SOA Research Institute

Aging and Retirement

Catastrophe and Climate

The Impact of Climate Change Risk on Retirement Essay Collection

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CONTENTS

Introduction

The Society of Actuaries (SOA) Research Institute Aging and Retirement and Catastrophe and Climate Strategic Research Programs are pleased to present this collection of essays that explores the impact of climate risk on retirement from authors with varying perspectives. Our intent is to provide a useful resource for readers to become more familiar with the variety of issues surrounding the impact of climate risk on retirement and set the stage for future research. Concurrently, there is an in-depth effort to look at climate in regard to how it will impact retirement fund investments and will accompany this work.

PRIZE WINNER: *Climate Change Risk and Vulnerable Retirees* by Sam Gutterman
This prize-winning essay discusses the vulnerability of the aging retired population to the risks of climate risk. The author addresses socioeconomic, health, and location vulnerabilities.

PRIZE WINNER: *Liability-Driven Investing and Climate Risk: Facing Reality One Step at a Time* by Emilie Paquet, Jean-Francois Giroux and Christina Somers
In this essay, the authors present conclusions they have drawn from case studies using Climate VaR data. They review three forms of climate risk facing companies forming the basis for their selection of using Climate VaR data for their case studies.

PRIZE WINNER: *Climate Change, Housing and Retirement Security* by Anna M. Rappaport
This prize-winning essay focuses on how housing impacts retirement well-being, including issues related to climate risk. The author starts with a discussion of the economic issues related to housing and retirement, followed by a discussion of how housing affects lifestyle and well-being, leading into how climate is an important factor in determining a retirement location. Challenges, risks, and tips for selecting a retirement location are also presented.

Climate Change and Retirement: Navigating the Challenges Ahead by Derek Jun
The author of this essay reviews the various challenges of climate change and how making investment choices based on an investor's beliefs around climate change can pose challenges to long-term asset management.

The SOA Research Institute's Aging and Retirement and Catastrophe and Climate Strategic Research Programs would like to thank the following individuals for their input throughout this project:

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Our appreciation and congratulations again go out to all of the authors in this collection.

Climate Change Risks and Vulnerable Retirees

Sam Gutterman

What climate change risks are retirees exposed to? Taking a macro-level view, they are the same as those experienced at all ages; these risks include, for example, property damage, mortality, morbidity, and displacement risks. However, taking a closer look, because of their sensitivities to some of these risks, many retirees are likely to bear a proportionately greater share of these risks than younger-age adults.

This is primarily due to their increased vulnerability to such damages. The Intergovernmental Panel on Climate Change (IPCC) defines *vulnerability* as "the propensity or predisposition to be adversely affected"[1]. As such, vulnerable populations are those who tend to be more exposed and sensitive to climate-related changes than the average individual. These include those in both lower socioeconomic groups in more developed countries and those in less developed and developing countries, especially those in rural areas. Many retirees are vulnerable to these risks due to their less-protected property and fragile health. The objective of this essay is to discuss this vulnerability to the retired population, especially as retirees age.

According to the IPCC, vulnerability to climate change hazards encompasses the following elements:

- Exposure – the extent to which an individual or entity could be exposed to damage or loss by climate change or its effects;
- Sensitivity – the degree to which people or communities are affected by climate change, either adversely or beneficially; and
- Adaptive capacity – the ability of people or communities to adjust or respond to adverse impacts and take advantage of potential opportunities that arise.

Becoming a retiree does not suddenly transform an individual into being vulnerable. However, certain aspects of being a retiree can increase that person's vulnerability to these risks, such as ill health as a result of the aging process and moving toward a reduced and relatively fixed income[2], both of which can introduce financial stress and reduce that person's adaptive capacity. As retirees age, their health and mortality become more sensitive to many climate change hazards.

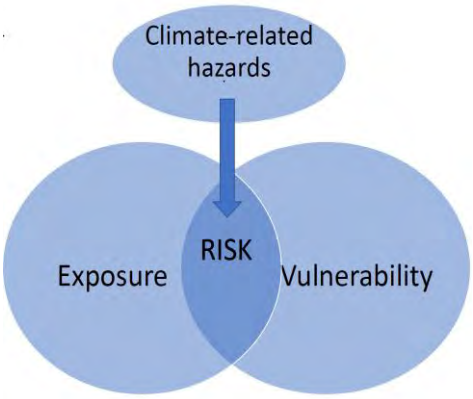
Vulnerability can be affected by one or more factors, including age, health/disability/fragility status, location (e.g., closeness to exposure and support), available healthcare and safety infrastructure, mobility and access to transportation, adaptation measures taken and ability to change, access to insurance protection, personal and family resources, and socioeconomic and migrant status.

[1]IPCC (2017). "Definition of Terms Used Within the DDC Pages". Glossary. www.ipcc-data.org/guidelines/pages/glossary/glossary_uv.html

[2] Other than from Social Security benefits that are indexed to the Consumer Price Index in the United States.

The at-risk population are those in the intersection of being exposed and being especially vulnerable to climate-related exposures, as indicated in Figure 1.

Figure 1
RISK: THE INTERSECTION OF EXPOSURE AND VULNERABILITY



Those at a higher degree of risk with greater exposure and vulnerability to the adverse effects of climate change include:

- the elderly,
- the fragile,
- young children and pregnant women,
- the under and malnourished,
- those of lower socioeconomic status,
- the socially isolated or homeless,
- those with less educational attainment,
- those with inadequate access to information and healthcare services,
- those with certain chronic physical or mental health conditions (e.g., suffering from cardiovascular, kidney, diabetes, and respiratory diseases),
- those with limited family and community support,
- those living in poor-quality housing or degraded environment, and
- those who work under unsafe conditions.

They may reside in an especially exposed location (e.g., in a twice-flooded area or buildings in a too-narrow wildlife-urban interface area). Those most exposed or vulnerable may not have the resources to move or may not be willing to start over. In any case, unless forced, convincing anyone, especially a retiree, to relocate can be a tough sell, although a significantly higher cost of insurance or lack of insurance availability can provide a meaningful incentive to move. In addition, evacuation or emigration may lose much of their wealth that may be sunk into their home. In some cases, however, an exposed location could simultaneously be viewed as being highly desirable, such as living on the shore of a river or ocean, or at the edge of a forest.

The relative risk for a specific person can differ by climate hazard, each of which should be assessed separately. In addition, there are also compound (hazards occurring at the same time) or cascading (multiple hazards that are causally related) risks that can be greater than each separately. For example, excess heat and dryness can result in wildfires, while excess heat and high humidity can result in a heat stroke. For many retirees, these risks can be

particularly dangerous when they exacerbate existing health and mortality risks. To obtain a full (holistic) picture of a person's exposure it is helpful to assess both their exposure and vulnerability to each major hazard.

The extent of vulnerability should be recognized, that is, one may not be either vulnerable or not vulnerable – individuals are often exposed to a range of partial vulnerability.

Climate-related hazards can affect individuals differently, as exposure and vulnerability are heterogeneous. Many retirees have benefited from adaptive actions such as upgrading and appropriately maintaining their property and remaining active and healthy, both physically and cognitively. For example, to avoid (or minimize) property loss, some buildings have been built or re-built to a higher building standard; in an area that has been subject to flood risks, it could be built to withstand that hazard. If located in a woodland interface boundary area, it could be built a certain distance from a forest with a heat or fire-resistant roof. Some retirees remain healthy through physical activity or are prepared to avoid or withstand loss or damage.

Although the aggregate percent of those over age 65 who were in poverty was 10.3% in 2019 in the United States compared with a poverty rate for all ages of 12.8%[3], a concern remains that income for many retirees can be significantly lower than when they were working, with an income that is relatively fixed, except for their Social Security benefits.

Many individuals with low income (or wealth) or who are in an otherwise disadvantaged population segment are often more vulnerable to the effects of climate change than those with higher incomes, as they have relatively higher exposure, greater sensitivity, less adequate insurance coverage, less access to resources such as healthcare services, reduced mobility in times of extreme events, and lower adaptive capacity to withstand the adverse effects of climate and weather variability. In addition, poor retirees usually have a higher percentage of their resources at risk from climate-related hazards.

Accumulated savings, if any, together with a lack of income potential, may lead to insufficient resilience to substantial changes in economic returns of the type that climate change can produce. Preventive action is needed to reduce the number of the elderly who will become vulnerable by building more resilient and sustainable structures, infrastructures, and communities. This action may be needed because retirees may not maintain their homes to the level they might have when working, partly because of fewer years expected to stay in their current homes.

Vulnerability to climate change can differ between those living in urban and rural areas. This may be due to relatively weak infrastructure and insufficient adaptation to respond effectively to climate change risks. Such vulnerability is exacerbated in some urban areas located in areas close to rivers or coasts, exposing people to the adverse effects of hazards such as floods, storms, and landslides.

An example of those who are disproportionally vulnerable is those who are disabled, frail, or cognitively impaired, who may be especially exposed to climate emergencies partly because of their reduced ability to take protective action or react to changed circumstances.

In addition, the extent of and the inability to avoid exposure to one or more ongoing climate hazards and a reduced ability to recover from damage are key determinants of the harm process.

[3] American Community Survey.

As retirees age, their bodies tend to get frailer and become more sensitive to weather extremes, particularly hot weather. The number of temperature and weather-related illnesses and deaths is bound to climb with an aging population. Among the hardest hit will be those already suffering from multi-morbidities, especially when they include chronic respiratory or cardiovascular conditions. This greater sensitivity increases their health vulnerability. An example is that nearly half the deaths related to Hurricane Katrina in Louisiana in 2005 were of people over age 75.

Note, however, that while there will be an increase in heat-related conditions, there may also be a decrease in cold-related effects. The net effect will differ by geographic location. The migration of retirees toward warmer climates may result in a change in the net effect of these two trends.

In addition, those older than age 65 can be especially affected by poor air quality, wildfires, dust storms, and heavy rainfall, all of which can contribute to increased respiratory risks, both making pre-existing respiratory diseases more severe and initiating respiratory conditions in previously healthy individuals.

Socioeconomically disadvantaged retirees are more likely to live in hotter parts of cities with higher-density residential structures, less effective insulation and air conditioning, and lower quality or older construction materials. Racial, ethnic, and disabled individuals are particularly affected.

Heatwaves are especially deadly for the elderly when temperatures rise suddenly. They might also take medications that result in heat intolerance and impair their body's response to heat, including the ability to thermoregulate. Living in small units or apartments can make it difficult to deal with extreme heat, especially those with minimal ventilation. In some cases, small window sizes or lack of windows that open can contribute to insufficient airflow where an air conditioner may not be easily or affordably installed. In addition, many cannot afford to buy or operate cooling devices or have easy access to public cooling centers; nor can everyone stay at home all day in an air-conditioned space. In the United Kingdom, for example, about 90% of heatwave deaths were among people aged over 65.

The World Health Organization (WHO) (2014)[4] estimated that at a global level for those aged 65 and older, there will be about 38,000 heat stress-related deaths in 2030 (reaching about 95,000 in 2050), with about 4,500 in high-income regions associated with climate change. In the United States, in contrast to an expected 8,500 deaths in a typical year under current baseline climate and demographic conditions, an additional 59,000 deaths per year are expected by 2050 assuming the current level of adaptation, no increase in power outages, and no exceptionally hot years[5].

Older adults are also more vulnerable than others to waterborne pathogens, due to their inefficient thermoregulatory systems, greater sensitivity to dehydration and gastrointestinal illness, and inadequate immune systems. Older adults may also be slower to seek medical attention.

Older people may also disproportionally suffer from adverse mental conditions, such as a reduced ability to cope with trauma, anxiety, agitation, and depression from conditions such as heatwaves or other extreme conditions, as

[4] World Health Organization (WHO) (2014). "Quantitative Risk Assessment of the Effects of Climate Change on Selected Causes of Death, 2030s and 2050s." http://www.who.int/globalchange/publications/quantitative-risk-assessment/en/.
[5] Atlantic Council (2021). "Extreme Heat, the Economic and Social Consequences for the United States". August 2021. ISBN-13: 978-1-61977-192-5.

well as increased concerns resulting from uncertainty and insecurity over how they will survive such future events. Social isolation, although not restricted to retirees, can contribute to more deaths when living alone.

In addition, evacuations from either sudden or slow-onset events and conditions can pose significant health risks to less mobile and fragile older adults, especially those who are frail, medically incapacitated, cognitively impaired, or residing in nursing facilities. Evacuations may be further complicated by the need to concurrently transfer medical records where not stored digitally offsite, medications, and medical equipment.

Conclusion

Current and future retirees should be aware of their vulnerability to hazards related to climate change. There is value in living in resilient buildings and locations. However, limited means and aging may reduce the level of their preparedness. The extent and patterns of vulnerability can differ by type of hazard, as will methods used to prepare for and adapt to these hazards. Although many retirees may focus on more short-term concerns than climate-related risks, preparedness is always more effective than loss recoverability.

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Liability-Driven Investing and Climate Risk: Facing Reality One Step at a Time

Emilie Paquet, Jean-Francois Giroux and Christina Somers

One of the main goals of pension plan sponsors who use LDI is to minimize unrewarded risks. In addition to traditional unrewarded risks, such as currency, interest rate, inflation and reinvestment risks, a risk that is becoming increasingly important is climate risk. Therefore, the first step in preparing to face climate risk is to understand it to be able to assess its impact. The good news is that we're now able to obtain a wide range of data related to climate risk that is relatively accurate and reliable for the majority of bond issuers.

In liability-driven investing (LDI), in addition to unrewarded risks, default risk and migration risk are the most significant. One of the main goals of an LDI strategy is to ensure that expected cash flows are received in order to meet the pension plan's liabilities or, in other words, minimize default risk. Migration risk arises when a company's credit rating falls below BBB, thereby becoming a high-yield issuer. By exiting the investment-grade universe, the impact on the performance of an LDI strategy is significant, since the manager would, in many cases, be forced to sell the company's bonds under conditions that aren't necessarily favorable.

Maintaining a good credit rating is therefore crucial, and while factors such as having a healthy balance sheet and profit margins remain fundamental to issuers' credit analysis, the impact of climate change now adds a new dimension to migration risk.

Understanding Climate Risk

Climate risk comes in three forms for companies:

Physical	Physical risks refer to the financial risks from the increasing severity and frequency of extreme climate change-related weather events (i.e., acute physical risks); longer-term gradual shifts of the climate (i.e., chronic physical risks); and indirect effects of climate change such as public health implications (e.g., morbidity and mortality impacts).
Transition	Transition risks refer to the financial risks related to the process of adjustment towards a low-greenhouse gas (GHG) economy. These risks can emerge from current or future government policies, legislation, and regulation to limit GHG emissions, as well as changes in market and customer sentiment toward a low-GHG economy.
Technological opportunities	The transition to a low-carbon economy can present unexploited growth potential for companies. For example, companies could enjoy additional income if they invested in clean technologies (e.g., electric vehicle batteries) or will be in a position to take advantage of opportunities if they have patents related to clean technologies. Technological opportunities can therefore lead to a positive contribution to business valuation and reduce climate risk.

Source: Manulife Investment Management, Office of the Superintendent of Financial Institutions

Climate risk is systemic (i.e., undiversifiable), and will impact nearly every company around the world; however, the magnitude of the impact of these types of risk/opportunity will depend on how we approach climate change as a society. For instance, the impact of the transition factor will be higher in a scenario where we succeed in limiting the temperature increase to only 1.5°C by 2050, as this will mean that significantly stricter regulations will have been put in place to achieve this.

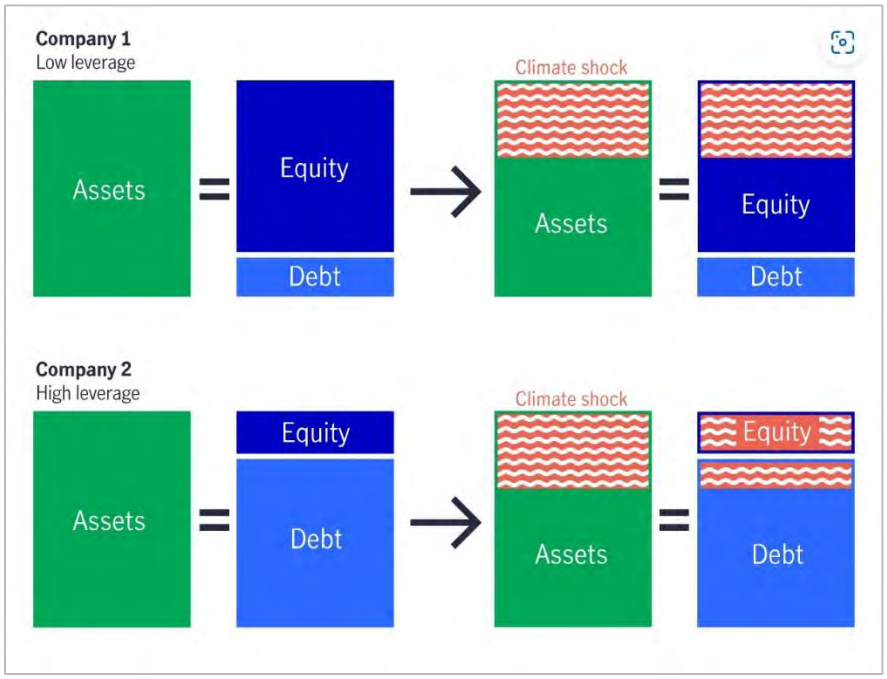
In our view, the most likely scenario is one of those provided by the Network for Greening the Financial System, which assumes that global temperatures will increase by 2°C by 2050 and that the transition will be disorderly across sectors and regions. In this scenario, our society is somewhat slow to act and therefore has to accelerate later to rectify the situation—a reactive rather than preventive approach. This scenario suggests that the transition component will have a relatively high, but longer-term impact, meaning that companies have somewhat of a grace period before more drastic policies are implemented.

In an LDI context, another important factor to consider is the capital structure. Since LDI strategies mostly invest in bonds, which have a higher priority in the capital structure than equities, the climate shock is milder. The impact of a new policy or climate event is initially absorbed by a decrease in equity value, and depending on its financial strength, its bonds and credit rating could remain intact, as illustrated for Company 1 in the chart below.

Furthermore, in the event of bankruptcy, bondholders have some protection, as they're among the first investors to be reimbursed from the disposition of assets. The average recovery rate frequently cited in the industry is 40% in

the event of bankruptcy; loss of value of a bond should therefore be between 0% and 60%.

Figure 1
A COMPANY WITH A STRONG BALANCE SHEET CAN BETTER ABSORB A CLIMATE SHOCK



Source: Manulife Investment Management, MSCI, 2022. For illustrative purposes only.

Measuring Climate Risk

Several providers of climate risk data and measures are currently available on the market. We've considered and analyzed several of them up to this point. This includes the raw data associated with GHG emissions, whether in absolute or intensity terms, which can be broken down based on the value chain, from upstream direct emissions in scope 1 to indirect downstream emissions in scope 3 and energy consumption emissions in scope 2. One of the limits of this data, which is nevertheless tangible, is the fact that it's historical and doesn't make it possible to see how a company manages its climate risk, which could have an impact on its future valuation and consequently on an LDI strategy. Also, this type of data doesn't necessarily capture all forms of climate risk such as technological opportunities.

For these reasons, we've chosen to work with a forward-looking measure that considers the three previously described forms of climate risk and is in line with the recommendations of the Task Force on Climate-related Financial Disclosures for performing scenario analysis in investment portfolios. The climate value-at-risk (Climate VaR) metric provided by MSCI aims to measure, in percentage, the potential negative impact of the effects of climate change on the valuation of issuers (at the company or share level) or individual holdings (at the security level) based on different scenarios.

As of November 30, 2022, the Climate VaR methodology coverage of corporate issuers was 92% in the United States based on the Bloomberg U.S. Corporate Bond Index. In comparison, this figure is 73% for Canada based on the FTSE

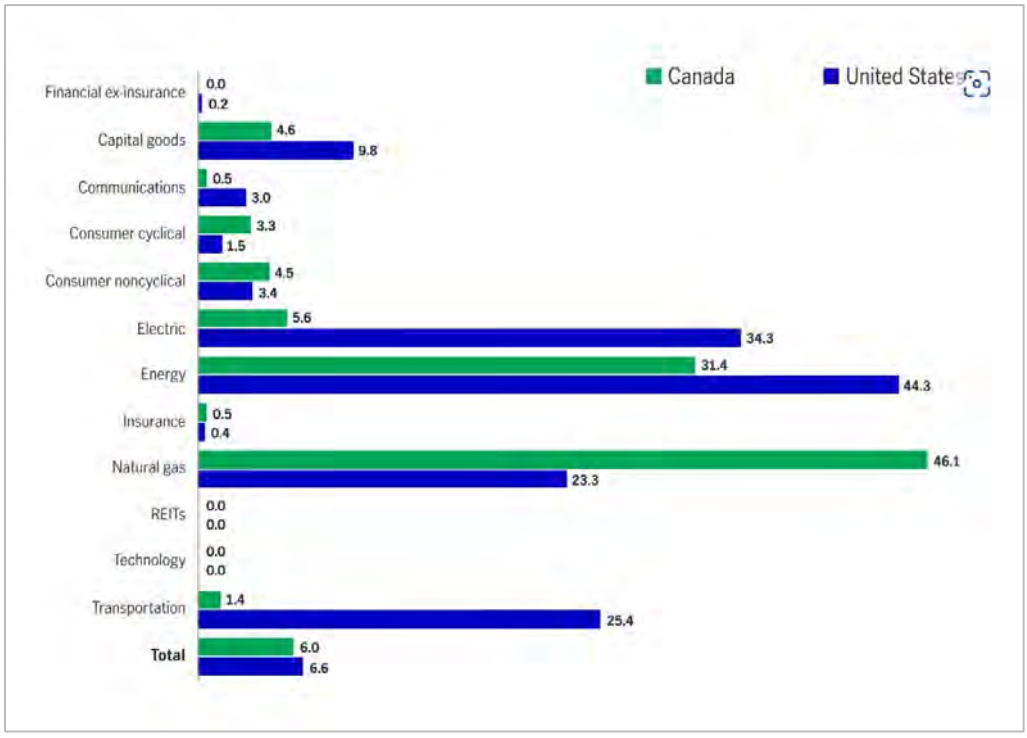
Canada Universe Index. This data is also available at the security level for most bonds, providing additional granularity as they take into account their maturity. Climate VaR is calculated using raw, quantifiable underlying data, such as GHG emissions, and uses a rigorous methodology, providing investors with relatively accurate and reliable data. It's worth noting that we're continuing to analyze and validate with our sustainable investment team the change in different methodologies from different data providers. Even though this data is separated into the three types of climate risk (physical and transition risks, and technological opportunities), the physical risk factor gives results that are too limited to be included in our analyses at this time. Within our first case studies for integrating Climate VaR, the following conditions are therefore based only on transition and technological opportunities factors.

Conclusion 1: U.S. Bond Markets Display Lower Long-Term Climate VaR than Canada

We assessed the two biggest bond markets in North America—the U.S. and Canada—to compare the level of Climate VaR that an LDI mandate would likely encounter. **At first glance, the Canadian corporate bond market is less exposed to climate risk with a** total Climate VaR at 6.0% compared to the U.S. at 6.6%[1]. In addition, Canada has only two sectors that could be considered high risk while the United States has four.

Figure 2

BOND CLIMATE VAR, WEIGHTED AVERAGE, BY SECTOR AND IN TOTAL (%)



Source: Manulife Investment Management, MSCI, as of November 30, 2022

[1] That means a decrease in value of 6.0% in a portfolio containing Canadian investment-grade bonds versus a loss of 6.6% in a U.S. bond portfolio.

Despite this, managing corporate bond climate risk is more complex in Canada than in the U.S. This is because more than 35% of Canadian corporate bonds are short-term bonds from the financial ex-insurance sector, which significantly reduces the total Climate VaR of the Canadian market (since these short-term bonds have virtually zero exposure to climate risk). LDI mandates invest primarily in mid- to long-term bonds to match the duration of liabilities, which is typically between 12 and 25 years. Therefore, they can't use many of these bonds to reduce climate risk as much as a traditional corporate bond strategy could.

A look at the longer-term segments, which better represent the investments of an LDI mandate, shows that the U.S. market is actually **less** exposed to climate risk than the Canadian market, due to the latter's higher proportion of long-term bonds from oil and pipeline companies.

Table 1
CLIMATE VAR FOR LONGER-TERM CORPORATE BONDS IN AN LDI CONTEXT (%)

	Midterm	Long term
United States	5.7	8.8
Canada	8.4	11.7

Source: Manulife Investment Management, MSCI, as of November 30, 2022.

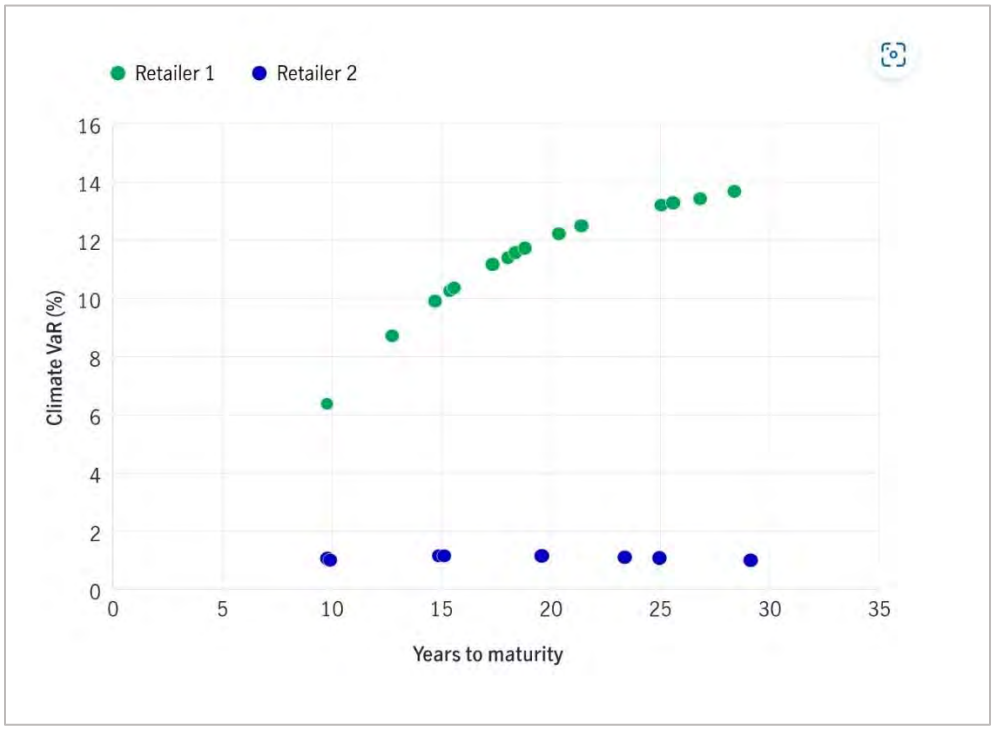
While there are other factors to consider, such as basis risk and meeting investment objectives, we believe the U.S. bond market is a good option for diversifying the climate risk exposure of LDI mandates.

Conclusion 2: Security Selection Has More Impact than Curve Positioning

Naturally, there is a direct relationship between the term of a bond and its exposure to climate risk (all else equal, the longer the term, the higher the Climate VaR). However, we would have expected the difference to be more pronounced, especially in a scenario where the temperature increase is limited to 2°C. For instance, the difference between two bonds from the same U.S. retailer—one of which matures in 20 years and the other in 29 years—is only 2%. Meanwhile, the difference in the Climate VaR between this same 29-year bond and a bond of a similar retailer with the same term is 13%.

Figure 3

EXAMPLES OF THE DISTRIBUTION OF CLIMATE VAR FOR MEDIUM/LONG-TERM BONDS FROM TWO MAJOR U.S. RETAILERS



Source: Manulife Investment Management, MSCI, as of November 30, 2022

These results indicate that, in order to mitigate climate risk, selecting companies with better environmental practices is more effective than investing in a bond of the same company, but with a shorter maturity. When carefully executed, security selection and sector allocation can reduce climate risk without affecting interest-rate sensitivity, unlike a shift in curve positioning.

Conclusion 3: Climate VaR Data Leaves Room for Judgement

It's worth noting that the Climate VaR data is based solely on the quantitative data available at a specific point in time and doesn't take into account the potential and commitment of an issuer to improve its environmental practices. In our view, two identical Climate VaR numbers aren't necessarily equal, and they necessitate human judgment. Fundamental research and commitment from issuers will always be a necessary addition to any quantitative approach to nuance some results. For instance, the following two issuers each have a Climate VaR of 60% (the worst possible Climate VaR), but when we look at the investments made by both companies in recent years and their climate plans, it becomes clear to us that Company A's climate risk is lower than Company B's.

Company A Climate VaR: 60%	This company generates electricity primarily from coal and natural gas and, for this reason, has a high Climate VaR. However, since 2009, the company has begun to invest billions of dollars in renewable energy and plans to continue to diversify and expand its capacity to produce greener energy, which is encouraging from a climate risk perspective.
Company B Climate VaR: 60%	This company is an oil producer and, like most of its peers, has a very high Climate VaR. The company's strategy to reduce its environmental footprint relies almost entirely on building carbon sequestration facilities, the effectiveness of which have yet to be proven. This is good from an environmental standpoint, but in terms of climate risk, it's less certain. Its capital expenditure continues to be primarily dedicated to its oil projects and the company remains highly exposed to any potential regulations targeting this sector. Unfortunately, there is no indication that its climate risk will diminish in the near future, and this is the type of issuer we're trying to avoid when managing climate risk, especially in a context where this company contributes more to scope 3 GHG emissions through its users.

For illustrative purposes only

The contribution of human intervention in the decision-making process of an LDI strategy shouldn't be underestimated. The ability to distinguish between the different nuances present in the data (Company A versus Company B, for instance) is crucial to properly manage climate risk.

The Next Steps

As demonstrated above, we believe climate risk is now an integral source of migration risk, and while the use of Climate VaR data provides a good starting point to better identify and manage this climate risk, our work doesn't stop there.

Active ownership	As a steward of capital, we have a duty to positively influence and guide corporate environmental practices to achieve a more sustainable future. We believe that solely excluding any issuer with a high Climate VaR lacks perspective and could, potentially, be detrimental to achieving investment objectives. We prefer to use our position of proximity to company management to engage with these companies and find solutions together so that, ultimately, climate risk can progressively diminish over time.
Collaboration with data providers	Collaboration between data providers and asset managers is key to achieving greater reliability. For example, we were able to contribute our expertise in consultations about improving several models: physical risks, probability of default in the bond Climate VaR, integration in the trajectory of an issuer's decarbonization in the transition risk, and so on.

Lastly, the environmental aspect often receives the most attention among the three ESG factors, but the other two factors—social and governance—are never far behind. Are we soon going to see a social and governance VaR emerge, especially when we look at other systemic issues, such as human rights and inequality when it comes to human capital? What's certain is that the level of complexity in analyzing and managing corporate bond migration risk will continue to increase, so the ability to establish a rigorous and meticulous credit analysis process has become more important than ever for LDI strategies.

A Risk Too Significant to Be Ignored

Given our planet's changing environment, climate risk is too significant to be ignored, particularly for those who invest for the long-term. In many cases, the investment timeframe for pension asset managers is indefinite, making climate risk a key consideration, particularly if the plan participants skew younger (as they have more time to be affected by climate change). While prudent asset managers cannot take their eyes off the many other investment risks, we believe that they'd be well-served by taking into account the climate risks their portfolios may face now and into the future. By considering their climate value at risk, keeping abreast of changes in the measurement of said risk, and engaging with their portfolio companies, prudent pension managers cannot only help protect their funds, but also affect positive change for their planet.

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Climate Change, Housing and Retirement Security

Anna Rappaport

Where to live is a very important retirement decision with major financial and lifestyle implications. Climate change adds new considerations into this picture, with special issues for retirees. Weather events can destroy housing or the area around a house, and the expectation of weather events can raise insurance costs or make insurance difficult or impossible to get. Experiencing a major weather event can be frightening and life threatening, and the aftermath of a major weather event can disrupt lives for a long period of time.

Research from the Society of Actuaries Research Institute's Aging and Retirement Strategic Research Program documents the importance of housing in a retiree's financial well-being and offers information concerning deciding where to live. In 2022, Hurricane Ian was a major event in Florida. The SOA annual meeting in 2022 was in Florida and I was asked to participate in a panel and provide personal experience with storms. This essay draws on prior research from the SOA Research Institute, personal and anecdotal experience with storms as well as new articles and papers about Hurricane Ian and other weather events and housing. It focuses on how housing impacts retirement well-being and then adds in issues related to climate change.

Housing and Retirement Economic Issues

Housing is a very important part of assets for many Americans. The SOA Research Institute study *Segmenting the Middle Market: Retirement Risks and Solutions – Phase 1 Report Update to 2010 Data*[1] provides an analysis of the assets of Americans at and near retirement age. The analysis was based on the Survey of Consumer Finances data. A key conclusion is that for certain middle market segments, non-financial assets (primarily their homes) are much more valuable than financial assets (not counting the value of defined benefit income or Social Security). Some retirees have few financial assets.

There are two related issues beyond the proportion of the housing asset relative to total assets:

- While conventional thinking often is that housing values always go up, they can go down as well, and they can be depressed for a long time. Values increased a great deal before the Great Recession and then declined markedly in some areas. Depending on the area, it took a long time for values to come back.
- Housing is not a liquid asset and incurs high transaction costs to sell. Depending on the market, it can take a long time to sell housing and it may be desirable to put considerable work and money into sprucing up the housing prior to selling.

[1] https://www.soa.org/resources/research-reports/2013/research-seg-middle-market/

My view is that it is important to consider how housing fits into the asset mix, and it is undesirable for the value of housing to be a very large percentage of total assets.

Housing cost is the largest area of spending for many retirees. Housing costs on average are the largest area of spending for retirees[2] . The Elder Index[3] measures the income seniors need to live independently based on location, single vs married, health status, and home-ownership status. This shows the importance of housing cost on an average basis. Examples are shown below for four areas selected to represent different cost levels. The website includes a simple process for calculating the index for other geographic areas. Table 1 shows costs by component for single homeowners with mortgages who are in good health. Table 2 shows costs by area for single homeowners with excellent health and different housing situations.

Table 1

ELDER INDEX VALUES – DOWNLOADED NOVEMBER 16, 2022

WHAT ARE THE COMPONENTS OF THE INDEX? MONTHLY INDEX DETAIL FOR SINGLE HOMEOWNER WITH MORTGAGE IN GOOD HEALTH

Area	Kenosha, WI	Osceola, FL	Hattiesburg, MS	Berkeley, CA
Cost level	Average (97%)	Low (86%)	Low (85%)	High (136%)
Housing	$1,425	$1,322	$1,072	$2,575
Transportation	291	277	377	250
Food	275	275	275	275
Health	421	303	416	453
Miscellaneous	331	267	288	326
Monthly Total	$2,743	$2,444	$2,428	$3,879

Note: The big difference by area is in housing costs. Other costs seem to vary also. Highest cost area has lowest transportation cost and probably has the most public transit. Percentages in cost level are overall percentages of the national average.

[2] See Tables 1 and 2 of Rappaport, Anna, *Impact of Inflation on Retirees*, 2023, https://www.soa.org/491f93/globalassets/assets/files/resources/research-report/2023/inflation-essay-rappaport.pdf

[3] See Tables 1 and 2 of Rappaport, Anna, *Impact of Inflation on Retirees*, 2023, https://www.soa.org/491f93/globalassets/assets/files/resources/research-report/2023/inflation-essay-rappaport.pdf

Table 2
ELDER INDEX VALUES – DOWNLOADED NOVEMBER 16, 2022
HOW DOES INDEX VARY BASED ON HOME OWNERSHIP VS. RENTING, AND BASED ON HAVING A MORTGAGE OR NOT? MONTHLY INDEX FOR SINGLE IN EXCELLENT HEALTH – 2021 – BY HOME OWNERSHIP STATUS

Area	Kenosha, WI	Osceola, FL	Hattiesburg, MS	Berkeley, CA
Cost level	Average	Low	Low	High
Renter	$1,939	$2,102	$1,903	$3,408
Owner with Mortgage	2,639	2,368	2,329	3,794
Owner no Mortgage	1,880	1,528	1,631	1,870

Note: There is a large difference by area in housing costs for renters and owners with mortgages, much lower difference for owners without mortgages. Relative costs are very different depending on home ownership status.

Homeowners without a mortgage are still required to pay taxes, should buy insurance and should do maintenance on their homes. In many areas, taxes, insurance and maintenance for housing have gone up in the last few years. They can be dramatically higher than expected for homes owned for a long time. Homeowners still also need to pay for utilities which is a part of having a place to live.

Housing and Retirement Well-Being

Housing is an important factor in the lifestyle and well-being of retirees. Location affects access to family and friends, medical care, transportation, recreational opportunities, climate, safety and more. People are familiar with a house where they have lived for a long time and very often want to stay there. They find comfort in the familiar surroundings. There is a wide choice of housing. Some locations and communities are age friendly, and others are not. Some housing includes access to or provision of support services. The SOA Research Institute publication, *Where to Live in Retirement*[4], lays out the questions to ask and issues involved in choosing retirement housing.

Some housing supports change and evolving needs. While retirees say that they want to remain in their homes, that does not mean that the homes will work for them if their needs change. The SOA Research Institute publication, *Late-in-Life Decisions Guide*[5], lays out some of the issues related to housing needs as needs change late in life.

Specialized senior housing: Some specialized senior housing offers a combination of housing and support services. There are various levels of support in such housing, and different communities offer different packages. Continuing care retirement communities (CCRCs) combine independent living, assisted living and higher levels of care in one package[6].

[4] https://www.soa.org/4937ba/globalassets/assets/files/research/research-pen-housing.pdf
[5] https://www.soa.org/resources/research-reports/2022/2022-lil-decisions-guide/
[6] For more information about CCRCs and the levels of care and support they offer, see the paper *Improving Retirement Experience by Integrating Family, Friends, Housing and Support: Lessons from Personal Experience, https://www.soa.org/globalassets/assets/files/resources/essays-monographs/managing-impact-ltc/mono-2014-ltc-manage-rappaport.pdf*

How Climate Fits In

Climate can be an important factor in determining the desirability of a location. Some households prefer very warm climates, and others much cooler climates. Climate also is linked to access to different types of recreation during the year. Ice and snow present hazards and difficulties in driving and walking.

Climate and catastrophic events such as hurricanes, tornados, wildfires, floods, earthquakes, volcanic eruptions, and landslides are examples of climate events that can become catastrophic. The impact of climate may also lead to erosion of the seashore and shifting of barrier islands. Some events are immediate whereas other events such as droughts, beach erosion, and wildfires that keep burning can occur over a period of time. These events are not new, but their intensity and frequency has increased. The risk of these events should be considered in location choice. Some locations such as flood plains and some coastal areas have a high probability of future major events, whereas other areas have a lower probability with a lot of uncertainty about when or whether there will be an event or how serious it will be. The risk of serious events seems to be increasing over time. Serious events involve the risk of property damage or complete destruction of property, raise the cost of insurance, may affect the availability of insurance, may require evacuation and may present major risks to finances, health and safety.

Some climate events lead to major asset losses. There was press coverage in 2022 about Florida retirees[7] who have lost most or all of their assets due to Hurricane Ian. A story in Scientific American indicates that uninsured property losses are estimated at between $10 billion and $17 billion. While it estimates the insurance losses, it does not provide an estimate of the number of people wiped out financially[8] .

Climate events often lead to changes in building codes. For example, hurricane damage has led to requirements for stronger construction to withstand wind. Flooding near the shoreline has led to requirements that some structures need to be built somewhat elevated and off the ground.

One of the immediate questions of the last few years is whether property destroyed or seriously damaged by a major climate event should be rebuilt. Zoning requirements and the availability of insurance affect the decision to rebuild. There is an increasing recognition that property should not be rebuilt where it has been repeatedly destroyed and is in a high-risk area[9].

Challenges and Risks

Affordability. Housing is the greatest cost for Americans in retirement. Housing cost has risen a great deal during the last few years. Housing values have been affected by inflation.

Accessibility and safety. Many older individuals ultimately develop mobility problems. Housing with stairs is not suitable for many mobility limited people. Housing without significant stair issues can be made more accessible through the use of ramps, handrails, grab bars and chairs in showers, removal of fall hazards, etc. Stair lifts and elevators are options in some houses with full flights of stairs.

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[7] https://www.orlandoweekly.com/news/uninsured-flood-losses-from-hurricane-ian-expected-to-top-10-billion-32653705
[8] https://www.scientificamerican.com/article/hurricane-ian-destroyed-retirees-life-savings/
[9] Retirement Section News, April, 2023, *Climate Change, Emerging Risks, and Retirement Security,* https://www.soa.org/sections/retirement/retirement-newsletter/2023/april/ret-2023-04-rappaport/

There are additional safety issues in connection with evacuation and weather events. Evacuation options are different depending on whether (1) the individual has a car, can drive and manage the situation, (2) the individual has a car but needs help driving and/or managing, or (3) the individual has no car. Evacuation needs to be completed in advance of the event and evacuation by car depends on having passable roads. Evacuation is never easy, but it can be difficult or impossible for people with mobility, sight or hearing limitations and/or dementia. Evacuation depends on having a way to evacuate and a place to go with appropriate support. Evacuation incurs additional costs that some retirees cannot afford. Housing choice in areas with considerable climate risk should consider the feasibility of evacuation.

Risks and events affecting value and desirability of housing. Community choice and risk are also important in deciding where to live. As discussed above, climate events are linked to location. There are other forms of neighborhood or community change such as new parks, new employers coming to town and growth in the value of homes. There are also downside risks such as large employers leaving town, violence in the area, toxic waste dumps nearby, and highways being built through the middle of town. While some may be predictable, others are not. The town one lives in can have major problems, leading to a decline in public services, increase in taxes or both. A large employer in town may close its operation, or an important hospital (maybe the only one) can close. Condominium associations and gated communities offer many benefits, but they can have a variety of problems, causing difficulties to the owners, unexpected special assessments in condominiums and loss in value. Community risk may be predictable, as in a flood plain, but it also may be unpredictable.

Insurance. Homeowner's insurance is expensive, particularly in areas with major climate risk, such as barrier islands and flood plains. Homeowners can have a variety of insurance situations including having very good insurance, not having insurance, having homeowner's insurance but not flood insurance, having insurance but not enough, or having insurance but not getting a satisfactory settlement. Note that lenders require insurance but if there is no mortgage, there is no mandate to have insurance.

The challenges for homeowners in areas that experience major weather events include insurance company bankruptcies, rising insurance costs and limited availability of insurance.

It should also be noted that insurance does not always pay what is expected. This may be because of the provisions of the policy or the judgement of the insurance company.

The insurance markets in storm prone areas have had challenges. Insurance carriers have left the market and prices have risen a great deal. In Florida, Citizens Insurance was established by the legislature in 2002 in order to enable citizens who could not get market-based insurance to get homeowners' coverage[10]. The Florida legislature passed new legislation in the fall of 2022 designed to help the insurance industry[11].

There are some complexities with types of coverage needed. Hurricanes are one type of climate risk. Hurricane damage can come from wind damage or flooding. In Florida, homeowners' insurance would cover the wind damage, but not flooding. Flood insurance is usually provided by a federal program (but there may be some private options.). My understanding is that $250,000 is the maximum that a private home can be insured for with an additional $100,000 available to insure contents. For businesses, the limits are $500,000 for a business structure

[10] https://www.citizensfla.com/who-we-are
[11] https://www.insurancebusinessmag.com/us/news/breaking-news/what-does-historic-florida-legislation-mean-for-struggling-insurance-market-431047.aspx

and $500,000 for additional items. Structures that flood also can suffer wind damage, and there may be many structures that suffer both, leaving the building owner in the middle between two insurers.

Insurance has gotten quite expensive and lower income homeowners may not be able to afford it. In any case, some homeowners will take a chance if insurance is not required.

Tips for Retirees and People Nearing Retirement

This information is provided for retirees. It may also be useful for financial wellness providers, employers and financial advisors. Employers are impacted when their employees and close family members are impacted by an event.

- Carefully consider the climate risk in the area you are choosing to live.
- Evaluate your total financial picture, including how much of your assets are allocated to housing, to avoid risking too much in a single asset.
- Be careful to determine how much insurance coverage you need, particularly if a high proportion of your assets are in your home. Seek out a reputable insurance carrier.
- Don't forget about flood insurance.
- Avoid living in areas or under situations where there is a good chance that you will need to evacuate if you are not able to do so or it will be very difficult.
- Pay attention to storm preparedness information from government agencies and other sources.
- Retirees, particularly younger retirees, frequently are helping their parents and other family members. In addition to paying attention to their own living situation, it is important to consider issues of location and climate for family members. The goal is to minimize the chance that they will be in difficult situations because of climate events, also.

Conclusions

The well-being and finances of retirees can be heavily linked to housing choices. There are many alternatives and risks involved with housing choices. Climate change intensifies some of the risks and makes some areas very risky to live in. It is important for households as they choose housing to consider these and other community risks.

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Climate Change and Retirement: Navigating the Challenges Ahead

Derek Jun

Climate change can profoundly impact retirees. Rising global temperatures heighten physical risks across many regions, impacting retirees who are more vulnerable due to age and potential health limitations. Heatwaves are a critical concern as they jeopardize older individuals' well-being, exacerbating pre-existing medical conditions and increasing heat-related illnesses. Flooding and storms compound these risks by causing property damage, displacement, and disruptions to vital services, affecting retirees' homes and communities.

In addition to long-term physical risks, government actions to combat climate change by transitioning economies to be low carbon can have meaningful near-term impacts. Government efforts to reduce greenhouse gas emissions by aligning policy with the Paris Accord may result in higher inflation and tax burdens for retirees. Carbon pricing mechanisms such as carbon taxes or cap-and-trade systems can reduce greenhouse gas emissions but increase costs for carbon-intensive industries. Increases in production costs are likely to be passed on to retirees as higher prices for goods and services. Many of the fiscal policies for climate change mitigation will likely require additional tax revenues. Governments may provide subsidies, tax credits, or incentives for renewable energy and climate-friendly sectors. Climate change mitigation and adaptation require significant public investments in renewable energy projects, public transportation systems, and climate-resilient infrastructure. Policy makers may employ mechanisms to ensure equitable distribution of costs for climate change mitigation and adaption, such as progressive tax structures and policies protecting vulnerable populations. These foundational components of climate action by governments are likely to increase retirees' tax burdens.

In addition to higher costs of living in retirement, the low carbon transition and its uncertainties pose challenges in managing retirement assets. A shift towards a greener economy exposes retiree portfolios to new risks and uncertainties. Regulatory changes, technological advancements, and market dynamics associated with the energy transition introduce volatility and fluctuations in investment values. Retirees and their financial advisors must navigate the changing investment landscape, as performance and stability may vary across sectors and regions. The timeline and pace of the energy transition remain uncertain, making long-term investment decisions for retirement assets difficult. Retirees need to assess investment strategies, diversify portfolios, and stay informed about market trends and regulations to effectively manage these additional challenges.

Consider an investor who believes that the world will transition to a lower carbon economy. They may align their investment portfolio to reflect this view by increasing allocation to green investments such as clean energy, electric vehicles, or “sustainable” technology companies. The investor may also avoid companies in fossil fuel and energy intensive industries. While these investment choices may seem logical given the investor’s beliefs, challenges and risks exist. While green investments are aligned with a low carbon transition, they may not yield optimal financial returns if asset valuations are high. Emerging industries that develop to support a low carbon economy may be subject to new regulations and further technological advancements may impact profitability. Avoidance of fossil fuel and energy intensive companies can result in suboptimal investment outcomes, when reducing diversification and income stability from above market dividends generated by these companies. Energy related sectors will likely continue to generate returns for shareholders from its core business of producing and delivering hydrocarbons that

society demands, until it is displaced by sustainable energy solutions. In context of existing demand, emission reduction policies that attempt to reduce fossil fuel supply will likely result in higher commodity prices that positively impact financial performance of the energy sector.

Climate change poses substantial risks and challenges for retirees, impacting their safety, well-being, and long-term asset management. Addressing these challenges requires comprehensive planning, adaptive strategies, and informed decision-making to ensure retirees can effectively navigate the challenges ahead.

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