

## **USS briefing: Capital funding and exhaustion risk – distribution of outcomes**

This briefing note provides details of analysis, requested by members of the Joint Negotiating Committee (JNC), of the risk of the scheme running out of funds before all benefits due to members have been paid.

This is a very technical document by design and developed for a specific purpose for the JNC and Valuation Technical Forum (VTF). It is released on request in the form we shared with the JNC. A small number of terms used in this note are explained in the appendix (and there is also a glossary of commonly used terms on the [2023 valuation page](#)), but it remains a piece of work that will require detailed knowledge and understanding of the concepts it explores.

The analysis has been provided to the JNC and has also been discussed by the VTF. The VTF was assembled to provide the opportunity for early and informal discussion between the USS Trustee, UCU and UUK (and their respective advisors) in relation to some of the technical aspects of the 2023 valuation.

In managing the scheme's reliance on the sector and to meet current regulatory requirements, the trustee must consider the ongoing ability to demonstrate solvency at each valuation date.

As a result, the application of the analysis in this note in the context of scheme funding decisions would need to be considered alongside an acceptable measure of the scheme's solvency (which, by design, looks to avoid material reliance on mean-reversion or other assumptions which could vary significantly over time).

While the metrics in this analysis could factor into the Trustee's decision making, the scheme cannot fund solely on the basis of this modelling (i.e., simply that there are few modelled circumstances in which the scheme may be unable to pay benefits) given the need to also consider the associated volatility along the way.

The Trustee is currently considering how, alongside other risk metrics and the wider integrated risk management framework, these outputs might inform future decisions in relation to the valuation investment strategy.

### Capital funding and exhaustion risk – distribution of outcomes

This note sets out analysis in respect of March 2021 and June 2022 capital exhaustion and liability shortfall probability analysis originally discussed with the JNC and VTF.

The analysis shows the modelled likelihood of the scheme exhausting all capital<sup>1</sup> before paying all accrued benefits, and the shortfall vs remaining liabilities or assets (for those scenarios in which capital exhaustion does and does not occur respectively).

We assume a fixed investment strategy throughout, and present the results based on three separate allowances for deficit reduction contributions into the scheme:

- 0%
- 5% Of Total Payroll Per Annum for 30 years
- 10% Of Total Payroll Per Annum for 30 years

We present the analysis based on starting points of 31/03/2021 and 30/06/2022 and is provided in table and histogram forms (one for each level of employer reliance represented by the deficit recovery contributions (DRCs) as outlined above).

This is in line with the style of the Miles and Sefton plots, showing the distribution of USS assets and shortfall, with shortfall shown at boundaries of £10bn, £20bn and £30bn (the document can be found [here](#) and should be read in conjunction with this paper).

*Note that we have generated the results based on the principle that once all capital is exhausted, the value of the liability is held fixed at the corresponding level (i.e. at the point of capital exhaustion) from that year onwards.*

*To facilitate comparison with the Miles and Sefton plots, we have quoted the results in both nominal and (CPI) real terms.*

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<sup>1</sup> Where “Capital” refers to assets held and invested within the DB fund.

## Appendix 1: 30/06/2022 Analysis

### Assumptions:

- **Investment Strategy:**
  - VIS aggregate portfolio (60% Growth, 25% Other Fixed Income, 35% LDI, -20% Cash [Leverage])
  - Portfolio held fixed over full simulation, rebalanced monthly
- Accrued benefits as at 30/06/2022 assumed to roll off.
- Three Employer Reliance cases assumed with deficit reduction contributions at:
  - 0%
  - 5% Of Total Payroll Per Annum for 30 years
  - 10% Of Total Payroll Per Annum for 30 years
  - (Note these contributions are assumed to be received regardless of the prevailing funding position)
- USSIM 30/06/2022 capital market expectations (see table 13 in appendix 3)
- 5000 stochastic simulations via the Ortec Finance “GLASS” ALM solution.
- The initial market value of assets: £77.6bn
- The underlying cashflows are consistent with the Rule 76.1 report. These cashflows are rolled forward to 30/06/2022 allowing for realised inflation and assumed membership changes

### Appendix 1.1: Breakdown of 30/06/2022 shortfall results by year and by remaining liability in nominal terms

As demonstrated in the following tables:

- The earlier capital exhaustion occurs, the greater the remaining shortfall (vs the remaining liabilities) – see bottom row of tables below.
- At 30 years (2052), we observe capital exhaustion probabilities of 6.1% (assuming 0% DRCs), 0.8% (5% DRCs) and 0.0% (10% DRCs). Further, in the 0% Employer Reliance case, all 6.1% of scenarios in which capital exhaustion occurs at the 30-year point correspond to instances when outstanding liabilities exceed £30bn
- For the 10% Employer Reliance case, the scheme begins to experience capital exhaustion scenarios at the 40-year point (2062 - 0.4% of scenarios)
- Towards the end of the projection horizon, by year 60 (2082), the probability of capital exhaustion is 17.9% (0% Employer Reliance), 5.0% (5% Employer Reliance) and 0.9% (10% Employer Reliance).

Tables 1, 2 and 3: Probability of capital exhaustion by outstanding SS liability – 0%, 5% and 10% Employer Reliance Cases respectively as at 30/06/2022, Nominal Terms:

Table 1 (0% DRC):

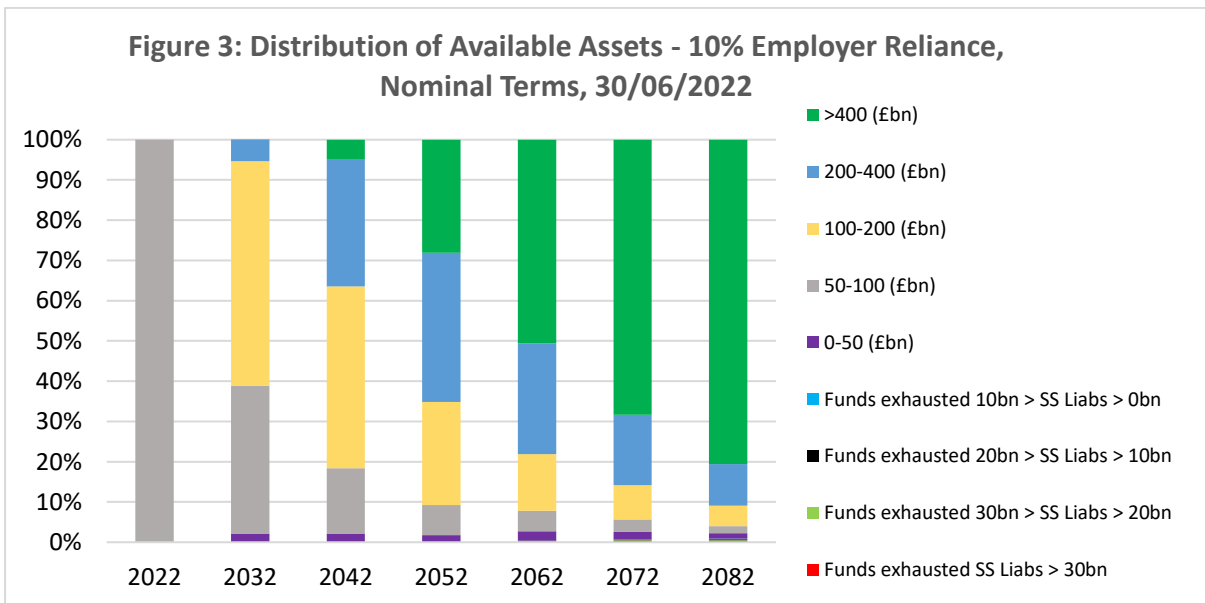
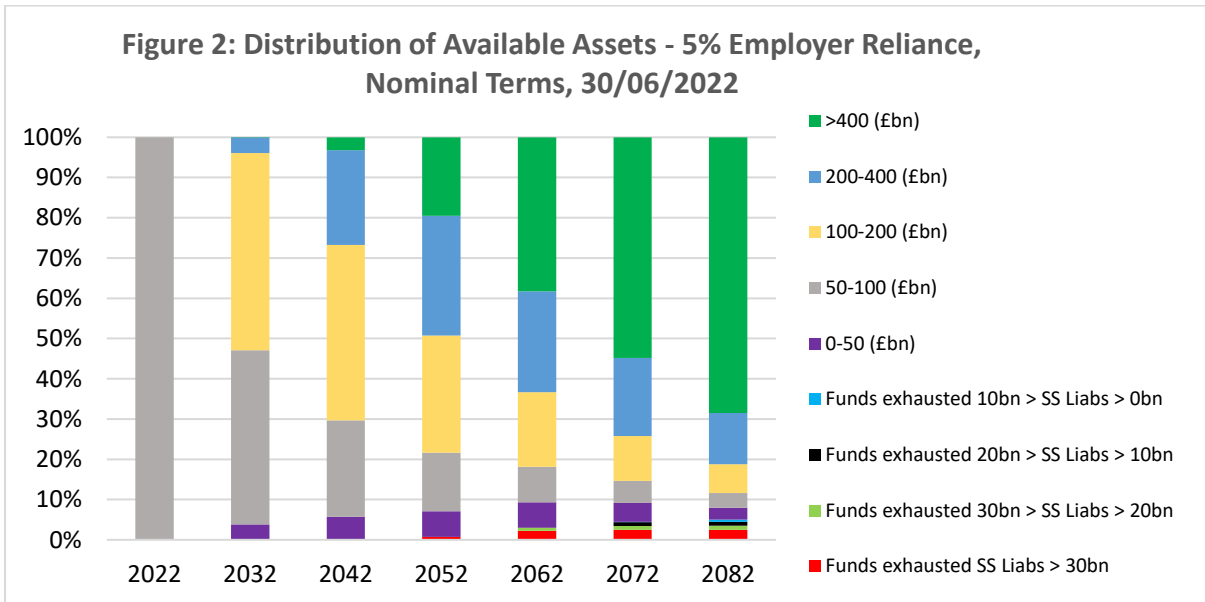
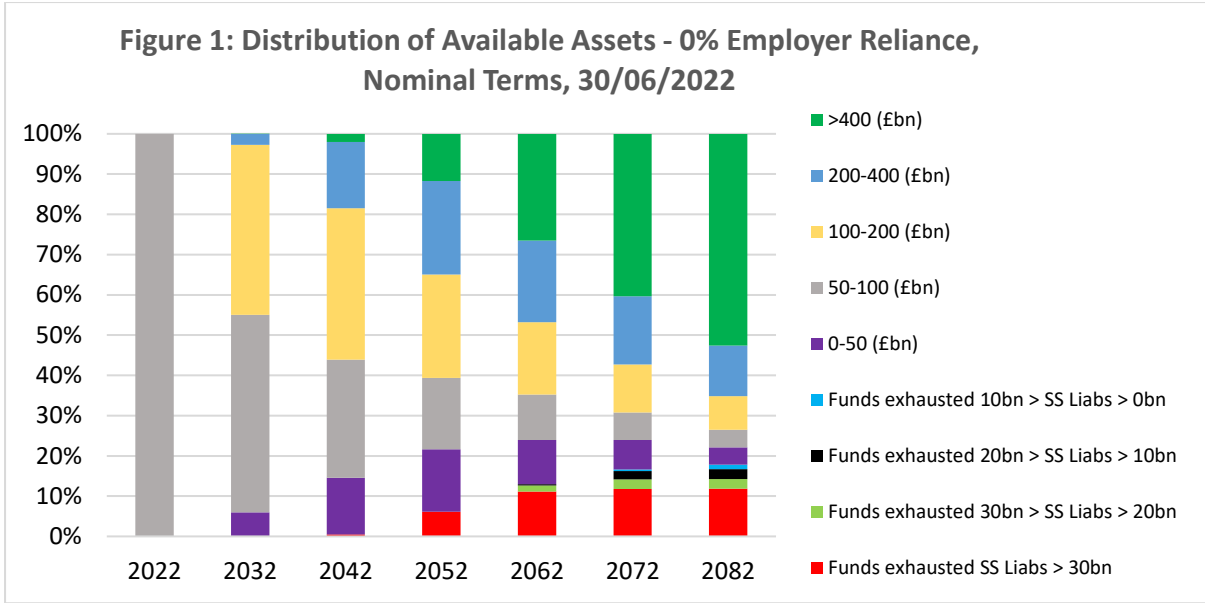
|                       | Outstanding Assets/Liability | 2022   | 2032  | 2042  | 2052  | 2062  | 2072  | 2082  |
|-----------------------|------------------------------|--------|-------|-------|-------|-------|-------|-------|
| Capital Not Exhausted | 0-50 (£bn)                   | 0.0%   | 6.0%  | 14.1% | 15.6% | 11.0% | 7.3%  | 4.3%  |
|                       | 50-100 (£bn)                 | 100.0% | 49.1% | 29.3% | 17.7% | 11.3% | 6.8%  | 4.3%  |
|                       | 100-200 (£bn)                | 0.0%   | 42.2% | 37.6% | 25.6% | 17.9% | 11.9% | 8.4%  |
| Remaining Assets      | 200-400 (£bn)                | 0.0%   | 2.7%  | 16.5% | 23.3% | 20.3% | 16.9% | 12.6% |
|                       | >400 (£bn)                   | 0.0%   | 0.0%  | 2.0%  | 11.7% | 26.5% | 40.5% | 52.5% |
| Capital Exhausted     | 0 to £10bn                   | 0.0%   | 0.0%  | 0.0%  | 0.0%  | 0.0%  | 0.4%  | 1.2%  |
|                       | £10bn to £20bn               | 0.0%   | 0.0%  | 0.0%  | 0.0%  | 0.3%  | 2.0%  | 2.4%  |
| Remaining Liabilities | £20bn to £30bn               | 0.0%   | 0.0%  | 0.0%  | 0.0%  | 1.5%  | 2.4%  | 2.4%  |
|                       | Above £30bn                  | 0.0%   | 0.0%  | 0.5%  | 6.1%  | 11.2% | 11.8% | 11.9% |

Table 2 (5% DRC for 30 Years)

|                       | Outstanding Assets/Liability | 2022   | 2032  | 2042  | 2052  | 2062  | 2072  | 2082  |
|-----------------------|------------------------------|--------|-------|-------|-------|-------|-------|-------|
| Capital Not Exhausted | 0-50 (£bn)                   | 0.0%   | 3.8%  | 5.7%  | 6.3%  | 6.3%  | 4.6%  | 3.0%  |
|                       | 50-100 (£bn)                 | 100.0% | 43.3% | 23.9% | 14.6% | 8.9%  | 5.5%  | 3.7%  |
|                       | 100-200 (£bn)                | 0.0%   | 49.0% | 43.6% | 29.1% | 18.5% | 11.1% | 7.1%  |
| Remaining Assets      | 200-400 (£bn)                | 0.0%   | 3.8%  | 23.5% | 29.7% | 25.1% | 19.4% | 12.7% |
|                       | >400 (£bn)                   | 0.0%   | 0.1%  | 3.2%  | 19.5% | 38.2% | 54.9% | 68.5% |
| Capital Exhausted     | 0 to £10bn                   | 0.0%   | 0.0%  | 0.0%  | 0.0%  | 0.0%  | 0.1%  | 0.5%  |
|                       | £10bn to £20bn               | 0.0%   | 0.0%  | 0.0%  | 0.0%  | 0.1%  | 0.9%  | 1.0%  |
| Remaining Liabilities | £20bn to £30bn               | 0.0%   | 0.0%  | 0.0%  | 0.0%  | 0.7%  | 1.0%  | 1.0%  |
|                       | Above £30bn                  | 0.0%   | 0.0%  | 0.1%  | 0.8%  | 2.2%  | 2.5%  | 2.5%  |

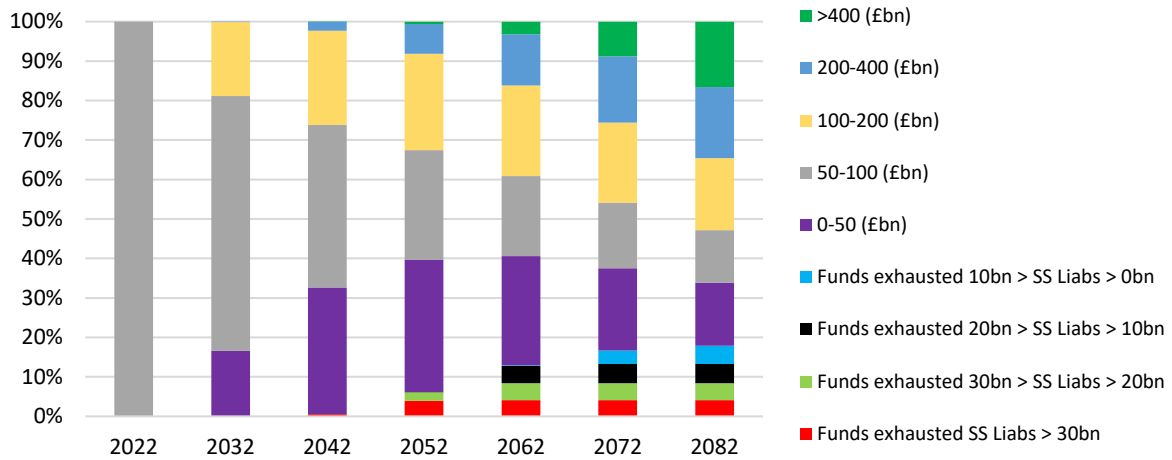
Table 3 (10% DRC for 30 Years)

|                       | Outstanding Assets/Liability | 2022   | 2032  | 2042  | 2052  | 2062  | 2072  | 2082  |
|-----------------------|------------------------------|--------|-------|-------|-------|-------|-------|-------|
| Capital Not Exhausted | 0-50 (£bn)                   | 0.0%   | 2.2%  | 2.2%  | 1.8%  | 2.3%  | 1.8%  | 1.3%  |
|                       | 50-100 (£bn)                 | 100.0% | 36.7% | 16.2% | 7.5%  | 5.1%  | 3.1%  | 1.7%  |
|                       | 100-200 (£bn)                | 0.0%   | 55.7% | 45.1% | 25.6% | 14.1% | 8.5%  | 5.1%  |
| Remaining Assets      | 200-400 (£bn)                | 0.0%   | 5.3%  | 31.7% | 37.0% | 27.5% | 17.5% | 10.4% |
|                       | >400 (£bn)                   | 0.0%   | 0.1%  | 4.8%  | 28.1% | 50.6% | 68.3% | 80.6% |
| Capital Exhausted     | 0 to £10bn                   | 0.0%   | 0.0%  | 0.0%  | 0.0%  | 0.0%  | 0.1%  | 0.2%  |
|                       | £10bn to £20bn               | 0.0%   | 0.0%  | 0.0%  | 0.0%  | 0.0%  | 0.2%  | 0.2%  |
| Remaining Liabilities | £20bn to £30bn               | 0.0%   | 0.0%  | 0.0%  | 0.0%  | 0.1%  | 0.1%  | 0.1%  |
|                       | Above £30bn                  | 0.0%   | 0.0%  | 0.0%  | 0.0%  | 0.3%  | 0.4%  | 0.4%  |

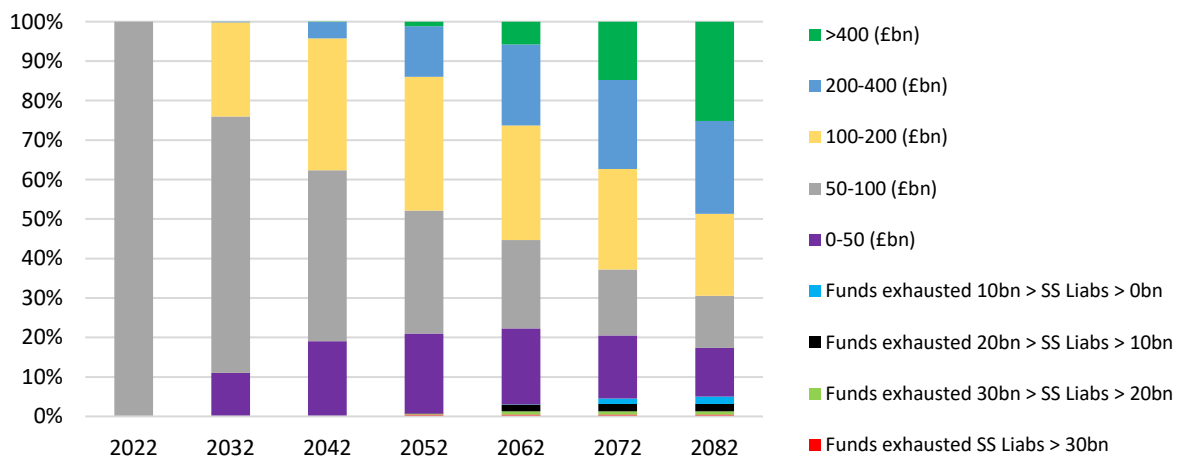




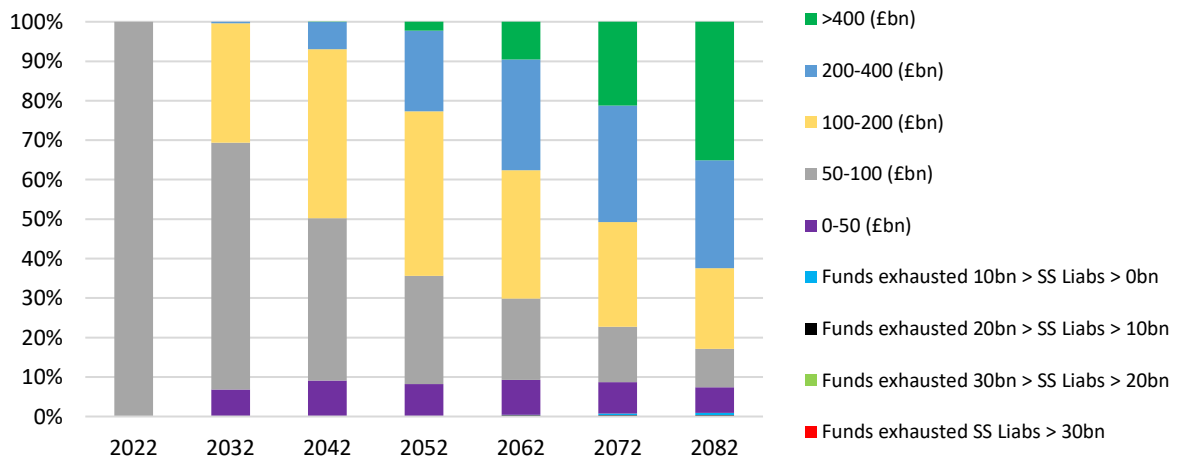
**Figure 4: Distribution of Available Assets - 0% Employer Reliance, Real Terms, 30/06/2022**



**Figure 5: Distribution of Available Assets - 5% Employer Reliance, Real Terms, 30/06/2022**



**Figure 6: Distribution of Available Assets - 10% Employer Reliance, Real Terms, 30/06/2022**



## Appendix 2: 31/03/2021 Analysis

### Assumptions:

- **Investment Strategy:**
  - “Strong” case aggregate portfolio (55% Growth, 25% Other Fixed Income, 32% LDI, - 12% Cash [Leverage])
  - Portfolio held fixed over full simulation, rebalanced monthly
- Accrued benefits as at 31/03/2021 assumed to roll off.
- Three Employer Reliance cases assumed with deficit reduction contributions at:
  - 0%
  - 5% Of Total Payroll Per Annum for 30 years
  - 10% Of Total Payroll Per Annum for 30 years
  - (Note these contributions are assumed to be received regardless of the prevailing funding position)
- USSIM 31/03/2021 capital market expectations (see table 13 in appendix 3)
- 2000 Simulations.
- The initial market value of assets: £80.6bn
- The underlying cashflows are consistent with the Rule 76.1 report. These cashflows are rolled forward to 31/03/2021 allowing for realised inflation and assumed membership changes

### Appendix 2.1: Breakdown of 31/03/2021 shortfall results by year and by remaining liability in nominal terms

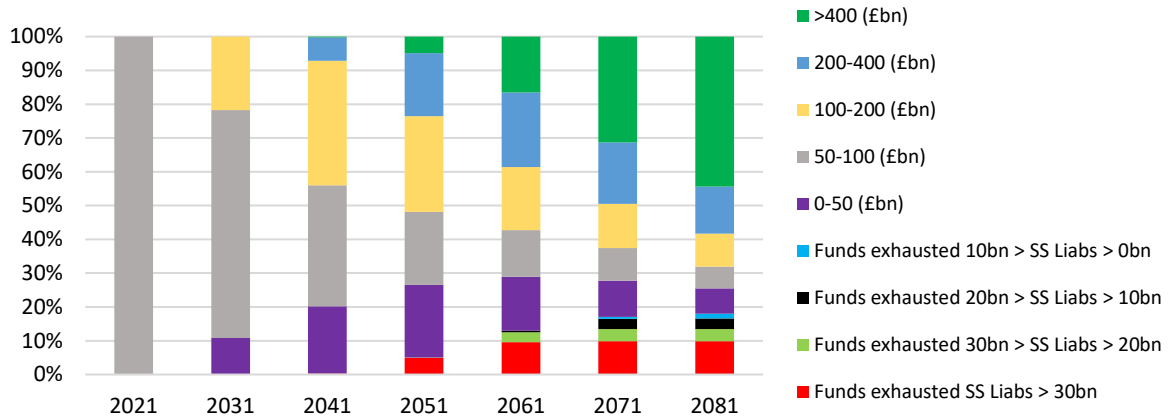
As demonstrated in the following tables:

- We again see from the following tables/histograms that the earlier capital exhaustion occurs, the greater the shortfall.
- At 30 years (2051), we observe capital exhaustion probabilities of 5.0% (assuming 0% DRCs), 0.5% (5% DRCs) and 0.0% (10% DRCs). Further:
  - In the 0% DRCs case: Of those 5.0% scenarios where capital exhaustion occurs at the 30-year point, almost all of them (4.9%) correspond to instances when outstanding liabilities exceed £30bn
  - In the 5% DRCs case: All the scenarios that experience capital exhaustion at the 30-year point correspond to instances when outstanding liabilities exceed £30bn
- For the 10% DRCs case, the scheme begins to experience capital exhaustion scenarios at the 40-year point (2061 - 0.4% of scenarios)
- Towards the end of the projection horizon, by year 60 (2081):
  - The probability of capital exhaustion is 18.2% (0% DRCs), 5.0% (5% DRCs) and 0.8% (10% DRCs).
  - 81.8% (0% DRCs), 95% (5% DRCs) and 99.2% (10% DRCs) of scenarios exhibit a surplus funding position.

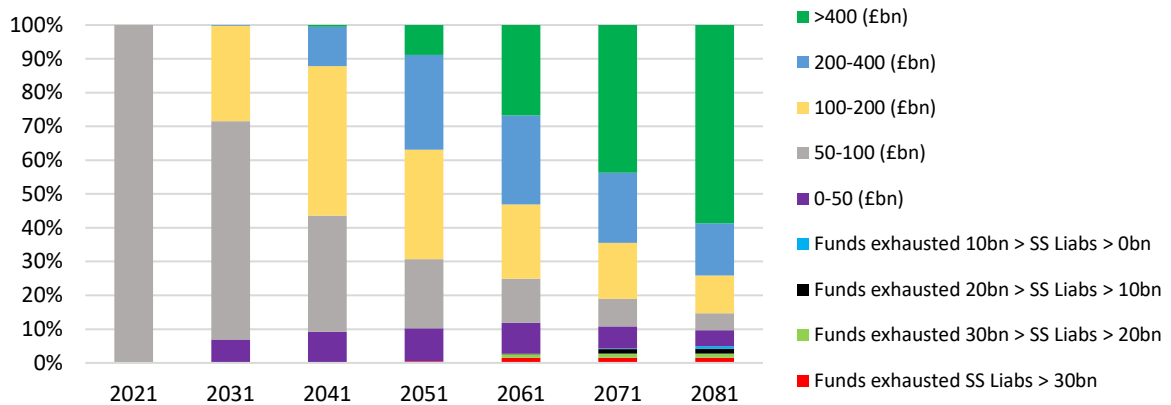




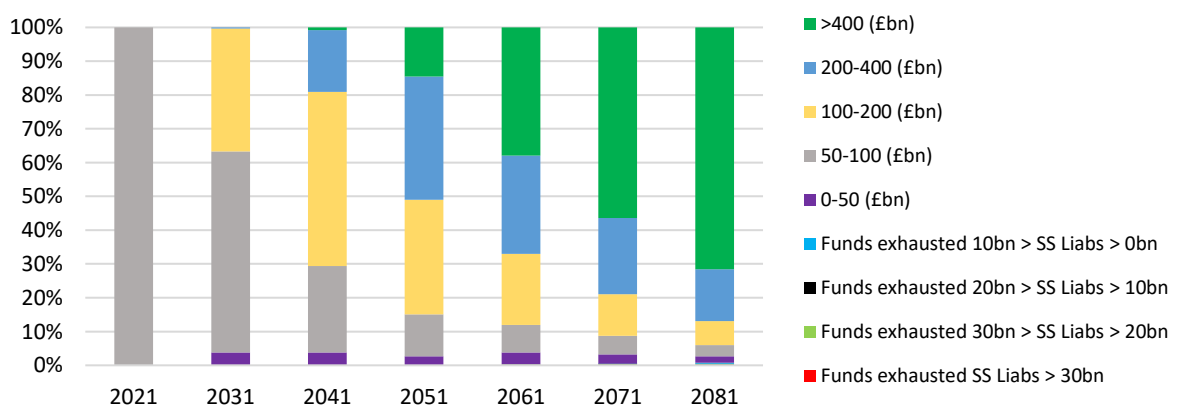
**Figure 7: Distribution of Available Assets - 0% Employer Reliance, Nominal Terms, 31/03/2021**



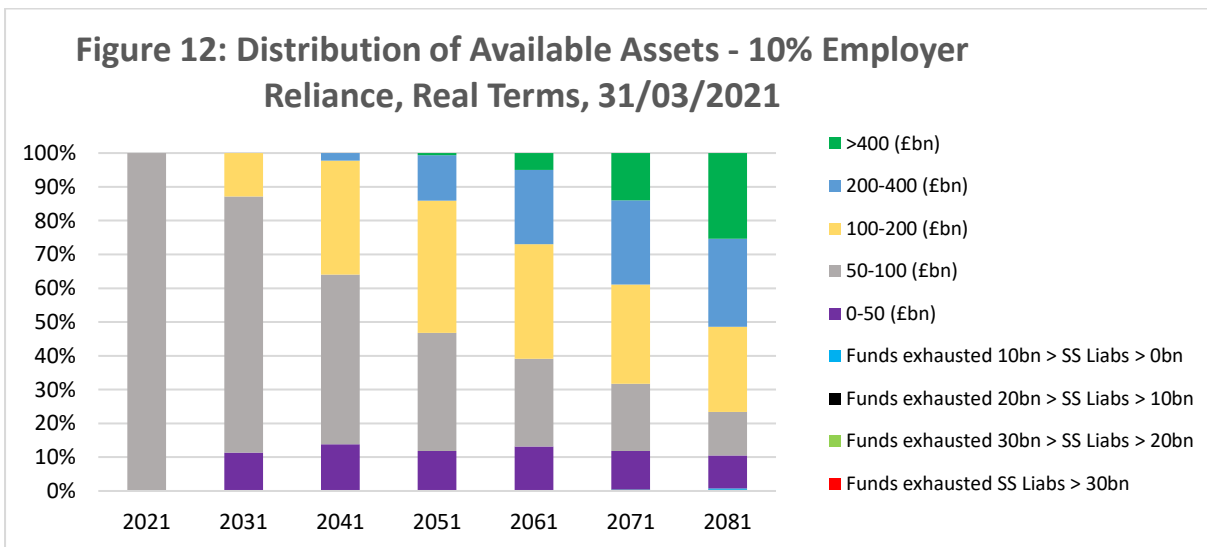
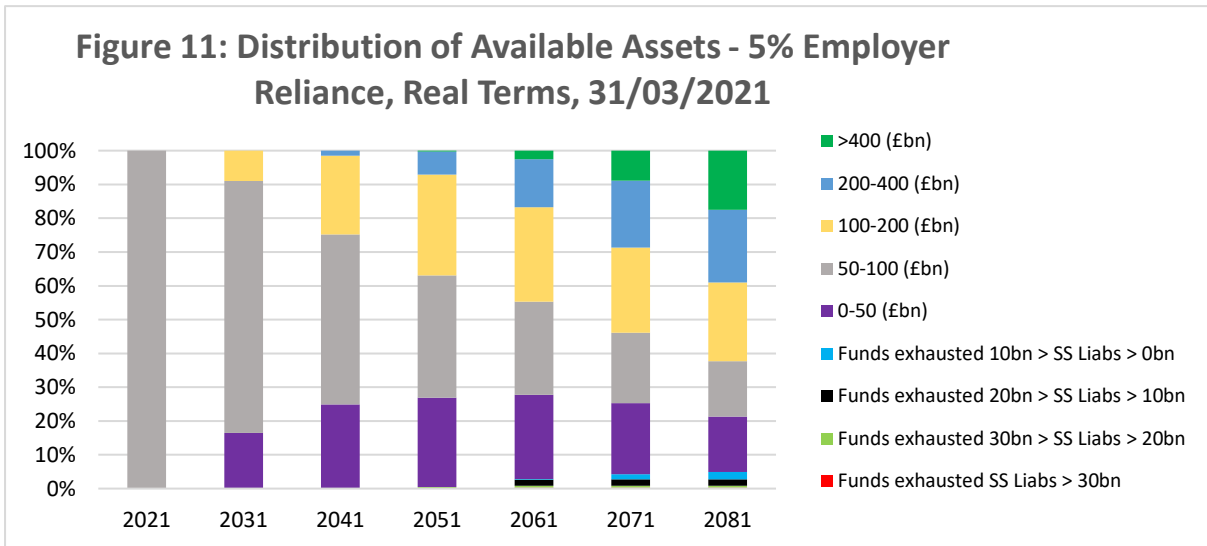
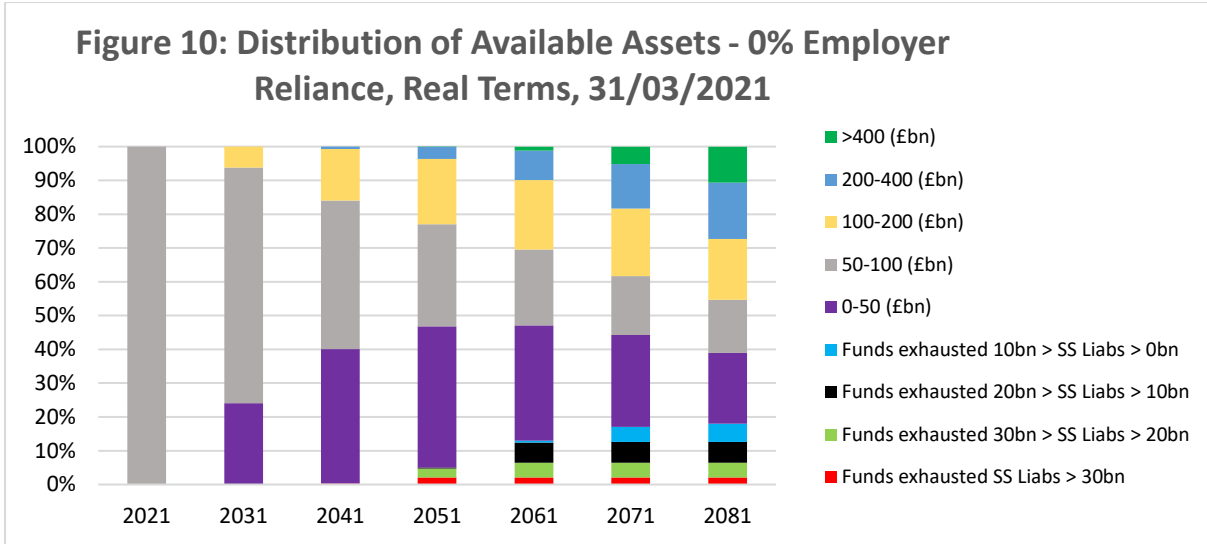
**Figure 8: Distribution of Available Assets - 5% Employer Reliance, Nominal Terms, 31/03/2021**



**Figure 9: Distribution of Available Assets - 10% Employer Reliance, Nominal Terms, 31/03/2021**







### Appendix 3: Supplementary Assumptions and technical terms

Table 13: USSIM Capital Market Expectations

| Asset class   | Expected return over 30-years |          |                 |          |
|---------------|-------------------------------|----------|-----------------|----------|
|               | Relative to Gilts             |          | Relative to CPI |          |
|               | 31/03/21                      | 30/06/22 | 31/03/21        | 30/06/22 |
| Equities      | 4.2%                          | 3.8%     | 3.5%            | 3.7%     |
| Property      | 2.2%                          | 1.3%     | 1.6%            | 1.2%     |
| Listed Credit | 1.9%                          | 1.9%     | 1.2%            | 1.8%     |
| US Tips       | 0.6%                          | 0.3%     | -0.1%           | 0.2%     |
| LDI           | -1.0%                         | -0.3%    | -1.7%           | -0.4%    |
| Cash          | 0.4%                          | 0.0%     | -0.2%           | -0.1%    |

30 Year UK CPI Assumptions:

31/03/2021: 2.2%

30/06/2022: 2.5%

- Valuation Investment Strategy (“VIS”)**: A theoretical, but investible, asset allocation developed for the 2020 valuation. While the VIS is expected to deliver the required level of long-term returns at a level of investment risk consistent with the Trustee’s investment risk appetite, it does not define the actual assets in which USSIM may invest
- Stochastic Asset Liability Modelling (“ALM”)**: A modelling tool which projects the potential evolution of scheme assets and liabilities through time across multiple independent economic scenarios. The tool provides insight into the range of potential outcomes at the Total DB plan level over a long-term horizon, and facilitates impact analysis for different investment strategies, benefit structures, contribution arrangements etc.
- Employer Reliance**: The degree to which the DB scheme is “reliant” on the sector to support the full payment of accrued liabilities over the full modelled horizon



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