

Hot and Bothered?

How climate change might affect UK longevity

This paper discusses how climate change and resource constraints might impact UK longevity.

We introduce three climate change longevity scenarios pension schemes can use in stress tests of their funding plans. These scenarios, together with consideration of other risks such as covenant and investment risk, can help pension schemes introduce the issues of climate change and resource constraints into their risk management framework.

The pressure's on

US President Donald Trump has had something of an 'on-again, off-again' relationship with climate change. Once upon a time he was part of a business group endorsing action to tackle the issue.¹ More recently he has pulled the United States out of the Paris Agreement, denied publicly that climate change is "one of our big problems", and left the 2018 G7 summit just before the bit about cleaning up the oceans. He's even suggested that global warming is a Chinese conspiracy against US manufacturing.²

In contrast to Trump's flimflamming, the scientific community is unwaveringly committed to tackling climate change. In its Global Risks Report for 2018³, the World Economic Forum listed 3 of its top 5 risks as being environment-related (extreme weather events, natural disasters, and failure of climate-change mitigation and adaptation), with environmental risks ranked highly in their reports consistently since 2011. In the meantime in the UK, plastic bags in supermarkets now incur a fee to encourage shoppers to use their own bags, and the rise of reusable coffee cups shows increased consumer consciousness of wider environmental issues. Environmental risk, growing in status in recent years, has never been so prominent.

In March 2018, the UK Government's Environmental Audit Committee requested information from the UK's 25 largest pension schemes on how they manage climate change risks. It wanted to test the zeal for sustainability in financial and strategic decision-making. Some schemes demonstrated that they are seriously considering the issues. That said, the Parliamentary Under Secretary of State for Pensions and Financial Inclusion, Guy Opperman MP, believes trustees, scheme managers and pension professionals suffer from "widespread misunderstanding" on the impact of climate change on pension schemes. In his view good practice is "far from universal".⁴

Things are certainly heating up in this area and the Environmental Audit Committee's output is only likely to lead to further initiatives. Institutional investors such as pension schemes are expected to lead the way with green investment. Furthermore, the Institute and Faculty of Actuaries (IFoA) issued a risk alert in May 2017, stating that "Actuaries should ensure that they understand, and are clear in communicating, the extent to which they have taken account of climate-related risks in any relevant decisions, calculations or advice";⁵ trustees should expect to hear more about this from their actuaries soon.

Much of the existing body of work on this topic has focussed on financial markets and investment choices. However climate change will also have the potential to impact life expectancy in both direct and indirect ways. Given trustees' responsibility to pay benefits as they fall due, ensuring the scheme is resilient to possible future outcomes is arguably more important than achieving the 'correct' best estimate assumption. As they say, to fail to prepare is to prepare to fail.

“Overwhelming evidence shows that climate change and energy transition are risk factors that UK pension funds and their advisers must consider and manage in order to discharge their legal duties. This clearly includes undertaking an analysis of sponsor covenants and assumptions about investment performance, but as this report shows, longevity assumptions may also be highly relevant.”

- Joanne Etherton (Pensions Lawyer, ClientEarth)

¹ In December 2009 Donald Trump was one of a number of business leaders who published an open letter in the New York Times urging President Obama to act on climate change at an upcoming UN Climate Change Conference in Copenhagen
<https://www.nytimes.com/interactive/2017/06/03/us/politics/document-Nyt-Ad-Re-Climate-Change-Trump-Signer.html>

² <https://twitter.com/realDonaldTrump/status/265895292191248385>

³ <http://reports.weforum.org/global-risks-2018/>

⁴ <https://www.parliament.uk/documents/commons-committees/environmental-audit/180215-Guy-Opperman-to-Chair-Green-Finance.pdf>

⁵ <https://www.actuaries.org.uk/documents/risk-alert-climate-related-risks>
 In addition, the Institute & Faculty of Actuaries' policy briefing "Climate Change: Managing Risk and Uncertainty" outlines how climate change can be addressed from a risk management perspective, while "Resource and Environment Issues: A Practical Guide for Pensions Actuaries" focuses on practical aspects.

It's all connected

The knock-on effects of climate change are far-reaching and diverse, comprising a huge web of linked risks and effects. In the words of the World Economic Forum (WEF), “the truly systemic challenge here rests in the depth of the interconnectedness that exists both among these environmental risks and between them and risks in other categories.” It’s also not difficult to pick out other risks from the WEF’s Global Risks Report that aren’t categorised as environmental risks but are certainly related. Food and water crises, for example, or failure of critical infrastructure.

Much of the body of published work to date focuses on outcomes in each area in isolation, whereas in reality the impact of climate change on longevity will be an aggregate of many dependent factors from a vast network of systemic risks. It’s with this in mind that we have tried to capture such interactions in our analysis. By way of illustration, here are a few examples.

Warmer summers are a damp squib



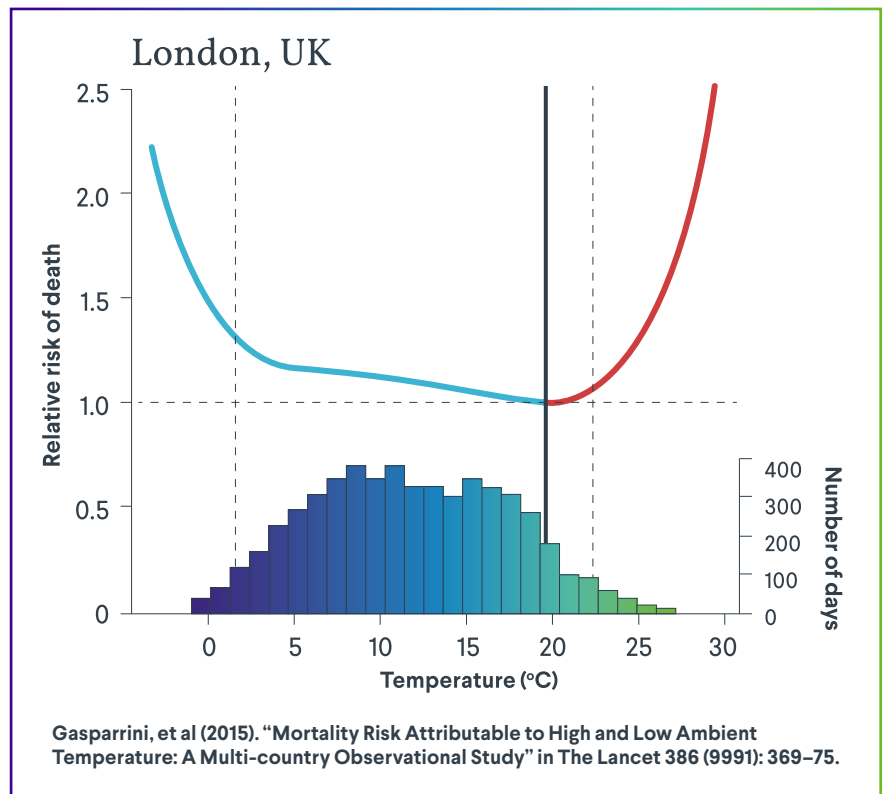
“ The multiple and linked climate change risks on both mortality and asset valuations provide a complex and potentially perfect storm. Understanding and modelling these risks is vital for their proper management. ”

- Professor Aled Jones (Director of the Global Sustainability Institute)

Global warming is what first springs to mind when we think of climate change. Some optimistically envisage the positive effect of ‘better’ British summers. It’s true that, in isolation, an increase to average temperature would be beneficial for life expectancy in the UK, as we’d expect to see cold-related deaths reduce by more than heat-related deaths would rise. The graph below illustrates this; the red and blue line shows the relative risk of death at different temperatures, with the lowest point on the line (at around 19.5°C) showing the optimum temperature. The bars below the line show the actual incidence (in days) of these temperatures in London over a 14-year period (1993 to 2006); with all else equal, rises in average temperatures would bring us closer to optimum levels.

This all sounds like good news. However, it’s important to note that climate change doesn’t just mean a higher average; it also means there are greater fluctuations between extreme heat and extreme cold, which the UK is not well equipped to deal with. Dramatic swings in temperature are the real killer, especially for vulnerable people like the elderly. Such fluctuations may well reduce life expectancy regardless of warmer overall temperatures. And that’s just the direct impact – there are a whole host of knock-on effects too.

While warmer temperatures may help food production in some places, they would be disastrous to global farmland as droughts increase. At the same time, melting ice caps would increase water levels, leading to a higher incidence of flooding which could cause extensive damage to worldwide farmland and infrastructure and result in widespread food shortages. The UK is a net importer of food, so relies heavily on global sources. Issues with importing food would mean rising prices, and healthy fresh food may become out of reach for a large section of the UK population as a result.

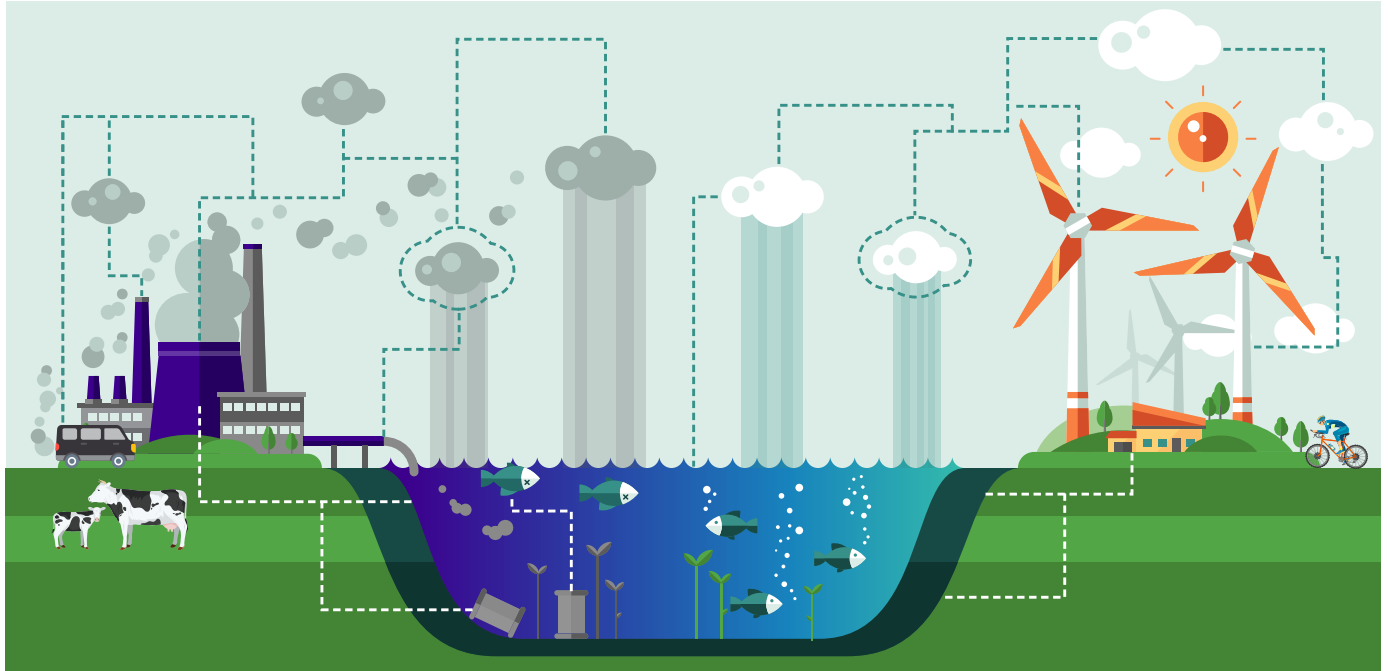


Extreme weather events could also lead to forced mass migration – leading to overcrowding, political conflict and further strain on the world economy.

Many infectious diseases such as malaria are spread by insects and other organisms. Increases in temperature in certain parts of the world could intensify the breeding patterns of these insects, in turn raising the levels of transmission of such diseases. It is perhaps unlikely that temperatures in the UK will reach the levels for us to be directly affected. However, we live in a global society and, as we have seen recently with the Zika virus, infections which thrive and mutate in some parts of the world can readily be transported further afield. This threat is amplified by our growing antibiotic resistance.

The Paris Climate Agreement’s central aim⁶ is to restrict a global temperature rise this century to well below 2°C. If global temperatures begin to approach this level, severe emission restrictions may come into force which will significantly limit the use of fossil fuels. Before we even reach this point, we may find depletion of the world’s fossil fuels stocks leads to significant resource constraints. Here another connection comes into play; our long and healthy lives are currently heavily reliant on fossil fuels, for example transportation and refrigeration of year-round fresh foods, and temperature regulation for homes and places of work. Restrictions to the use of fossil fuels would put all this at risk resulting in poorer health and increased risk to life.

A drastic detox



For the sake of reducing our cortisol levels let's try a rosier vision.

Aside from driving climate change, we know that the burning of fossil fuels results in air pollution and consequently reduces life expectancy, for example via increased respiratory disease. The flip side of this situation is what would happen if we were to react effectively and invest heavily in greener alternatives to fossil fuel. Say, for example, we managed to do away with the need for oil and gas altogether. Air pollution would be drastically reduced, leading to improvements in life expectancy owing to the near-eradication of related deaths.⁷ Fewer pollutants in the air also means cleaner water.

While electric cars may become more popular and more efficient, we might decide they're still bad for the environment (they still need to be charged, after all, not to mention all the chemicals used in batteries) and take to walking and cycling more. Getting places under our own steam would make us healthier, with lower incidence of

diabetes, cardiovascular illness, cancers and potentially dementia, and the air would be cleaner from lower exhaust fumes.

As part of this clean living we could choose to eat less red meat⁸, or indeed may need to as part of realising that mass farming pollutes the air with methane produced by cows.⁹ Western diets might move away from unhealthy processed meat products, which are associated with a range of health problems such as cancer and heart disease. The food we eat may also improve in quality and become more plentiful as a result of cleaner air and water.

Positive adaptation to the issues of climate change is likely to benefit health directly at the same time as reducing sources of poor health. It has the potential to be a positive feedback loop: we exercise more; our health improves; the land, air and water quality improves; we get even healthier, and are able to be even more active; and so on.

⁶ <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>

⁷ The Royal College of Physicians estimates that around 40,000 deaths per year in the UK are caused by outdoor air pollution. <https://www.rcplondon.ac.uk/file/2916/download?token=RzylFzis>

⁸ In October 2015 the World Health Organisation added red meat to its list of known carcinogens. It is estimated that the risk of colorectal cancer rises 17% per 100g of red meat consumed daily. <http://www.who.int/features/qa/cancer-red-meat/en/>

⁹ It is estimated that globally around 15% of all greenhouse gas emissions relate to livestock, with the majority of this due to cows. <http://www.fao.org/news/story/en/item/197623/icode/>

What's the forecast?

We are not trying to predict the exact outcome of climate change. The point is to consider both the enormous range of potential outcomes and the multifaceted nature of how climate change can and will affect longevity. Climate change brings with it a complicated collection of related risks and impacts, highly dependent on our own reaction – or inaction – to the issue. The interconnectivity of the modern world we live in, with all its current benefits and drawbacks, intensifies the effect of these environmental matters.

Owing to the vast interdependency between factors, a comprehensive risk analysis on this topic will be complex.¹⁰ Therefore our work has focussed on scenario testing as an effective and tangible way to quantify the impact of risks associated with climate change. It may be difficult to predict exactly what will happen, but it is possible to test how resilient your funding plans are to certain events.

We have built three potential future scenarios, in each case considering the projected evolution of life expectancy and likely impact on a typical pension scheme's liabilities.¹¹ These are scenarios that trustees may wish to use to inform risk assessments made as part regular governance, or to feed into assumption-setting. The likelihood of each scenario is difficult to ascertain, being dependent, amongst other things, on government and societal activity. However, it *is* possible to look at these stress tests in light of how prepared you are for each scenario.

¹⁰ In their discussion paper "Climate Change and Mortality", the Resource and Environment Working Group of the International Actuarial Association present a detailed description of positive and negative effects while acknowledging that quantifying the impact is extremely difficult. http://www.actuaries.org/CTTEES_ENVIRO/Papers/REWG_CCandMortality_final_Nov2017.pdf

¹¹ Liability impacts quoted are only due to effects on longevity.

Head in the sand



This scenario considers a range of disastrous outcomes resulting from a total lack of response to resource and environmental risk. Climate change has led to global crop failures and food shortages, as well as an influx of diseases into the UK from warmer climates, to the extent that the incidence of infectious disease is akin to that we might have seen a century ago.

There is no further progress on cancer treatments, and both cancer and cardiovascular disease start an upward trend, owing in part to poor diets resulting from the healthy food shortages. Severe temperature fluctuations result in the equivalent of a harsh flu epidemic every three years. Antibiotic resistance continues to rise and new discoveries in this field are limited. Premature mortality rises from flu

deaths and infections as well as increasing frailty amongst older individuals. This is exasperated by resource limitations restricting the service the NHS can provide (possibly to the point of dissolution).

For this scenario we have assumed that mortality rates will rise in the future (and so life expectancy will fall). Since it is an extreme scenario, we have assumed that this will start to happen very soon.

Impact on cohort life expectancy from age 65		
Typical member	Current Deferred, age 50	Current Pensioner, age 65
Men	-3.6 years	-1.1 years
Women	-4.0 years	-1.4 years



Challenging times



In this scenario we've considered a less extreme outcome where we achieve some adaptation, but still struggle to adapt quickly enough to overcome the limitations of finite resources. We consider the implications of the possibility that we have reached 'peak oil flow' and that the availability of oil will become a constraint to economies in the future.

A consequence of this could be increasing fuel prices, leading to severe constraints in finances and funding of the NHS. Alongside this, reduced access to, and increased cost of, imported food stocks could have a detrimental impact on health outcomes via, for example, greater difficulty in maintaining healthy fruit and vegetable rich diets throughout the year.

We reflect this in our scenario by assuming that a significant proportion of lower income groups are unable to afford their basic needs (heating, fuel, medicine), and that this leads to life expectancy ceasing to improve. We assume also that resource constraints impacts are less severe for higher socio-economic groups.

Impact on cohort life expectancy from age 65		
Typical member	Current Deferred, age 50	Current Pensioner, age 65
Men	-1.2 years	-0.4 years
Women	-1.7 years	-0.7 years



Green revolution



Recent years have seen increasing public awareness of our footprint on the environment. In this scenario we assume that widespread calls for change and rapid technological advances lead to positive adaptation to climate change, leading to improved longevity.

Here, some combination of environmental conscience, legislation and possibly fuel scarcity leads people to ditch their cars in favour of walking, leading to better health and cleaner air. Significant improvements in the availability and efficiency of green energy also improves air quality. Added to this, there is less reliance on processed foods and red meat due to better health education, along with a general interest in reducing greenhouse gases. Preparation for global warming has led to better protection against

extreme temperatures (e.g. home insulation), leading to lower cold and heat-related deaths. In addition, better communication systems and less traffic on the roads lead to faster and more responsive emergency services.

The above improvements to diet, exercise and air quality are reflected in lower incidences of cancer, cardiovascular disease, dementia and respiratory diseases. There are also fewer temperature-related deaths.

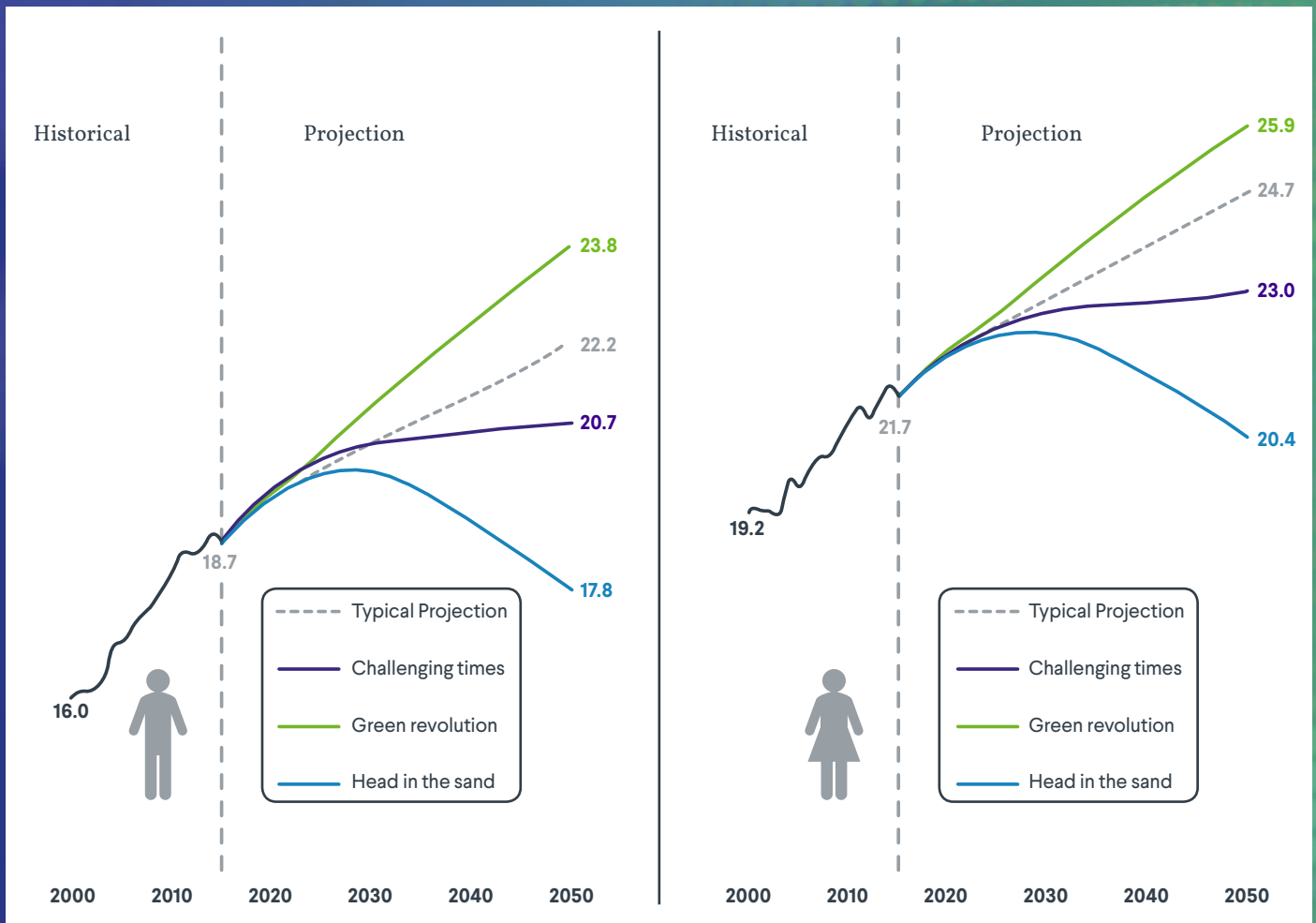


Impact on cohort life expectancy from age 65		
Typical member	Current Deferred, age 50	Current Pensioner, age 65
Men	+1.9 years	+0.9 years
Women	+1.6 years	+0.8 years



Comparing the scenarios

The graph below shows projected life expectancy¹² from age 65 at each year into the future under each of our scenarios next to a typical assumption currently used by many pension schemes.¹³ We also provide the backdrop of life expectancy from age 65 observed each year since the year 2000.¹⁴ As you will expect, the most positive longevity scenario is our green revolution – with a significant increasing gap over time compared against our ‘head in the sand’ scenario where we fail to respond to the risks presented by climate change.



It could at least be seen as cheering that this enormous range of results is in direct relation not to events outside our control, but to our own behaviours and choices across the globe. What will actually transpire will depend on social and political movements worldwide, as well as consumer trends and the habits of different demographics.

Of course, good news for longevity is bad news for pension schemes (and vice versa). For a typical scheme, the liability impact ranges from around a 5% increase if we respond strongly and positively to the risks, against a liability reduction of up to 12% in the scenario where we sit on our hands. These impacts will be compounded by any linked outcomes for financial markets. It's important to note that our scenarios only consider longevity and not the overall impact on pension schemes including consideration of all risks.

¹² Life expectancy is shown on a period basis i.e. prior to any allowance for future improvements. This is to enable direct comparison with the observed historical values. Please note that the projected life expectancy for specific individuals aged 65 will be higher than shown in the chart as this will include the improvements anticipated over their remaining lifespan. These cohort life expectancies underpin the liability impacts and the differences in life expectancies shown alongside the individual scenarios.

¹³ Here we have assumed a typical assumption of the 2016 edition of the core CMI model with a long-term rate of 1.5% p.a.

¹⁴ This life expectancy is for Club Vita as a whole reflecting the life expectancy seen across UK DB pension schemes.

Not just a matter of life and death

In this paper we have focussed on how climate change and resource constraints could affect UK longevity. However, when stress testing the funding plans of your pension scheme it is important to consider the holistic effects of a scenario on scheme funding risks. The events described in the longevity scenarios in this paper will also have material effects on other scheme risks, in particular invested assets, interest rates and inflation and sponsor covenant.

For example:

- **Discount rates:** Any damage to the world economy is likely to affect yields on government bonds and rates of inflation, with knock-on effects for liability calculations.
- **Loss of value on assets ('stranded assets'):** Carbon emission limits could result in unanticipated write-downs and devaluation of assets for certain businesses, reducing asset returns for investments in such companies and affecting sponsor covenants.
- **Investment outlook:** Investment returns may directly correlate to how well underlying businesses respond to climate change adaptation, particularly in the longer term and for businesses in regions greatly affected by climate change events.
- **Sponsor covenant:** Where companies positively adapt to the changing world, sponsor covenants may remain sound or indeed improve. However, pension schemes where the sponsor has considerable fossil fuel dependencies or exposure to climate-related risks (e.g. crop failures, extreme weather events) may see a weakened covenant unless they have a clear adaptation plan.

Indeed, whilst our 'head in the sand' scenario is beneficial in liability terms, the broader distresses and the economic environment is likely to mean that this scenario will nevertheless be painful in terms of trustee funding.

“ Understanding the potential for substantial economic uncertainty and material stranded assets is crucial when allowing for climate change within the Pensions Regulator’s integrated risk management framework. ”

- Nick Silver (former Chair of the IFOA Resource & Environment Group)

To wrap up

We hope the scenarios which set out in this paper are helpful to start discussion as part of trustee funding considerations. While we cannot know for sure what climate change will bring in the coming years, trustees of pension schemes and their advisers will need to consider the implications as they set assumptions and build a longer-term strategy. The Government and the population might adapt to the threats and adapt positively enough to increase life expectancy, or the reaction may be too muted to counteract the potential major detriment to our longevity. Either way, the risks of climate change have now been brought into the light; they will undoubtedly remain on the agenda for the foreseeable future.

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Additional notes

Our scenarios are available in Club Vita reporting and from our website, along with information about the parameters used in our analysis. While it is incumbent upon trustees of pension schemes to consider climate risk, we recommend a holistic look at risks to your scheme.

Reliances and limitations

In this research paper (the “Research”), Club Vita LLP (“CV LLP”) has provided to the UK pensions industry a discussion around potential impacts of climate change, including the impacts on DB pension schemes and a number of illustrative scenarios for how life expectancy may evolve in the future. The scenarios are not necessarily intended to represent the range of possible outcomes for pension schemes. They are intended to be used by pension schemes considering stress testing their funding plans, as well as facilitating wider discussions on climate change risk.

The Research is based upon CV LLP’s understanding of legislation and events as of July 2018 and therefore may be subject to change. The Research is CV LLP’s high-level analysis of potential future scenarios and is not, nor is it intended to be, specific to the circumstances of any particular pension scheme.

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This paper complies with the requirements of Technical Actuarial Standard 100, effective from 1 July 2017.