6/14.3) =	£6.13m

Step 2: Roll-forward of the value of the pensioner liabilities to 31 March 2012¹⁰

Current approach: £6.29m x [(1.04) ^{2.25}] =	£6.87m
Proposed approach - smoothed: £6.13m x [(1.0425) ^{2.25}] =	£6.73m

Step 3: Roll-forward of the value of the assets to 31 March 2012

Current approach: £5m x 0.5 x [(6,000/5,000) + (7,000/5,500)] =	£6.18m
Proposed approach- smoothed: £5m x 0.5 x [(5,250/5,000) + (6,000/5,500)] =	£5.48m

Summary of assets and liabilities at 31 March 2012 (after smoothing but before applying the stress test)

	Current Approach £m	Smoothed Approach £m
Value of pensioner liabilities	6.87	6.73
Total protected liabilities ¹¹	7.48	7.33
Value of assets	6.18	5.35
Deficit	1.30	1.98
Funding level	83%	73%

Step 4: Apply stress test to smoothed assets and liabilities

Assumed drop in UK equity total return index¹²: 21.7%

Smoothed assets at 31 March 2012 after stress test: £5.35m * (1-0.217) = £4.19m

¹⁰ For simplicity, the appropriate rate for each roll-forward is assumed to be the same as the corresponding post-retirement discount rate.

¹¹ Total protected liabilities are calculated by adding the following to the liabilities in respect of pensioners: External liabilities (assumed nil), estimated costs of winding up (3 per cent of pensioner liabilities) and estimated expenses of benefit payment (£0.4m)

¹² Based on asset stress on UK equity recommended by Redington

Assumed drop in nominal interest rate: 0.66%
 Corresponding s179 post retirement discount rate: $(4.25\% - 0.66\%) = 3.59\%$

Smoothed value of pensioner liabilities at 31 March 2012 after stress test:

$$£6.73m * (15.6/14.6) = £7.19m$$

Total protected liabilities at 31 March 2012 after smoothing and stress test: £7.81m

$$\text{Stressed deficit: } (£7.81m - £4.19m) = £3.62m$$

Step 5: Calculate smoothed liabilities with margin for investment risk

The margin for investment risk represents the increase in deficit as a result of applying the stress test to the smoothed assets and liabilities.

$$(£3.62m - £1.98m) = £1.64m$$

This is then expressed as a proportion of the smoothed liabilities:

$$(£1.64m/£7.33m) = 22.37\%$$

Smoothed liabilities after application of margin for investment risk:

$$£7.33m * 1.2237 = £8.97m$$

Step 6: Calculate underfunding at 31 March 2012

$$(£8.97m - £5.35m) = £3.62m$$

5. Summary

	Current Approach £m	Smoothed Approach £m	Smoothed Approach with margin for investment risk £m
Total protected liabilities	7.48	7.33	8.97
Value of assets	6.18	5.35	5.35
Deficit	1.30	1.98	3.62
Funding level	83%	73%	60%

The deficit of £3.62m in the last column represents the underfunding measure which will be used in the calculation of the scheme's risk-based levy.

