

# Market-Consistent Valuation of the Pension Plan Sponsor Support and its use in Risk- Based Capital Assessment

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# Background and Research Objectives

# Background: DB Pensions and Risk

- + Aggregate deficits in funding levels of DB pension funds at historically high levels, exacerbated by exceptionally low interest rate environment
  - At end-March 2012, UK DB pension fund assets of £1,027bn; aggregate buy-out liabilities of £1,703bn
- + Sponsors' commitments to provide future funding of the deficit has therefore become an increasingly important asset for pension fund members' benefits security
- + Over last ten years, actuarial risk measurement techniques in insurance have increasingly become more quantitative, market-based and probabilistic
- + EIOPA proposals for a similar approach to be applied to the measurement of the security of DB pension funds
- + Can the security of DB pension promises be measured consistently with similar promises made by insurance groups?

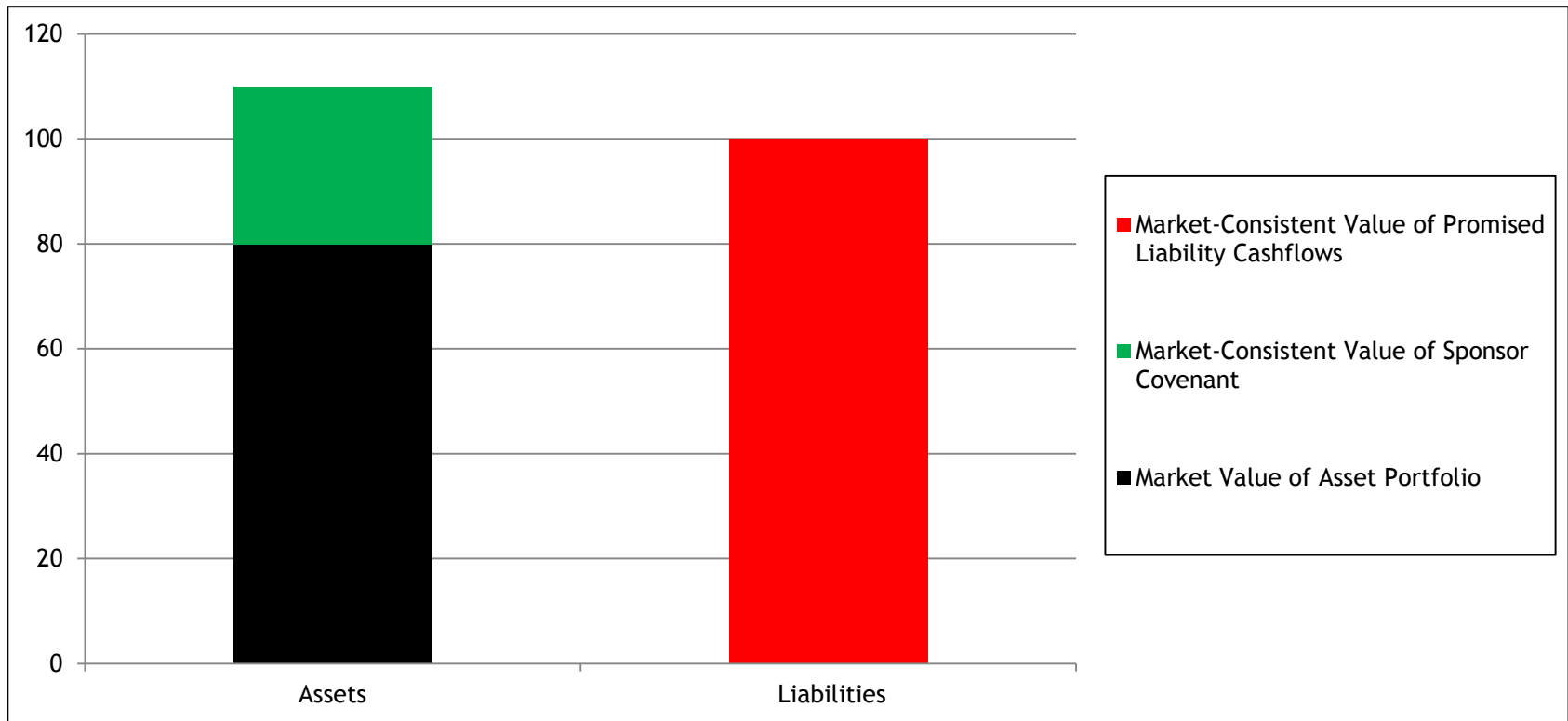
# Background: Research Objectives

1. How can the market-consistent 'holistic' balance sheet of a DB pension fund be measured? In particular, the sponsor covenant asset?
2. Are there 'short-cut' calculations that can be devised to approximate the 'full' method identified above?
3. How can the market-consistent balance sheet be used to calculate a risk-based capital measure consistent with emerging global insurance methods?

# **Market-Consistent Valuation of DB Pension Fund Balance Sheet**

# DB Pension Fund Market-Consistent ‘Holistic Balance Sheet’

- + In its simplest form, a DB pension fund market-consistent ‘holistic balance sheet’ would have three items:



# Valuing the Holistic Balance Sheet

## 1. Market value of asset portfolio

- In principle straightforward; not discussed in this research

## 2. Market-consistent value of promised liability cashflows

- In principle a straightforward present value, but market-consistent discount rate definition complicated by illiquid and very long-term nature of the cashflows

## 3. Market-consistent value of sponsor covenant

- We define the sponsor covenant as the sponsor's commitment to making future deficit-funding contributions required until pension liabilities are extinguished
- The sponsor's commitment to making deficit-funding future contributions can be a fairly complex form of cashflows:
  - + Credit-risky and long-term
  - + May be dynamic and path-dependent
  - + Sponsor credit risk may be correlated with deficit size ('wrong-way risk')
  - + Market-implied cost of sponsor credit risk may not be directly observable
  - + Etc.

# Valuing Sponsor Support

- + If the sponsor's equity value significantly exceeds the market value of the deficit, doesn't the market value of covenant = deficit?
- + This WOULD be the case if the sponsor were to inject the cash required to fund the deficit into the pension fund immediately
- + OR if the sponsor was risk-free
- + Otherwise, the sponsor covenant will generally be worth less than the deficit and will reduce in value as a function of two key factors:
  - The speed at which deficit contributions will be paid into the fund
  - The credit quality of the sponsor



# **Market-Consistent Valuation of Sponsor Support: Modelling Approach**

# Modeling Sponsor Support

- + The valuation first requires assumptions about the timing and determination of the promised future deficit-funding contribution stream
  - e.g. annual deficit contribution is set at 1/10 of deficit, re-set every three years,
- + The market-consistent valuation of the sponsor covenant will generally require assumptions to be made about the following:
  1. In what circumstances is the sponsor unable to make good on their deficit-funding commitment?
    - We assume this occurs whenever corporate sponsor default occurs, and only then
  2. What is the size of the pension fund deficit (if any) when sponsor default occurs?
    - This is a variable that we will model stochastically
  3. In the event of default, what proportion of the deficit (if any) is recovered from the sponsor?
    - Use standard corporate bond recovery rate assumptions
    - Assumes pension fund is an unsecured creditor like other corporate debt-holders

# Market-Consistent Valuation of Sponsor Support

- + With those modelling assumptions, the market-consistent valuation then needs to value this credit-risky stochastic cashflow stream consistently with observed market prices for other credit-risky cashflow promises of the sponsor
  - e.g. corporate bond prices of the sponsor
  - Requires market-based estimate of cost of exposure to default risk across all possible future circumstances that may arise over the period in which deficit contributions are made
- + Note that the market-consistent valuation methodology means that we do **not** need to make a direct estimate of the sponsor's probability of default, we only need to observe the market price of bearing that default risk
  - Risk-neutral valuation techniques

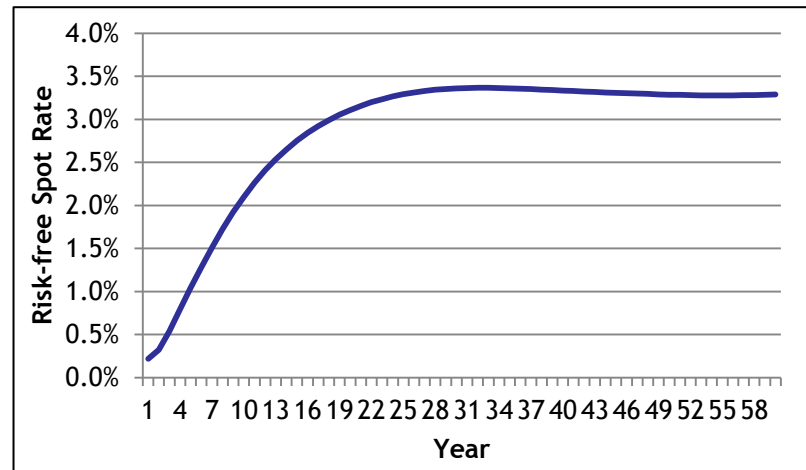
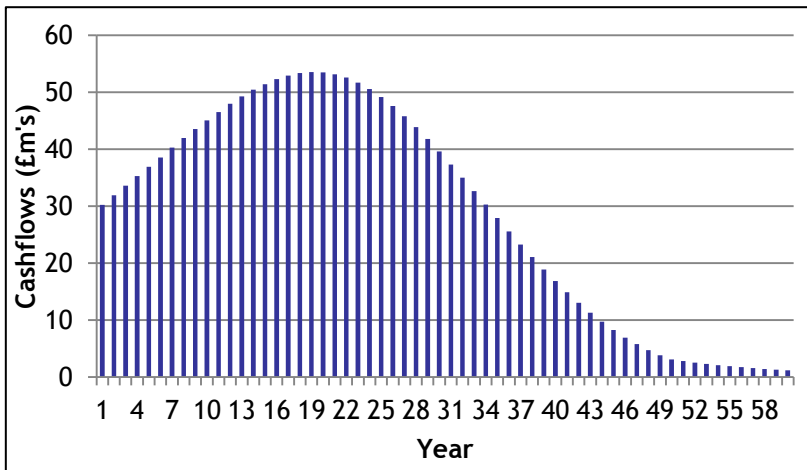
# Stochastic Modelling For Market-Consistent Valuation

- + The variable nature of the deficit contribution cashflow stream, and the correlation of sponsor default probabilities with deficit size, makes the valuation technically complex and generally requires a stochastic simulation approach to the valuation
- + This simulation model requires:
  - A risk-neutral simulation model for the behaviour of the market value of the pension fund's assets, liabilities and contributions
    - + Interest rates and inflation
    - + Equities, real estate and other risky asset classes
    - + Credit spreads and default risk
  - Assumptions about how the pension fund's asset strategy will evolve over all future possible scenarios
  - Assumptions about what deficit contributions are promised to be paid at each point in each simulated scenario
  - Sponsor default model (default probabilities and correlation with other economic variables such as interest rates and equities)

# **Market-Consistent Valuation of Sponsor Support: Some Case Study Results**

# Case Study

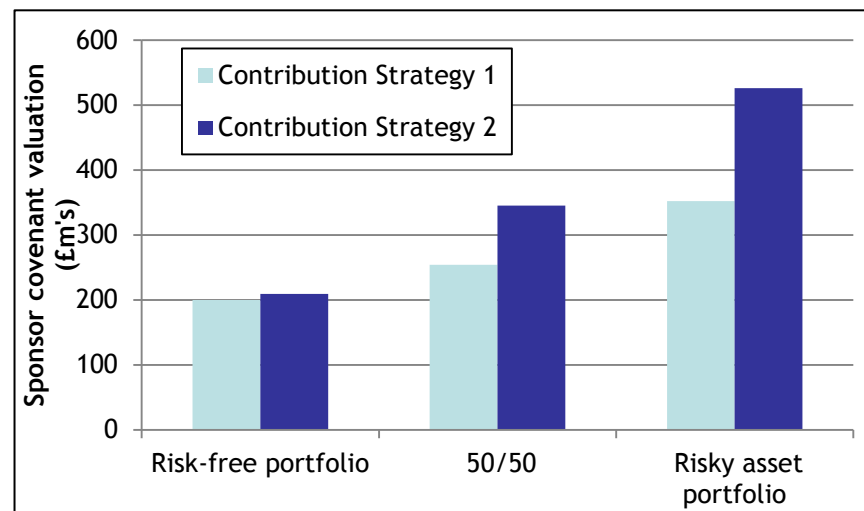
- + Promised liability cashflow schedule has present value of £1,000m when discounted using the UK government bond yield curve at end-2011



- + Assume current market value of assets is £800m
- + Consider two (extremes of) deficit contribution strategies:
- + Strategy 1: Deficit contribution is only paid when asset portfolio is exhausted
- + Strategy 2: Deficit contribution is calculated annually as market-consistent deficit / 5 (subject to min. of 0)

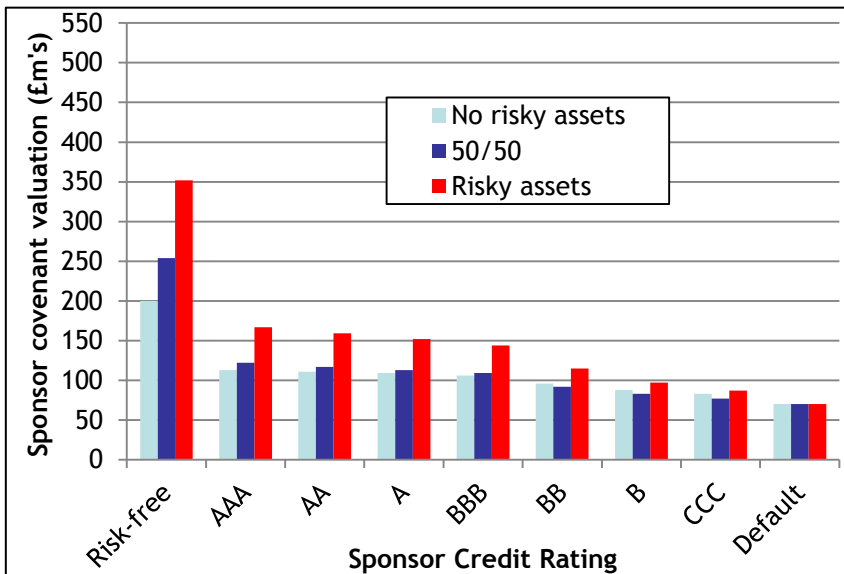
# Case Study Results: No Sponsor Default Risk

- + In the case of a risk-free sponsor, we would generally expect the market-consistent value to simply equal the difference between the market value of assets and the market-consistent value of promised liability cashflows
- + This is generally the case; however, an additional component of value can be generated for the sponsor covenant which reflects the possibility of the investment and contribution strategies generating terminal surplus assets

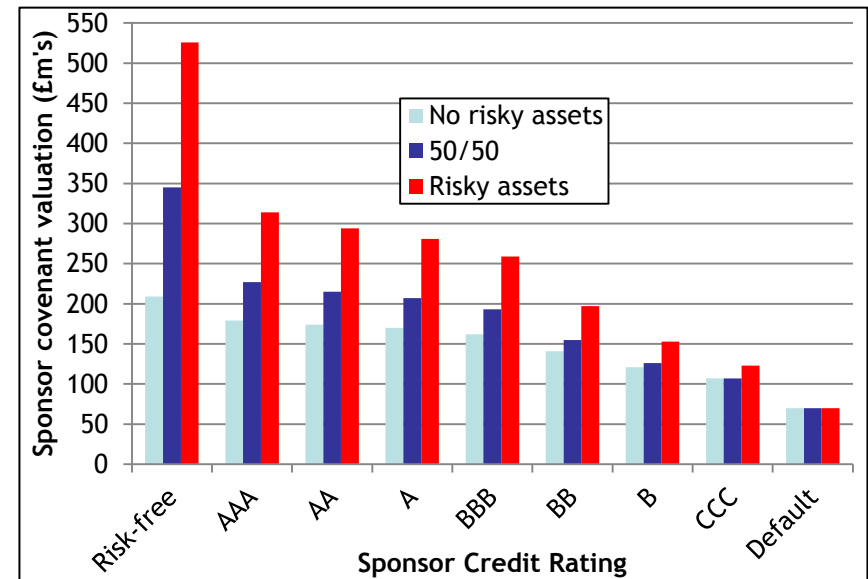


# Case Study Results: With Sponsor Default Risk

- + In the presence of sponsor default risk, the value of the sponsor covenant can be considered to have three components:
  - Current size of m-c deficit
  - + Value of potential terminal surplus assets
  - - Cost of sponsor default risk



**Contribution Strategy 1**



**Contribution Strategy 2**



# Risk-Based Capital Assessment

# Using the holistic balance sheet in risk-based solvency assessment

- + Over the last decade, the global insurance sector has increasingly made use of a 1-year value-at-Risk for the market-consistent balance sheet as a measure of solvency capital requirements
- + Similar approach can be implemented for the DB pension fund holistic balance sheet
- + This can give a measure of the assets / deficit contribution strategy required by the pension fund in order to give comparable levels of security to pension fund members as provided to insurance policyholders

# Calculating the 1-year Value-at-Risk

- + The simplest approach to calculating a 99.5% 1-year VaR involves the following steps:
  1. For each risk that impacts on the balance sheet, identify the 99.5<sup>th</sup> percentile stress event for that risk
  2. Re-calculate the balance sheet following that stress. Define the change in net asset value of the balance sheet as the capital requirement for that risk
  3. Aggregate the capital requirements of each risk using a set of correlation assumptions

# Case Study: Stress Assumptions

- + In the case study developed earlier, the holistic balance sheet was exposed to four risk factors:
  - + Change in the risk-free yield curve
    - Assume 99.5<sup>th</sup> percentile 1-year fall in risk-free rates is 1.0%
  - + Fall in risky asset portfolio value
    - Assume 99.5<sup>th</sup> percentile 1-year fall in risky asset portfolio is 38%
  - + Fall in the credit quality of the sponsor
    - Assume 99.5<sup>th</sup> percentile 1-year credit downgrade is to BB for a sponsor rated A today; and to default for a sponsor rated BB today
  - + Increase in the market level of credit spreads
    - Assume 99.5<sup>th</sup> percentile 1-year increase in credit spreads of 1.4% for long-term A-rated spreads and 4.5% for short-term BB-rated spreads

# Risk-Based Capital Assessment: Case Study Results

# Yield Curve Stress Results:

A-rated sponsor; Contribution Strategy 2; 50/50 asset strategy

Assets	Base Case	After Yield Curve Stress	Change
Asset portfolio value	800	833	+33
Sponsor covenant value	207	320	+113
<b>TOTAL ASSETS</b>	<b>1007</b>	<b>1153</b>	<b>+146</b>
<b>Liabilities</b>			
PV of promised liabilities	1000	1177	+177
<b>NET ASSETS</b>	<b>7</b>	<b>-24</b>	<b>-31</b>

# Risky Asset Portfolio Stress Results:

A-rated sponsor; Contribution Strategy 2; 50/50 asset strategy

Assets	Base Case	After Risky Asset Stress	Change
Asset portfolio value	800	649	-151
Sponsor covenant value	207	315	+108
<b>TOTAL ASSETS</b>	<b>1007</b>	<b>964</b>	<b>-43</b>
<b>Liabilities</b>			
PV of promised liabilities	1000	1000	0
<b>NET ASSETS</b>	<b>7</b>	<b>-36</b>	<b>-43</b>

# Sponsor Credit Rating Stress Results:

A-rated sponsor; Contribution Strategy 2; 50/50 asset strategy

Assets	Base Case	After Sponsor Credit Rating Stress	Change
Asset portfolio value	800	800	0
Sponsor covenant value	207	155	-52
<b>TOTAL ASSETS</b>	<b>1007</b>	<b>955</b>	<b>-52</b>
Liabilities			
PV of promised liabilities	1000	1000	0
<b>NET ASSETS</b>	<b>7</b>	<b>-45</b>	<b>-52</b>



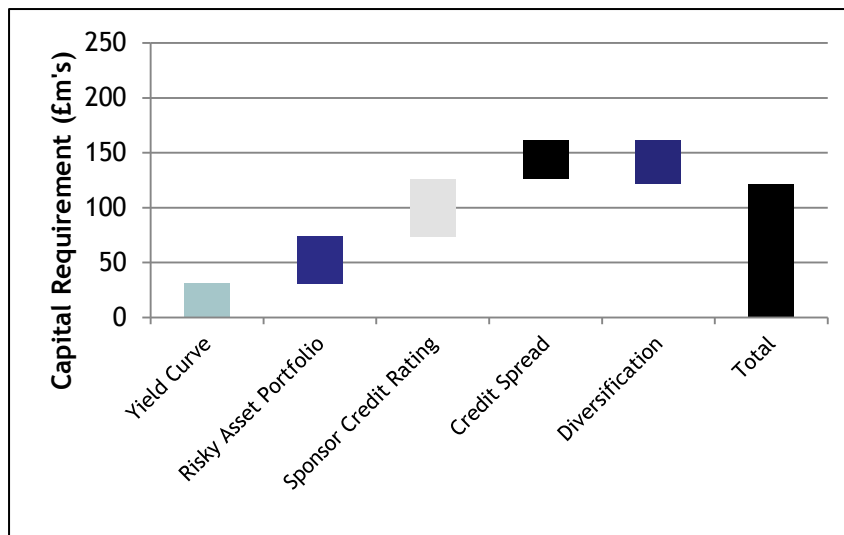
# Credit Spread Stress Results:

A-rated sponsor; Contribution Strategy 2; 50/50 asset strategy

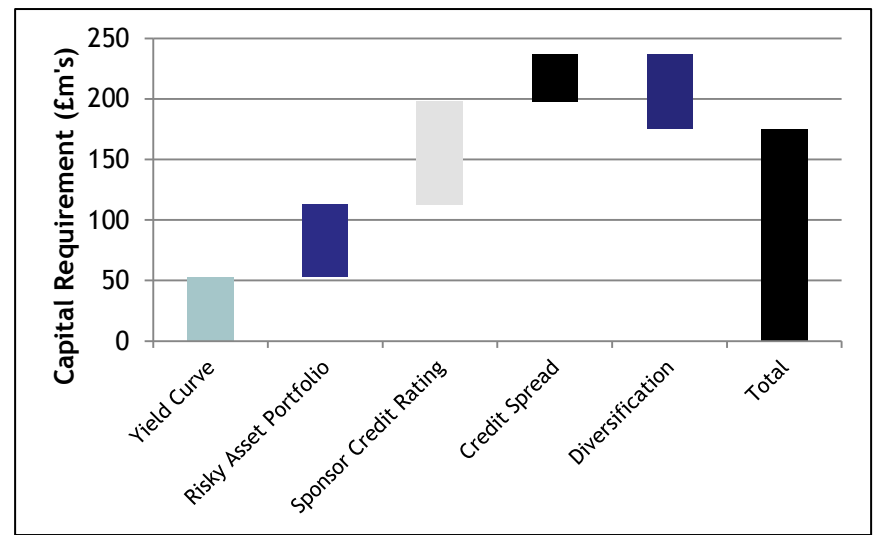
Assets	Base Case	After Credit Spread Stress	Change
Asset portfolio value	800	800	0
Sponsor covenant value	207	172	-35
<b>TOTAL ASSETS</b>	<b>1007</b>	<b>972</b>	<b>-35</b>
Liabilities			
PV of promised liabilities	1000	1000	0
<b>NET ASSETS</b>	<b>7</b>	<b>-28</b>	<b>-35</b>

# Case Study: Capital Results

- + Assuming Contribution Strategy 2, an asset strategy mix of 50% risky assets and 50% government bonds, we obtain the following capital requirements (with starting asset portfolio of £800m):



**A-rated sponsor**



**BB-rated sponsor**

# Case Study: Balance sheet summaries

Assets	Risk-free sponsor	A-rated sponsor	BB-rated sponsor
Asset portfolio value	800	800	800
Sponsor covenant value	345	207	155
<b>TOTAL ASSETS</b>	<b>1145</b>	<b>1007</b>	<b>955</b>
Liabilities			
PV of promised liabilities	1000	1000	1000
<b>NET ASSETS</b>	<b>145</b>	<b>7</b>	<b>-45</b>
<b>SOLVENCY CAPITAL REQUIREMENT</b>	<b>0</b>	<b>122</b>	<b>175</b>

- + In risk-free sponsor case, the sponsor covenant value acts as loss-absorber in any stress case, and so net asset value does not change under stress and the SCR is therefore zero
- + As sponsor credit quality falls, the sponsor covenant absorbs less of the variability under stress and net assets become sensitive to stresses in market prices

**■ Insights for pension fund risk management and investment strategy?**

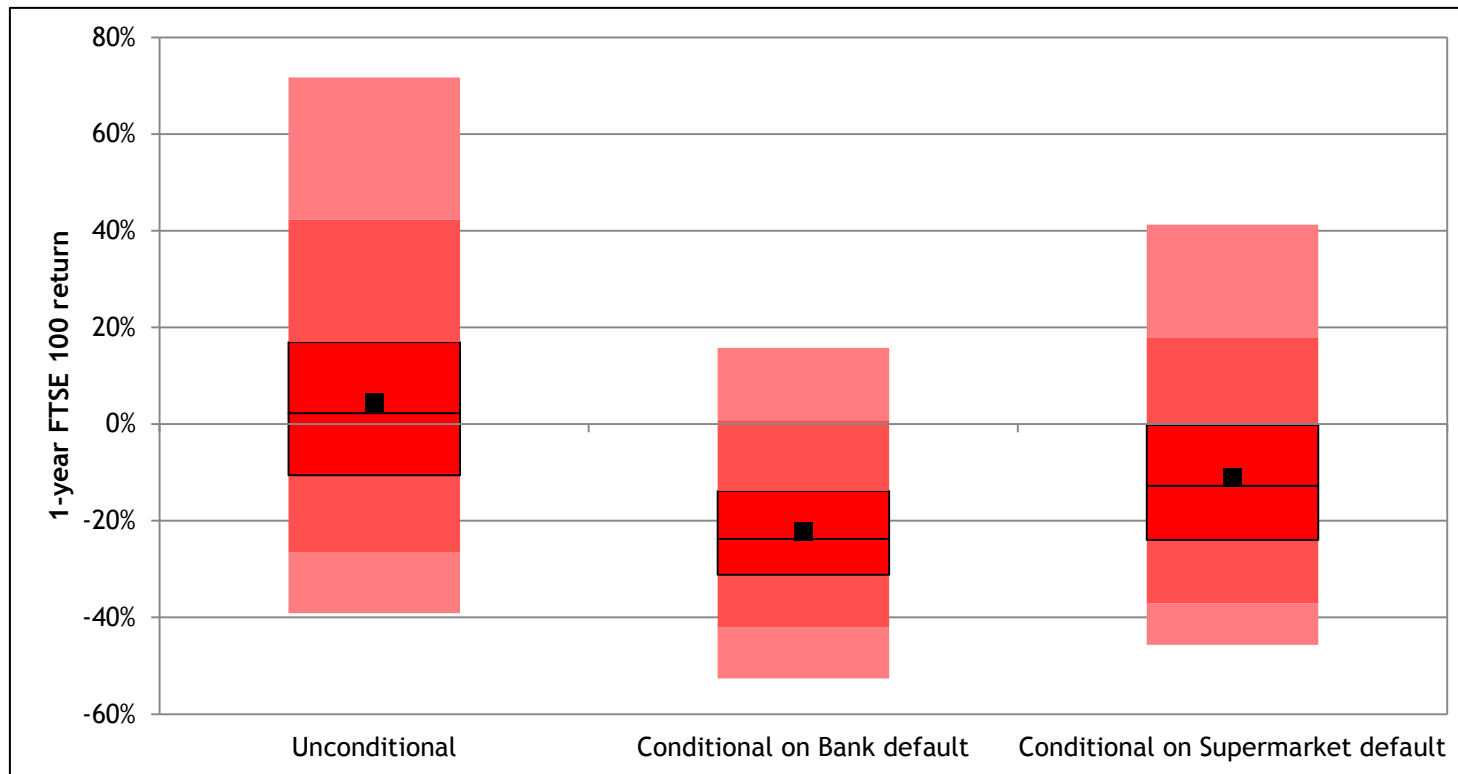
# Managing sponsor support risk

- + The market-consistent / 1-year VaR framework highlights the obvious point that obtaining high levels of member security in the current economic and funding environment requires management of sponsor credit risk
- + Can sponsor credit risk be pooled / diversified / hedged?
- + Pension protection funds are an example of sponsor credit risk pooling / insurance
  - Though in UK they only insure part of the promised liability
- + Are there other mechanisms by which pension funds can directly mitigate sponsor credit risk
  - Increasing the pace of deficit contribution funding is most obvious option
  - Market-based forms of sponsor credit risk insurance?
  - Asset strategy?

# Asset strategy from a sponsor credit risk perspective

- + The logic brings some clarity to the purpose of a pension fund's asset portfolio:
- + It is not there to fund the liability cashflows as they fall due in the normal course of events;
- + It is therefore to fund the cost of the future liability cashflows in the event that the sponsor defaults (most likely to happen in short-medium term)
- + Implies pension fund asset strategy should be less interested in 10-15 year expected asset returns and more interested in the **short-term resilience of the pension fund's asset portfolio value in the conditions associated with their sponsor's default**

# FTSE 100 1-year VaRs Conditional on Specific Sponsor Default



- + Produced in ESG where illustrative bank and supermarket were modelled as individual equities with typical assumptions for beta and stock-specific risks