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Assessing the impact of the recent coronavirus shock on UK corporate pension schemes

July 2020

This paper describes the impact of the recent coronavirus shock on the average UK corporate pension scheme using BlackRock analytics. We analyse the near-term and structural implications of current market events through the lens of asset allocation, funded status and risk in different economic scenarios, leveraging our proprietary risk management system, Aladdin®.

About the authors

Institutional Product Strategy is part of BlackRock's Global Product Group bringing innovation, discipline and focus to BlackRock's product line up through coordination of firm's product strategy, development and pricing globally.

Portfolio Analytics Group is part of the BlackRock Solutions®, which combines sophisticated risk analytics and capital market insights with Aladdin®, our fully integrated investment management technology platform.

BlackRock Portfolio Analysis & Solutions (BPAS) is part of BlackRock's portfolio solutions offering. The team of portfolio and investment professionals conducts customised, outcome-orientated engagements to assist clients with asset allocation, portfolio construction, risk management and implementation decisions. This is executed across multiple asset classes and structures.

Market environment

The sudden onset of the coronavirus has disrupted financial markets, resulting in levels of volatility not seen since the global financial crisis. Risk assets fell sharply as global economic activity came to an abrupt halt due to government-imposed lockdowns. Although the market has broadly rebounded, the duration of the economic slowdown and trajectory of the recovery remain uncertain due to policy execution risks, a continued spread of the virus and potential for an extended period of low demand in a post-COVID world. Brexit-related uncertainty further clouds the UK outlook, leaving portfolios exposed to significant currency and inflation risk. **While we do not see this as a repeat of 2008 given a more stable financial system, heightened uncertainty and accelerating structural trends underscore the need for a robust risk management approach.**

Having a long-term investment horizon and building resilient portfolios are key to weathering the short-term economic impacts of this crisis. Market moves have been deep enough to have a longer lasting impact on the funding outlook for pension schemes. Additionally, the rapid pace of structural change further drives the need for a review of a scheme's strategic asset allocation. Portfolio analytics and deliberate risk management can help weather these near-term market shocks through understanding and mitigating risks across asset classes. Additionally, scenario analysis can help portfolios adjust to accelerating structural change.

Effect on pension schemes

Pension schemes are acutely affected in this volatile market environment. The equity downturn has affected growth assets and a continued low rate environment has put upward pressure on the value of pension liabilities, undermining sponsors' ability to recover any shortfalls in funding. Many corporate defined-benefit (DB) schemes have already closed to new members, and it is likely that the trend will intensify in this crisis. At the same time, bulk-annuity transactions have increased with buy-ins and buy-outs reaching record highs over the last couple of years (Source: Broadridge UK DB Pension Navigator 2019, September 2019), with many scheme sponsors looking to decrease risk in the pension portfolio to facilitate more attractive insurance pricing.

When evaluating the optimal strategic asset allocation and appropriate level of risk for a scheme, it's important to consider this context and the scheme's specific end goal, whether it is full funding, a buy-in / buy-out or self-sufficiency. With many private DB schemes looking to de-risk further while still growing their assets to meet their liabilities, a robust risk management approach becomes even more critical in this turbulent market environment. But what does that mean in practice?

To help schemes navigate the impact of the recent market volatility on portfolio exposures and risk, **we have conducted an analysis of the average UK corporate pension scheme from the beginning of the year through the end of May**, using our proprietary risk management system, Aladdin®.

Case study 1

Impact to asset allocation and funded status

The average UK corporate pension scheme started 2020 in a strong funding position with a funded status of 91.1% (Source: PwC Skyval Index, April 2nd, 2020). Based on the most recent and detailed analysis of the sector conducted by Broadridge (UK DB Pension Navigator 2019, September 2019), the average scheme held approximately 19% of its portfolio in equities, 28% in fixed income, 5% in multi-asset, 5% in real estate, 10% in alternatives, 4% in buy-ins, and 2% in cash, with the remainder invested in LDI strategies. Between January 1st and May 31st, asset allocations are likely to have drifted substantially from their original strategic asset allocation (SAA), with fixed income allocations increasing at the expense of equities and alternatives. We estimate that the greatest deviation occurred on March 23rd, the trough in equity markets. This was followed by a rebound, which we believe brought most portfolios closer to the original SAA throughout April and May. Despite this rebound, we still expect a significant decline in funding levels given the combination of reduced asset values and increased pension liabilities on the back of near-zero interest rates.

Figure 1: Projected asset allocation and funded status of the average UK corporate pension scheme

	LDI	Equity	Fixed income	Multi-asset	Real estate	Alts*-hedge funds	Alts* – Private equity	Alts* - Other	Cash	Buy-ins	Funded status
1 Jan 2020	27.05%	19.23%	28.08%	5.13%	4.50%	3.11%	2.84%	4.10%	2.04%	3.94%	91.10%
19 Feb 2020	27.47%	19.47%	27.58%	5.13%	4.48%	3.10%	2.73%	4.10%	1.95%	4.00%	88.65%
11 Mar 2020	30.20%	16.70%	29.06%	4.80%	4.38%	2.98%	1.97%	3.42%	2.09%	4.40%	87.06%
23 Mar 2020	31.56%	16.87%	27.46%	4.71%	4.14%	3.28%	1.84%	3.29%	2.25%	4.60%	85.81%
30 Apr 2020	30.02%	17.69%	28.31%	4.93%	4.11%	2.95%	2.21%	3.37%	2.03%	4.38%	86.30%
31 May 2020	30.14%	18.11%	27.63%	4.95%	4.02%	2.93%	2.41%	3.47%	1.94%	4.39%	84.10%

*Alternatives.

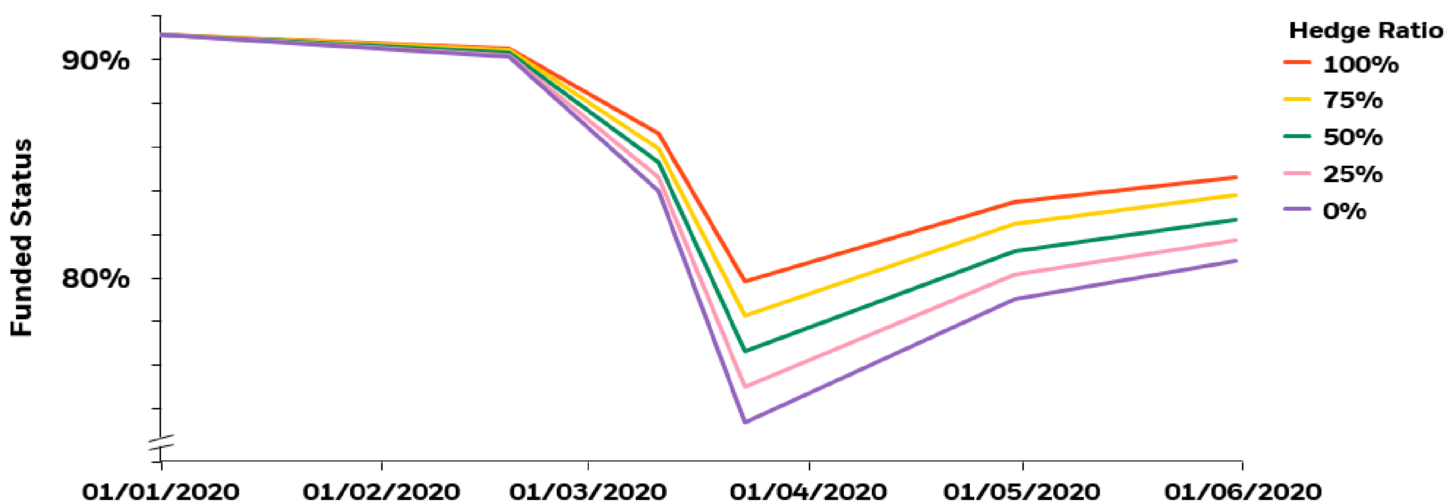
Source: BlackRock, 31/05/2020. Based on Broadridge data as of September 2019. Risk: 84% confidence interval, 180 constant weighted monthly observations, 1yr horizon; see the Appendix for additional risk details. BlackRock mapped fund exposures to public index and private market proxies in performing the analysis; All investments in LDI are assumed to be 3x leveraged; See the Appendix for details regarding the indexes used to represent each asset class. Allocations were obtained using Broadridge data as of September 2019 and then applying historical date range scenarios to move allocations forward. Historical scenarios simulate each scheme's current portfolio through historical time periods. The performance shown is hypothetical and does not represent the performance of any existing portfolio. There is no guarantee that any portfolio will perform in this manner under similar scenarios going forward. The hypothetical performance does not reflect fees and expenses. If fees and expenses were included, the performance would be lower. It is not possible to invest directly in an unmanaged index. Please refer to the Appendix for additional information.

Case study
2

Navigating the recovery

The impact to funded status during the market decline and subsequent market recovery can vary substantially depending on the LDI hedging strategy in place. Assuming the same initial funded status at the start of the year, we show the hypothetical impact of the market movements to funding levels with different hedge ratios implemented. Unhedged schemes' funded status in our analysis declined from 91% to 73% at the market trough, compared to a decline to 80% for their fully hedged counterparts. As the market rebounded, the funding ratio recovered to 85% for fully hedged schemes, but only to 81% for unhedged schemes.

Figure 2: Funded status movement for varying liability hedge ratios

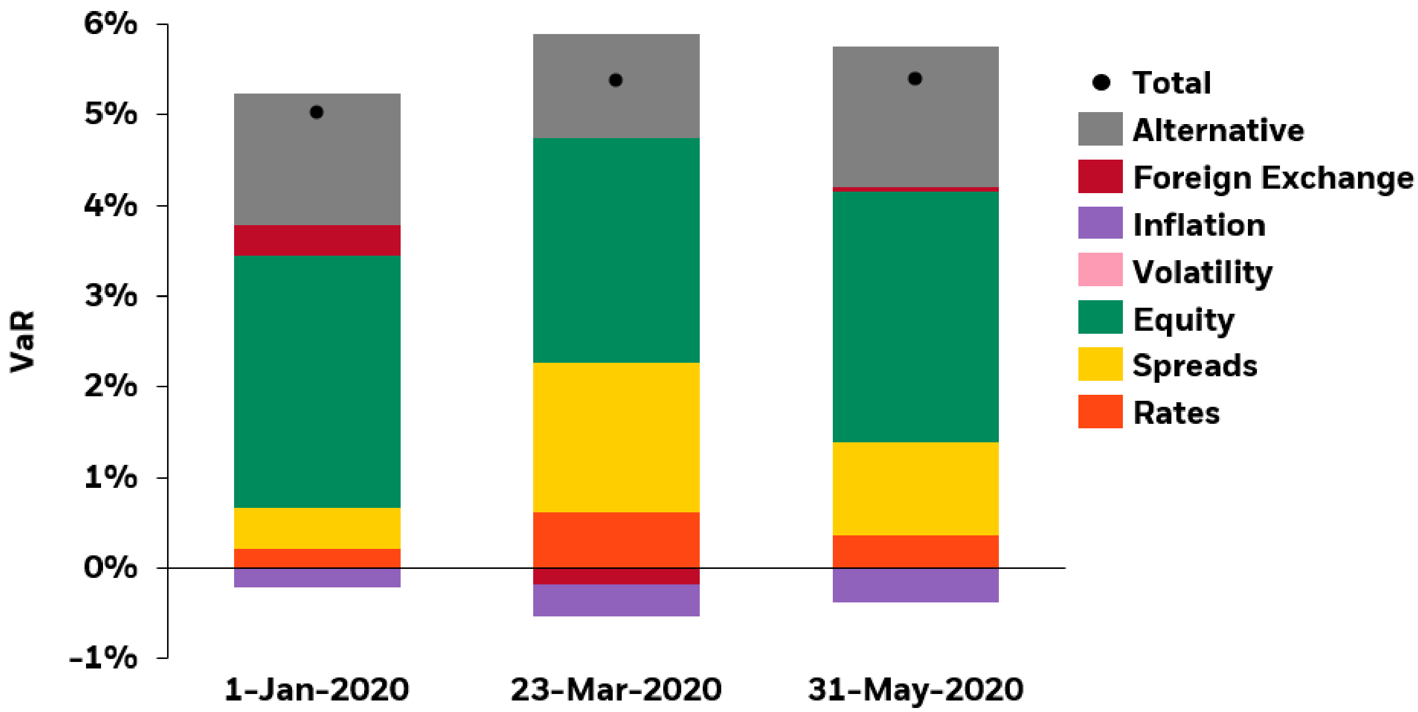


Source: BlackRock, 31/05/2020. Based on Broadridge data as at September 2019. Risk: 84% confidence interval, 180 constant weighted monthly observations, 1yr horizon; see the Appendix for additional risk details. BlackRock mapped fund exposures to public index and private market proxies in performing the analysis; All investments in LDI are assumed to be 3x leveraged; See the Appendix for details regarding the indexes used to represent each asset class. Allocations were obtained using Broadridge data as of September 2019 and then applying historical date range scenarios to move allocations forward. Historical scenarios simulate each scheme's current portfolio through historical time periods. The performance shown is hypothetical and does not represent the performance of any existing portfolio. There is no guarantee that any portfolio will perform in this manner under similar scenarios going forward. The hypothetical performance does not reflect fees and expenses. If fees and expenses were included, the performance would be lower. It is not possible to invest directly in an unmanaged index. Please refer to the Appendix for additional information.

Despite the market rebound, the market moves during the first half of the year may have a long-term impact on funding, even for schemes hedging 100% of their liabilities. Due to this funded status decline, pension schemes targeting a bulk-annuity transaction will be acutely impacted, with a buy-in or buy-out potentially no longer in sight. Having a consistent risk management framework is key to preventing these market movements from having adverse long-term implications on the health of the pension. With additional market volatility expected in the near term, taking action now can help to prevent additional downside risks to funding in the future.

In addition to causing a deviation from a pension scheme's strategic asset allocation, the increase in market volatility also impacts the risk profile of a portfolio. Figure 3 shows how the risk of the whole portfolio evolved from the beginning of the year, through the market decline and subsequent recovery. During this period, the unintentional overweight to fixed income and underweight to equities caused an increase in spread and rate risk with a decrease in exposure to equity markets. This has not only resulted in a decrease in funded status, but it has also reduced the size of the growth portfolio, affecting the ability to recover funded status losses in the future.

Figure 3: Sources of risk for the average pension scheme as asset allocation shifts

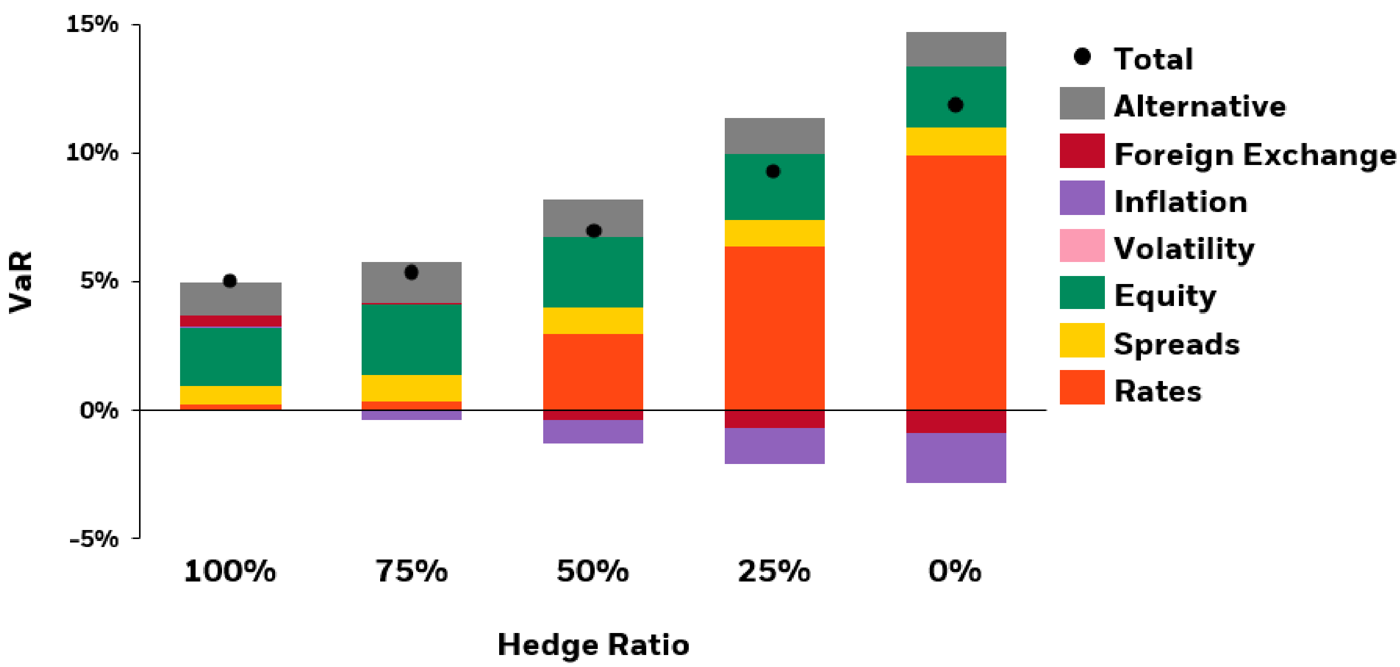


Source: BlackRock, 31/05/2020. Based on Broadridge data as at September 2019. Risk: 84% confidence interval, 180 constant weighted monthly observations, 1yr horizon; see the Appendix for additional risk details. BlackRock mapped fund exposures to public index and private market proxies in performing the analysis; All investments in LDI are assumed to be 3x leveraged; See the Appendix for details regarding the indexes used to represent each asset class. Allocations were obtained using Broadridge data as of September 2019 and then applying historical date scenarios shocks to move allocations forward. Historical scenarios simulate each scheme's current portfolio through historical time periods. The performance shown is hypothetical and for illustrative purposes only. It does not represent the performance of any existing portfolio. There is no guarantee that any portfolio will perform in this manner under similar scenarios going forward. The hypothetical performance does not reflect fees and expenses. If fees and expenses were included, the performance would be lower. It is not possible to invest directly in an unmanaged index. Please refer to the Appendix for additional information.

We also show the impact to the pension scheme's risk profile from increasing or decreasing the proportion of portfolio allocated towards LDI strategies. With rates at record lows, implementing a hedging strategy today can be expensive. However, this should be balanced with the risks of leaving the portfolio largely unhedged, especially during these highly volatile times.

To provide us with more insights, we applied a series of historical scenario simulations to the average UK corporate scheme asset allocation (Source: Broadridge UK DB Pension Navigator 2019, September 2019). The results, shown in Figure 4, suggests that moving from a fully unhedged portfolio to a 50% hedged portfolio cuts the level of risk in the portfolio by over 40%, from 12% to 7% risk, which further decreases to 5.4% risk at a 75% hedge ratio. The marginal risk benefits decline slightly closer to full funding; however, this should be balanced with the benefits from hedging future cash flows and maintaining consistent funding levels through time. As this analysis is based on the average UK corporate pension asset allocation, it's important to consider the specific circumstances of an individual scheme when implementing or changing any strategy in their portfolio.

Figure 4: Sources of risk for varying liability hedge ratios, as of May 31st, 2020



Source: BlackRock, 31/05/2020. Based on Broadridge data as at September 2019. Risk: 84% confidence interval, 180 constant weighted monthly observations, 1yr horizon; see the Appendix for additional risk details. BlackRock mapped fund exposures to public index and private market proxies in performing the analysis; See the Appendix for details regarding the indexes used to represent each asset class. Allocations were obtained using Broadridge data as of September 2019 and then applying historical date scenarios shocks to move allocations forward. Historical scenarios simulate each scheme's current portfolio through historical time periods. The performance shown is hypothetical and for illustrative purposes only and does not represent the performance of any existing portfolio. There is no guarantee that any portfolio will perform in this manner under similar scenarios going forward. The hypothetical performance does not reflect fees and expenses. If fees and expenses were included, the performance would be lower. It is not possible to invest directly in an unmanaged index. Please refer to the Appendix for additional information. Hedge ratios are adjusted by proportionately reallocating between LDI and every other asset class in the portfolio to achieve the correct balance between levered LDI exposure and liability; All investments in LDI are assumed to be 3x leveraged; Reallocations are done as of 1/1/2020, no further rebalancing is performed to maintain the hedge ratio through time.

Scenario analysis

Having a sophisticated risk management system can help clients plan for and navigate any market environment. While stress tests and scenario analysis do not eliminate the inherent risks of investing, they can help understand how risk translates into portfolio outcomes. Additionally, scenario analysis can help portfolios proactively adjust to accelerating structural change. In the charts below, we show the hypothetical returns of the whole portfolio with varying hedge ratios under five scenarios: rates decreasing, spreads widening and three pandemic recession scenarios.

Having a whole portfolio view of pension assets and liabilities is an important tool to help protect a portfolio from increased downside risk, as seen with both the rates and credit shocks, as well as the U-shaped and the L-shaped COVID recovery scenarios. In those hypothetical scenarios, decreasing the exposure to equity in the growth portfolio and hedging the rate exposure in the liability helps to limit the downside risk in the event of a sustained market downturn where rates stay lower for longer. This increased credit allocation also serves to cushion the negative impact to funded status, critical for schemes with a buy-in or buy-out in sight. Conversely, in the COVID-V scenario where fears of a prolonged outbreak dissipate, equities rally and rates increase, the upside in the portfolio is muted. With many DB schemes in cashflow negative territory and government bond yields at record lows, balancing the need for both diversification and yield is critical. Whole portfolio LDI+ strategies, inclusive of private market solutions, can help to bridge this gap. Although these are hypothetical results, we believe they provide useful insights in how to strengthen the resilience and efficacy of portfolios in a range of potential scenarios.

Figure 5: Rates down and spreads widening shocks with varying liability hedge ratios, as of May 31, 2020

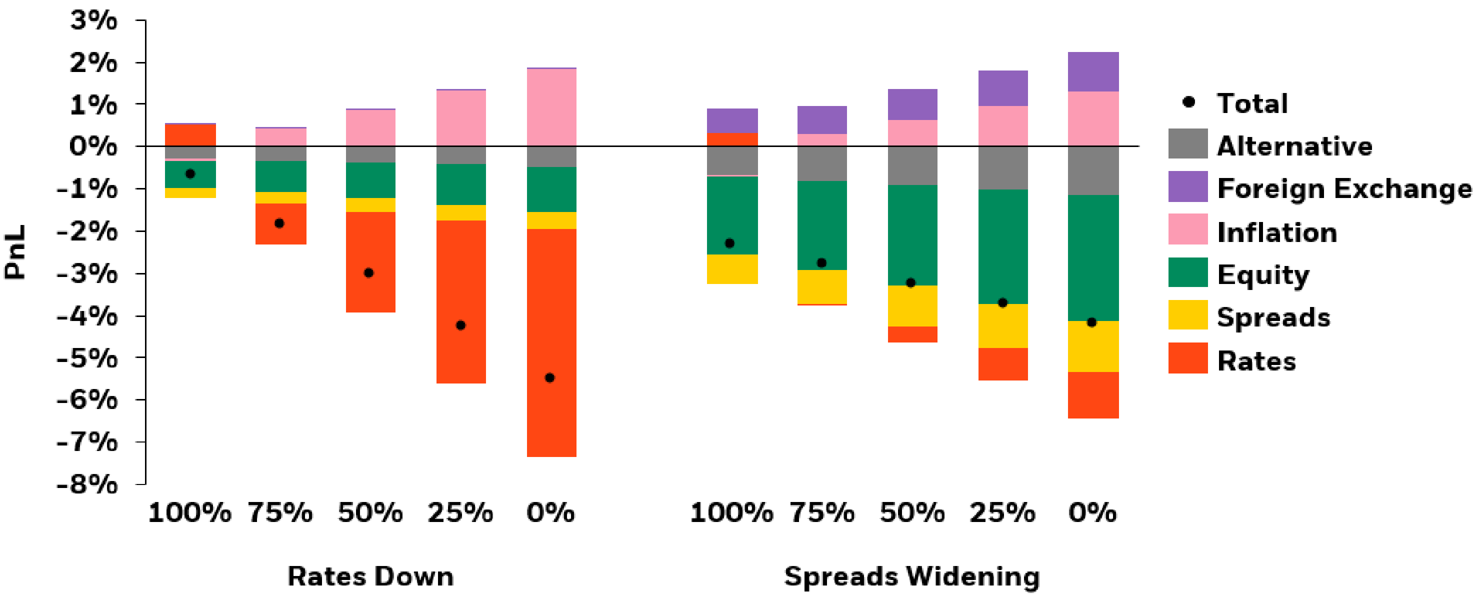
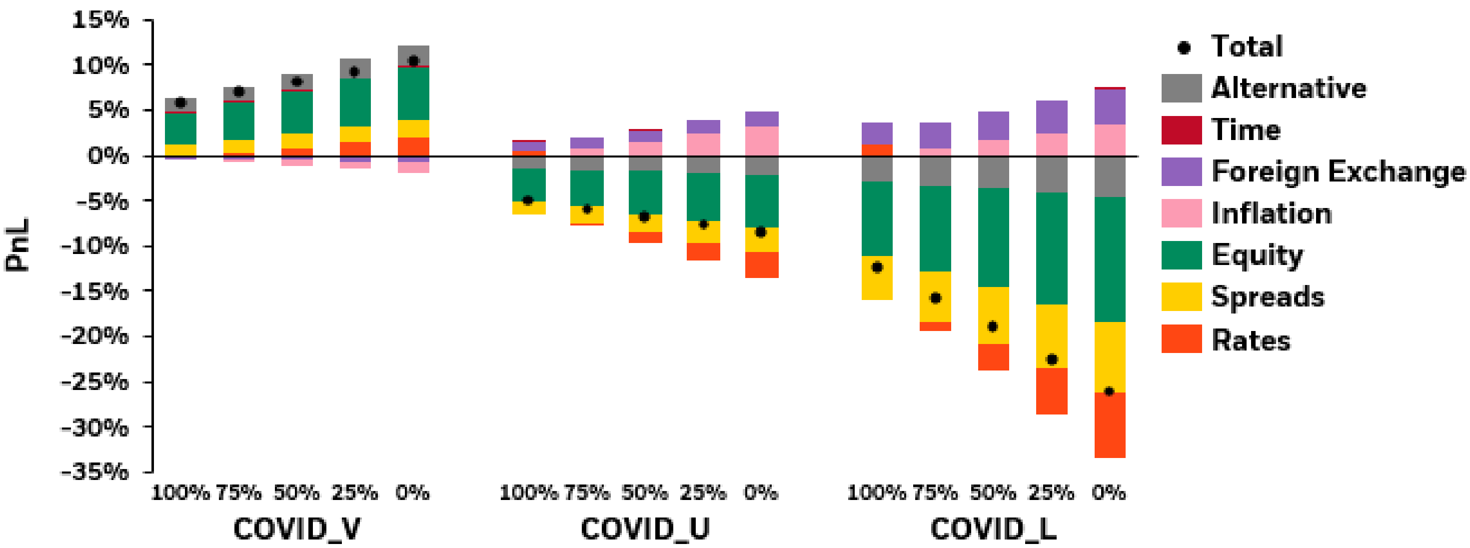


Figure 6: COVID recovery scenarios with varying liability hedge ratios, as of May 31, 2020



Source: BlackRock, 31/05/2020. Based on Broadridge data as at September 2019. Risk: 84% confidence interval, 180 constant weighted monthly observations, 1yr horizon; see the Appendix for additional risk details. BlackRock mapped fund exposures to public index and private market proxies in performing the analysis; See the Appendix for details regarding the indexes used to represent each asset class. Allocations were obtained using Broadridge data as of September 2019 and then applying historical date scenarios shocks to move allocations forward. Historical scenarios simulate each scheme's current portfolio through historical time periods. Hypothetical scenarios simulate each scheme's current portfolio through hypothetical large market shocks and geopolitical stresses, with implied shocks. The performance shown is hypothetical and for illustrative purposes only and does not represent the performance of any existing portfolio. There is no guarantee that any portfolio will perform in this manner under similar scenarios going forward. The hypothetical performance does not reflect fees and expenses. If fees and expenses were included, the performance would be lower. It is not possible to invest directly in an unmanaged index. Please refer to the Appendix for additional information. Hedge ratios are adjusted by proportionately reallocating between LDI and every other asset class in the portfolio to achieve the correct balance between levered LDI exposure and liability; All investments in LDI are assumed to be 3x leveraged; Reallocations are done as of 1/1/2020, no further rebalancing is performed to maintain the hedge ratio through time. The rates shock is -25 bps parallel shock to all positive key rates on the UK gilts curve, no rate is shocked below 0, rates that began negative have no shock applied. The spreads shock is defined as a 1% probability scenario of European Credit Spreads Widening (+26.5% shock to European Investment Grade Credit Spreads).

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The view on strategic asset allocation

The coronavirus pandemic is shaping new behaviours and accelerating pre-existing structural trends that are deeply altering the investment landscape. Positioning for this 'new world' requires a fundamental review of strategic asset allocation choices now.

We are witnessing several tectonic changes in the investment landscape. Firstly, even if activity goes back to more 'normal' levels over the next few quarters, we are unlikely to simply return to previous behavioural and consumption patterns. The BlackRock Investment Institute's core view is that activity will pick up again over a multi-year horizon – and we will resume the previous trend pattern of growth within the decade. But the economy may look meaningfully different by then.

The shock is also compressing the time-horizon over which this change is unfolding, with the future running fast at us. At the start of 2020, we were wary of the profound, but arguably slow-moving, impacts of the shift towards sustainability, de-globalisation trends, central banks reaching the limits of unconventional policies, and how to invest in a world of ever-lower yields. A few months on, these trends have been supercharged:

- De-globalisation is happening: US-China tensions are running high and the desire to re-shore supply chains is greater than ever
- Monetary and fiscal policies have gone through nothing short of a revolution, with an unprecedented speed and scale of response – and the boundaries between the two being blurred as some policy support is bypassing financial intermediation and 'going direct'
- De-globalisation and fragmentation call for a focus on real resilience, going beyond asset class correlations to diversify across sectors and countries that are well positioned for these trends

Arguably, the most important of these trends is sustainability. Structural sustainability – beyond just the confines of the labels E, S and G – is ever more crucial to how investments are assessed. Companies are being priced not on their near-term cashflow prospects but on the fundamental strength of their balance sheet, now and in the future, with ever more attention being placed on the ability to withstand shocks such as natural disasters and the accelerating impact of climate change.

Conclusions

The coronavirus shock is accelerating structural trends of inequality, de-globalisation, macro policy and sustainability. This is fundamentally reshaping the investment landscape and we believe will be key to investor outcomes. The most important action investors need to take today, in our view, is to review their strategic asset allocation and ensure portfolios are resilient to these supercharged trends and the accompanying shorter-term market volatility.

We suggest seeking to build portfolio resilience into a scheme's strategic asset allocation through diversification and a forward-looking approach to risk management taking into account different economic scenarios. In uncertain times, robust risk analytics and holistic management of a scheme's total assets and liabilities is even more critical to achieving desired scheme outcomes.

Understanding the implications of market movements to a portfolio's asset allocation, funded status and risk through various recovery trajectories is important to consider when evaluating portfolio construction and risk management decisions, with the goal of helping schemes achieve their desired objectives over time.

The analysis in this paper describes the impact of the recent coronavirus market volatility to the average UK corporate pension scheme. To gain a deeper understanding of how the current environment may affect your specific portfolio, please speak to your BlackRock Relationship Manager today.

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How you can partner with BlackRock

BlackRock seeks to help clients navigate this environment and evolve client portfolios to maximise success of future outcomes through three distinct engagement frameworks:

Outsourcing to BlackRock
For investors looking to outsource a sleeve or their entire portfolio:
Multi-Asset Strategies & Solutions (MASS)

- Client Portfolio Solutions
- Multi-Asset Solutions

Portfolio Consulting
For clients wishing to retain control of their asset allocation and implementation choices whilst wanting to better understand the risks and exposures of their portfolios:
BlackRock Portfolio Analysis and Solutions (BPAS)

Technology
For investors looking for technology to enable them to measure the risk and return drivers of their portfolios and to take stock of 'where they are' to 'decide where to go':
Aladdin (Risk, Enterprise, Wealth) & eFront

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Appendix 1: Asset class proxies

	Mapping Name	Allocation as of 1 Jan 2020
Equity – Total		***19.23%***
Eq. – Index – Traditional	FTSE All-World Index	8.61%
Eq. – Factor Index	FTSE All-World Index	1.05%
Eq. – Fundamental - Core	FTSE All-World Index	6.46%
Eq. – Fundamental – Specialist	FTSE All-World Index	2.07%
Eq. – Active quant/Factor	FTSE All-World Index	1.03%
Fixed Income – Total		***28.08%***
FI – Core – Index	Bloomberg Barclays Global Aggregate Corporate Index, 100% GBP Hedged	3.46%
FI – Core – Gov. (UK)	iBoxx Sterling Gilts Index	0.76%
FI – Core – Gov. (ex.-UK)	JPM Global Government Bond ex UK Index, 100% GBP Hedged	0.27%
FI – Core – Credit	Bloomberg Barclays Global Aggregate Corporate Index, 100% GBP Hedged	10.98%
FI – Core – Aggregate	Bloomberg Barclays Global Aggregate Corporate Index, 100% GBP Hedged	3.07%
FI – Specialist – High yield	ICE BofAML Global High Yield Index, 100% GBP Hedged	0.29%
FI – Specialist – EMD	JP Morgan Emerging Market Bond Plus 100% Hedged to GBP Index	1.72%
FI – Specialist – Absolute Return	Bloomberg Barclays Global Aggregate Corporate Index, 100% GBP Hedged	1.59%
FI – Specialist – Multi-sector	Bloomberg Barclays Global Aggregate Corporate Index, 100% GBP Hedged	4.84%
FI – Specialist – Other (incl. Structured Finance/Bank Loans)	Bloomberg Barclays Global Aggregate Corporate Index, 100% GBP Hedged	1.10%
Multi-Asset – Total		***5.13%***
MA – DGF – Strategic	60% FTSE All-World Index/40% Bloomberg Barclays Global Aggregate Corporate Index, 100% GBP Hedged	0.32%
MA – DGF – Dynamic	60% FTSE All-World Index/40% Bloomberg Barclays Global Aggregate Corporate Index, 100% GBP Hedged	1.84%
MA – DGF – AR	60% FTSE All-World Index/40% Bloomberg Barclays Global Aggregate Corporate Index, 100% GBP Hedged	2.36%
MA – Other	60% FTSE All-World Index/40% Bloomberg Barclays Global Aggregate Corporate Index, 100% GBP Hedged	0.60%
Alternatives – Total		***10.05%***
Alts. – Infrastructure	Infrastructure – Diversified Global (BlackRock risk factor)	2.11%
Alts. – Hedge Funds	Hedge Funds – Diversified Global Fund Weighted (BlackRock risk factor)	3.11%
Alts. – Private Debt	Direct Lending Hedged (BlackRock risk factor)	1.21%
Alts. – Private Equity	Private Equity – Diversified Global (BlackRock risk factor)	2.84%
Alts. – Other	Hedge Funds – Diversified Global Fund Weighted (BlackRock risk factor)	0.78%
Real Estate	*Real Estate – Core Global* (BlackRock risk factor)	***4.50%***
LDI	*29.28% FTSE Actuaries UK Conventional Gilts over 15 Years Index/58% FTSE Actuaries UK Index-Linked Gilts over 5 Years Index/12.72% GBP Cash*	***27.05%***
Buy-ins	*29.28% FTSE Actuaries UK Conventional Gilts over 15 Years Index/58% FTSE Actuaries UK Index-Linked Gilts over 5 Years Index/12.72%% GBP Cash*	***3.94%***
Cash	*GBP Cash*	***2.04%***

Source: Broadridge.

Appendix 2: Liability mapping

Component	Weight
FTSE Actuaries UK Conventional Gilts over 15 Years Index	29.28%
FTSE Actuaries UK Index-Linked Gilts over 5 Years Index	58.00%
GBP Cash	12.72%

Appendix 3: Pandemic recession scenarios

Moderate Recovery	Global Recession	Depression Fears
V-shaped Recovery	*U-shaped Recovery*	*L-shaped Recovery*
Description Governments relax lockdown measures after successfully containing the COVID-19 outbreak. A moderate recovery in global growth follows a sharp contraction and significant policy easing.	*Description* Strict lockdown measures take a toll on global growth, as the world faces an increasingly negative demand shock. Fears of a deepening recession rise as the duration of the lockdown increases, unnerving financial markets.	*Description* COVID-19 continues its global spread deep into Q2 2020. Fiscal and monetary stimulus efforts fail to prevent increased bankruptcies, defaults, and unemployment. An economic depression threatens to engulf major industries, with the financial sector at the forefront of the crisis.
Calibration Global equities rally as fears of a prolonged outbreak dissipate. DM equities outperform EM in the short term given better healthcare infrastructure. Staples underperform and value outperforms in a reversal of the initial sell-off. Spreads tighten and rates rally. EM FX sees a mild rally as currencies adjust to new levels of growth.	*Calibration* Global equities sell-off. Cyclicals underperform defensive stocks. Spreads widen aggressively, led by DM. Energy spreads further underperform the market, as falling demand drives oil prices to historic lows. Interest rates rally on the back of deflationary expectations. Yen and dollar strengthen due to their perceived safe-haven status.	*Calibration* Investors swiftly flee risk assets on fears of a global depression, with leisure and financial sectors underperforming. The impending hit to global growth increases deflationary pressures and is impetus for a flattening US yield curve. Long-end rates approach near-negative trajectory. Gold and yen outperform as investors flock to perceived safe-haven assets.

Source: BlackRock estimates as of 31/05/2020.

Aladdin and eFront technologies overview

Aladdin Risk is a proprietary risk engine that aims to give a clear view of risk and performance across your entire portfolio. Aladdin Risk seeks to make it easy to create the analyses you need to present the data meaningfully, to help improve your firm's risk management processes and foster more informed investment decision-making. Our service model includes sourcing positions, modeling portfolios and benchmarks, and producing a comprehensive suite of reports — with detailed quality control checks throughout.

In 2019, BlackRock acquired eFront, a world-leading, end-to-end alternative investment management software and solutions provider. eFront is a specialised business unit within the Aladdin technology offerings. Clients have been seeking an integrated view of exposures, risk and performance across the whole portfolio, as well as more integrated multi-asset investment management capabilities. Our partnership accelerates our ability to address this need.

We believe that the combination of eFront with Aladdin sets a new standard in investment and risk management technology, and is a signal of the growing importance and attractiveness of alternative asset classes. eFront will extend Aladdin's end-to-end processing capabilities in alternative asset classes, offering our clients access to a whole portfolio approach.

Risk factor glossary

Alternatives: Contribution to portfolio risk arising from a portfolio's exposure to alternative assets and strategies. Equity: Contribution to portfolio risk arising from a portfolio's exposure to returns across the equity market. This factor captures the risk associate with general equity market movements. Rates: Contribution to portfolio risk arising from a portfolio's exposure to risk associated with changes in yield curves. Spreads: Contribution to portfolio risk arising from a portfolio's exposure to credit spreads. Credit spreads capture risk associated with investment grade, high yield, and distressed debt credit spreads over benchmark interest rates. Foreign Exchange: Contribution to portfolio risk arising from a portfolio's exposure to risk associated with changes in foreign exchange rates. Inflation: Contribution to portfolio risk arising from a portfolio's exposure to risk associated with changes in inflation rates. Time: Contribution to portfolio risk arising from a portfolio's exposure to risk associated with passage of time.

Stress test scenarios methodology and assumptions

Risk calculations performed using BlackRock Solutions Aladdin risk model. Each portfolio component is mapped to a broad set of risk factors; the parametric sensitivity to changes in key interest rates, spreads, and other risk factors is calculated for each portfolio component. The parametric exposures are then summed using the appropriate portfolio weights to compute the portfolio's exposure to systematic market risk factors. BlackRock Solutions' parametric return model then uses the risk factor changes and exposures in the specified time period to estimate the return of the portfolio. Historical scenarios are calibrated to historical markets and the shocks used are representative of the actual market moves during these periods. Each portfolio component is mapped to a broad set of risk factors; the parametric sensitivity to changes in key interest rates, spreads, and other risk factors is calculated for each portfolio component. Market-Driven scenarios simulate current portfolio through hypothetical large market shocks and geopolitical stresses. These are also defined by a set of risk factors with carefully calibrated shocks. The remaining market shocks are implied using a covariance matrix. Stress test scenarios were performed using Portfolio Risk Tools, a proprietary BlackRock Solutions software. Scenarios have been chosen based on risks relevant to the peer group based on the composition of the portfolios and desire to protect against downside risk. Stress test performance is determined by the implied shock to each risk factor that the security or portfolio is exposed to. Shocks for unconstrained risk factors (i.e. implied interest rate moves, economic and market volatility, etc. in the risk model were derived using their historical correlations with the constrained factors). Implied shock scenarios provide the ability to perform hypothetical stress tests with the full risk factor set. Relationships between risk factors and implied shocks are derived using historical correlations and BlackRock analysis. Please note that this list of assumptions does not include all assumptions that may have been applied to a particular model and that the models themselves do not factor in every performance factor that can have a significant impact on a portfolio. Since many potential scenarios may exist, it is impossible to show all of the potential circumstances that would yield similar results. Actual events will vary and may differ materially from those assumed. It is provided to illustrate the estimated investment P&L of a company in a specific stress scenario. Actual returns may vary. The model is based purely on assumptions using available data, based on past and current market conditions, and assumptions relating to available investment opportunities, each of which are subject to change. The model is subject to significant limitations. It cannot account for the impact that economic, market, and other factors may have on the implementation of an actual investment. In addition to the variables identified above, the return of any portfolio will vary materially from the return shown based on numerous factors including, but not limited to, current
market conditions, the specific securities in the portfolio, and the current leverage costs, among others. While leverage can increase returns, it also increases risk of loss. This model is not intended to provide, and should not be relied upon for investment, accounting, legal or tax advice, nor used with any third-parties.

Stress test scenarios limitations

Hypothetical performance has inherent limitations. Such results do not represent actual trading, and thus may not reflect material economic and market factors, such as liquidity constraints, that may have had an impact on our actual decision-making. No representation is made that a portfolio will achieve results similar to those shown, and performance of actual portfolios may vary significantly from the hypothetical results. No representation is made as to the accuracy or completeness of the scenario analysis shown in this material or the validity of the underlying methodology, and results are provided for informational purposes only. The shocks specified give more color as to the magnitude of the moves, but are not the comprehensive set of moves that occur in each stress test. In addition, the models themselves do not factor in every performance factor that can have a significant impact on a portfolio. The scenario analysis should not be misinterpreted as constituting the actual performance of the portfolios nor should it be relied upon in connection with any investment decision relating to any product or strategy. All investments involve a risk of loss of capital, and no guarantee or representation can be made that an investment will generate profits or will avoid losses. We would be happy to further discuss our methodology and assumptions at your request.

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Capital at risk.

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