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The Earth is Warming: it doesn't matter why

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Few issues solicit extreme views from everyone you ask. Yes, no, black, white. Abortion rights are one such issue. Most argue adamantly for the side they have chosen, ignoring any conflicting statements. Sustainability defines a state that can continue over time without degradation. Over the last year I have become more aware of the risks to the earth's sustainability due to human interaction. I have found the same unwillingness on this topic to have a reasonable discussion among friends. Even some actuaries who, on other issues, attempt to substitute facts for appearances will argue very strongly on this topic. Bringing up global warming seems in particular to be a non-starter. While many believe that human activities are driving the earth's warming, others point to natural and recurring cycles driven by the sun. If the earth's climate passes a tipping point and spirals out of control, and the human population is no longer supported, it really does not matter why. We should be taking steps now to adjust to the world where we will live in the future rather than waiting to see what caused the devastation. Small adjustments and investments made now can avoid larger changes and societal breakdowns later.

Pascal's Wager

What I hope to accomplish in this essay is to make an argument similar to one made by Blaise Pascal. In the well-known Pascal's Wager, the eminent mathematician said that each person lives their life based on a bet about the existence of God. If you believe he indeed exists, then you live your life in an exemplary manner and give up some worldly rewards. If you do not believe in a deity, then you perhaps have more fun and collect more possessions but risk being wrong. Forever is a long time. In his argument, logic dictates that all should bet on the existence of God since the downside is small if wrong and there is the great upside of eternal life if correct.

Carrying this idea over to the future of planet earth and, by extrapolation, the human population that lives on it, humans should treat the future much as insurers treat capital. You don't need to manage as if a large asteroid is sure to hit the earth, but we should consider outlier scenarios if we want to survive for the next 10,000 years. This would cover both man-made global warming and potential mini ice age or warming periods. Low lying areas like Miami are at severe risk of even slight rises in ocean levels. Areas dependent on agriculture require steady weather patterns rather than volatile cycles of hot and cold, drought and flood. Resource depletion, whether it is freshwater, oil or minerals, will likely lead to increasing violence and wars between neighbors.

Malthusian fears

The data show that the earth is warming in most places; ice caps are melting, ocean levels rising and weather patterns becoming more volatile. Some say this is due to human activities such as burning fossil fuels and polluting the environment. Thomas Malthus, an 18th century demographer, argued that population could not continuously increase without eventually overwhelming a planet with finite resources. Due to scientific improvements, carrying capacity of the earth has increased and delayed an overshoot and collapse for many years, but the concept remains valid.

There are numerous "tipping points" that generate concern. Many species are threatened with extinction or are already gone, leading to reduced biodiversity. Some of these have been sources of food for humans. This impacts the delicate balance of nature. Once gone, an animal population is difficult to rebuild. The human population is at 7 billion and counting. According to Jorgen Randers' book *2052: A Global Forecast for the Next Forty Years*, the earth's population will level off and then start to drop after the next generation. This slowing is driven by the reducing demographic factor of children born per female. Science and economic growth have spread this reduction from developed countries to those that are developing. This will slow resource depletion and may extend the time before crisis. Just as Malthus' predictions were not initially realized, scientific improvements in crop management using fertilizers, watering systems or other discoveries could extend the human era.

Increased climate volatility

It is hard to argue with the statement that overall the earth is getting warmer. The melting Arctic ice cap has led to higher ocean levels and increased acidity of the oceans, lowering their ability to naturally absorb carbon dioxide gas. Skeptics do not challenge these facts. One unintended consequence of this phenomenon is changing weather patterns. As the ice caps melt and expose water, lower temperature differentials drive smaller atmospheric pressure changes. The result is that the jet stream does not push weather patterns through an area. A storm front will maintain its position for days while nearby areas do not get the needed moisture. This volatile feature of a warming planet has large societal implications based on food production and planning for catastrophes. Some have traced the Arab Spring events to the American use of corn for ethanol production that reduced exports and increased food prices around the world. From an insurance perspective, modeling future weather driven catastrophes has gotten much harder. The past no longer predicts the future, and there are nuances in the data that will take years to recognize. Human ingenuity may have met its match.

There are positive implications to a melting polar ice cap. The long sought after Northwest Passage to Asia is nearly upon us. Crops such as corn and soybeans grow further north than ever before, increasing the value of land in northern latitudes like Canada and Russia. But weather patterns spawning tornados have followed those temperature rises north. As ice melts, areas that used to reflect heat back out into space

now absorb that heat. This could form a runaway spiral as less challenging conditions will encourage search and discovery of oil and gas, leading to further warming and melting. Greenland is an area, as the ice sheet covering it melts, that will have untold risks and opportunities as methane gas is released from the frozen tundra and resources are found.

A warmer planet that continues to expand its human population increases susceptibility to disease. Many viruses have evolved with animal populations for millions of years, living benign lives inside these reservoirs. When they jump from these species to humans, who have not previously encountered them, they can have great impact. These reservoirs are hard to isolate at times, but we know that chickens hold influenza and bats seem to be where many severe African viruses live (e.g., Ebola). As humans expand their territory and become regularly exposed to these animals, previously unseen viruses will spill over to humans.

Insurers and a changing world

All types of insurers should track these developments. Weather patterns are changing. Tornados and hurricanes are acting differently than they have historically as the earth warms at higher latitudes and ocean levels rise. Southern Florida at its highest rises only a few feet above sea level, making much of this large state at risk of reverting to ocean or marsh. The city of Miami is at great risk over the next 50 years. Hurricane Sandy showed what can happen when a tidal surge aligns its timing with a large storm, but its devastation could have been much worse had the storm not weakened before moving inland. Convection storms seem to spawn more and stronger tornados and sustained winds, and seem to sit over an area and flood it rather than dissipate and get pushed out by the jet stream. We continue to build in areas that are not sustainable in the long run, and governments threaten insurers when they charge actuarially sound rates reflecting the higher claims. Business and public policy need to work together.

Viruses require extreme diligence. Influenza has proven an ability to impact the human population worldwide. Concentrated urban living will increase the contact rate, a major factor in the ability for an airborne illness to spread. The 1918 era influenza pandemic killed as much as 1% of the world's population, 0.6% in the developed world and as much as 10% in some regions of the undeveloped world. The ability to limit contact probably had more to do with the differential than medical options. Hospitals today would immediately be overrun by patients, and supplies would quickly run short as "just in time" supply chains quickly broke down for basic materials such as protective gloves and oxygen. Mortality and morbidity may change steadily or jump to a new distribution. Fat tails at both extremes may become the norm as some prove susceptible and others immune.

Two scenarios with ties to sustainability could cause interest rates to stay at low rates or even become negative for material periods of time. One is that more volatile climate drives additional catastrophes and high rebuilding costs, slowing GDP growth. The other

considers historical growth rates before the manufacturing era, which were near zero, and considers the possibility that growth over the past 250 years is really due to mispricing where "goods" are included but "bads" are ignored. The costs to clean up the pollution and other disturbances were not included so those need to be "caught up" by reducing growth in the future.

What can we do?

The bottom line is that it doesn't matter what the driver is if the result is negative to planet earth and its future ability to support the human population. If we can alter a negative path, nations need to work together and make adjustments. Whether global warming is due to human activities or merely a 200 year cycle that will correct itself over time doesn't matter. We need to work together to ensure that our grandchildren have a reasonable place to live. I don't want to be part of the generation whose actions led to the end of the world as we know it today. Reaching a tipping point around climate change is a risk we should not take.

Insurers, and especially actuaries, should take a leading role to study and quantify this issue. Our British peers at the Institute and Faculty of Actuaries have gotten the ball rolling by funding a survey of existing literature (Dr. Aled Jones at Anglia Ruskin University led the project, found at http://www.actuaries.org.uk/research-and-resources/documents/research-report-resource-constraints-sharing-finite-world-implicati), and other actuarial organizations are seeking out ways to get involved. But it can't be something we do in our spare time. This issue is too big. Companies and professional organizations should help fund research that looks at sustainability through objective glasses. Actuaries with backgrounds in casualty, life, health and pensions should work together to bring varying perspectives to the table. This is where the Joint Risk Management Section can play a role, as it already is a place where actuaries from many backgrounds have worked together to meet common goals. Together we can make the world a better place!

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