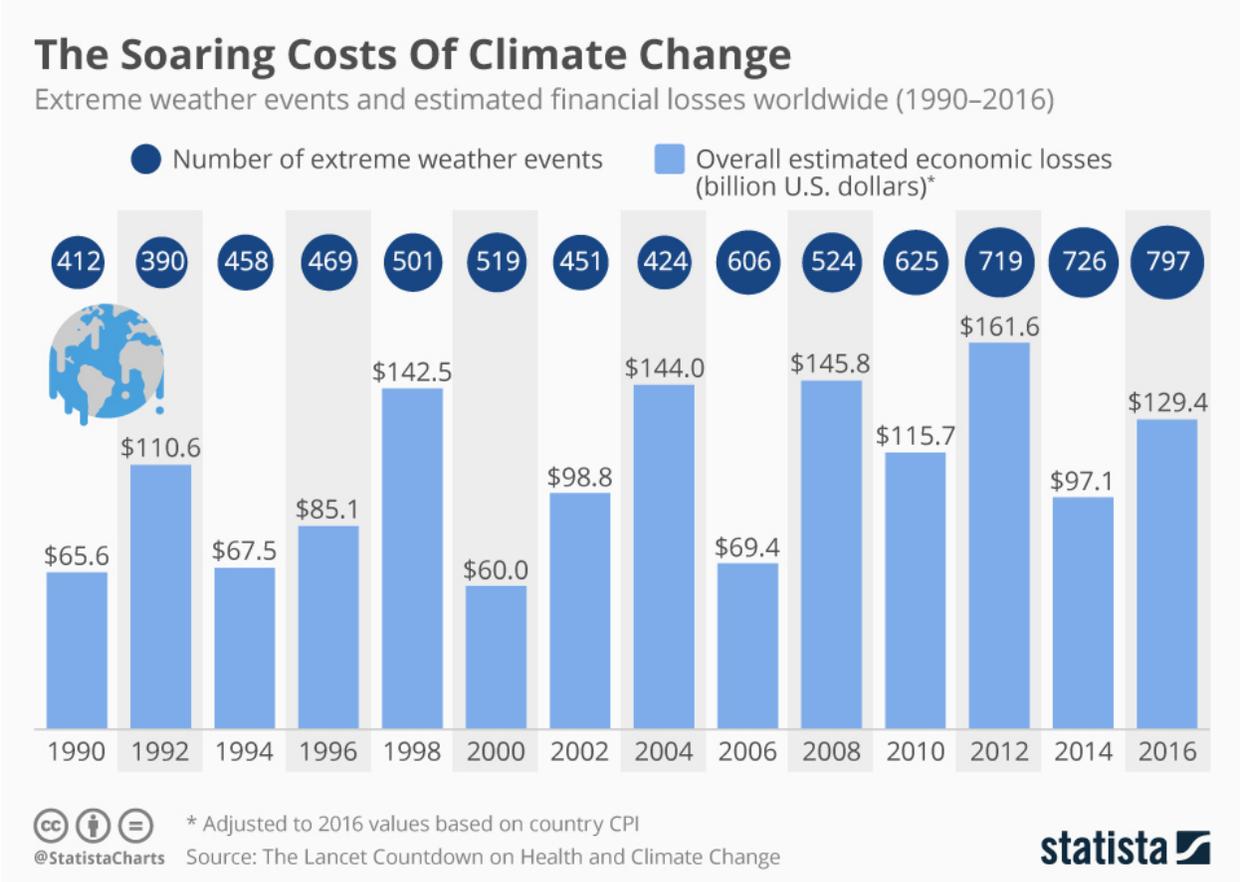


The Price of Climate Change

As civilization has grown and evolved we have always been dependent on our ability to build, create and provide for humanity in the face of change. An ability proven to be very useful in establishing and sustaining communities and economies. Unfortunately, due to a lack of foresight and general disregard for the possible ramifications of our doings, our progress as a society has come at a terrible cost. Following the industrial revolution in England, humanity began causing exponential and irreparable damage to the environment in efforts to improve upon the infrastructure and efficiency of societies. As cities progressed we started to depend more and more on natural resources, so much so that it began to affect our climate and ecosystems. As extreme weather and drastic shifts in climate began to effect neighborhoods and businesses, through catastrophic events, we see that soon the costs of cleaning up the messes will balance out, and possibly overtake, the cost of prevention. With all this in mind the question then becomes should we be worried about an impending economic disaster, how much exactly can we expect to lose as a result of climate change, and how do we prepare ourselves for the likely economic pitfalls our children and grandchildren will have to face.

In efforts to answer the first part of the question, I looked to newspapers, articles, and journals to find out what was being said about the future of climate change. Not to my surprise, I found a plethora of articles featuring warnings of an impending financial crisis with climate change at the center. With headlines such as *Banks warned of regulatory action as climate change bites global economy* and *Why companies should report financial risks from climate change?* it is becoming increasingly obvious that there is a growing risk that lacks the proper

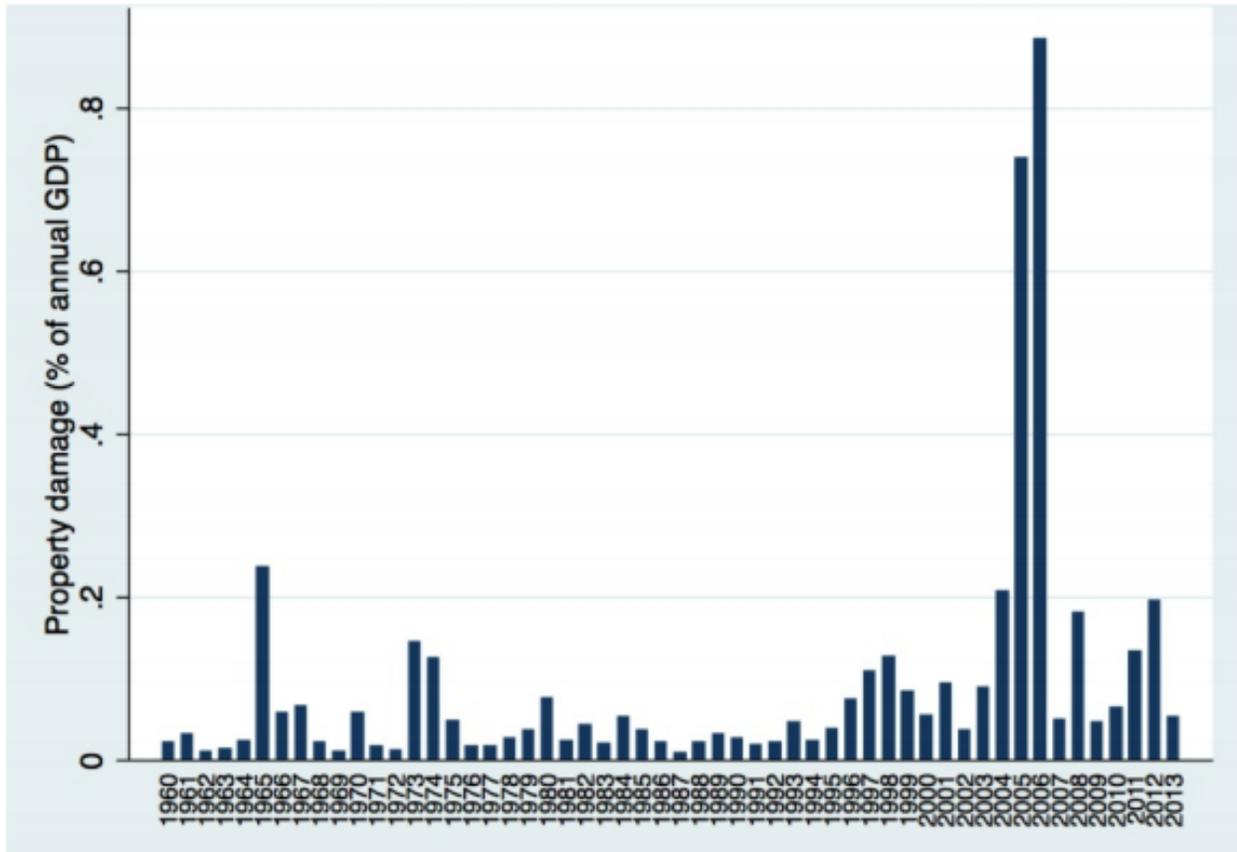
infrastructure to mitigate its complications. Currently, due to low personal and financial investment in the cause we are without the proper support to plan for and price climate change. However, even with fully realized support of climate change the issue then becomes how to accurately price and predict a completely unknown event. An article by Dr. Charles Donovan titled *Climate change is the new big risk for businesses*, outlines the difficulty of this task. “Assets may be mispriced because the full extent of climate risk is not fully understood.”



Although this seems daunting there are some resources out there to help us better price these damages from climate change related damages.

Fortunately we can look at past events and work to understand the past damages inflicted upon communities and their costs. Looking at the figure above we can see that not only is there an obvious upward trend in economic losses but they are incredibly costly and show no sign of

slowing. Another thing to note, is that even though the severity isn't always increasing the frequency is, and that number is really important to keep an eye on. To take a closer look at things, we turn to the time period of 2005-2006. In 2005 the south Gulf States were ravaged by hurricane Katrina, primarily New Orleans. The catastrophic weather event showed us just how unprepared we were to handle and contain the effects of a high caliber natural disaster. After all



was said and done, hurricane Katrina accumulated \$70 billion, in U.S. dollars, of damage.

As you seen in in the figure above, the property damages from 2005 reached a level equivalent to over .8% of the annual United States GDP (Gross Domestic Product). At first glance, this may not sound like much but when we compare it to government spending as a whole it paints a different picture. In the last decade the annual average of damages in the United States reached \$240 billion or 1.2% of our GDP (*The Economic Case for Climate Action in the*

United States, Universal Ecological Fund 2017). When we put this into the same context as the annual budget we see that this represents an amount equivalent to more than three times the Department of Education's budget and five times that of the Department of Homeland Security and it's expected to increase from \$240 to \$360 by 2020. This is incredibly concerning since these costs, backed by little to no economic infrastructure, are now rivaling some of the most important departments of government expenditures.

All this is well and good, but leaving things to big government budgets and GDP's can seem a bit impersonal and unrelatable. In a recent report done by Zillow the effect of rising sea levels, as a result of climate change, was examined closely. They found that by year 2100 as many as 36 coastal cities could be lost, which represents 1.9 million at risk homes, 1 in 6 being Boston homes. With the housing market being such a major cornerstone of the American economy one would imagine it would have a big impact on the stock market. In 2015 Stanford University published a report titled, *Environmental Disasters and Stock Market Performance*. Within the report we find an extensive breakdown of how the market reacts to different environmental disasters. In order to show the behavior of the market under these circumstances they compared "exposed" and "unexposed" firms, the former referring to company stocks that are in the affected area during, before, or after a natural disaster and latter referring to those that are not. The study showed that exposed companies, of course, have a lower stock market value but what's really interesting is that, on average, companies were shown to have negative estimates both five days before and twenty days after the event. This represents 0.3-0.7% fewer returns when compared to non-exposed companies which equates to anywhere from \$9 million to \$22 million. The report also says that companies with a wider range of subsidiary assets are able to brace the impact more effectively but those without such a cushion are more vulnerable to

catastrophic losses, especially over time. “Firms operating a large number of subsidiaries are able to mitigate these impacts to some extent...” (Seetharam). With these kinds of potential risks and losses in mind, without the proper planning, we are at risk for economic infrastructural deterioration. The Stanford report sums this risk in the following quote: “Natural disasters are found to have an economically large causal effect on countries’ long run growth, with losses from a 90th percentile event comparable to those of a banking crisis. National incomes losses are also found to be persistent, and do not recover to their pre-disaster trend within twenty years” (Hsiang and Jina, 2014). As these risks become more prevalent, the question then becomes how do we best prepare ourselves for these disasters?

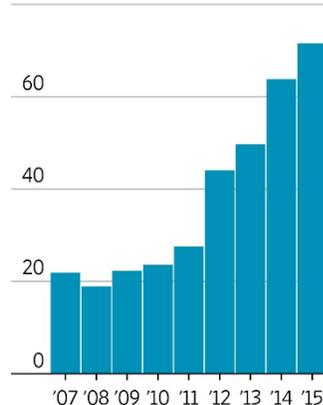
In a Fortune article titled *Here's How Global Warming Could Trigger the Next Financial Crisis*, the author Chris Matthews states that “...the last financial crisis showed us was that when insurance companies aren’t properly regulated or the risks they take on are poorly understood, the results can be disastrous.” According to this, the next logical step would be to install private insurance systems that could help protect companies and individuals recover from a catastrophic weather event. However, even with comprehensive insurance plans, damages are still hard to predict and even with accurate data, insurers are reluctant to cover vulnerable assets. Not to mention the human tendency known as “The Ostrich Paradox” which explains the difficulty for humans to imagine the probability and scale of large disasters and to prepare for them.

In order to get over these tendencies of underpreparation and begin efforts to improve upon insurance systems utilize more of the data at hand in regards to these disasters, introduce pricing strategies for at risk properties, and create incentives for those who practice preemptive disaster planning. Another big part of this is getting local governments and property managers to work together so that neither one takes on full financial burden in the aftermath of a disaster. As

the insurance infrastructure improves governmental entities are also more likely to invest in climate change preparedness. The biggest method used to insure in the case of a calamity is to invest in Catastrophe bonds or “Cat” bonds. These specialty bonds are insurance securitizations sponsored by local government and issued by reinsurance companies. This means that local governments will invest funds into insurance that helps cover private entities that would likely be affected in the event of a disaster so that the government has a way to rebuild its businesses and communities should the financial burden, after an event, get too high. According to *Artemis*, a risk analysis news agency, Cat bonds are a form of reinsurance which is a way to transfer risks from being directly on an insurer to an external investor, investors or another insurance agency. In the case that there is natural disaster, the investors lose their primary investment and those funds go to insure the primary insurers to cover the losses which, in turn, also help to protect the local government. This may sound like a strange investment but there is an incentive for the investors. In taking on these investments, these investors can expect promising investment rates and to accrue a fee once losses due to damage reach a certain level. As this is one of the most promising insurance plans it already represents about 7% of U.S. property casualty insurance and

Bond Boom

Outstanding catastrophe bonds and related investments, by year
\$80 billion



Source: Aon Securities
THE WALL STREET JOURNAL.

that number is expected to grow.

So it seems like given all the doom and gloom of climate change catastrophes we are definitely heading towards some big financial hardships with our losses soon reaching \$360 billion a year, but we have a solution, insurance! Using the data from previous events, working with local government and incentivizing a new era of coverage and preparation should lead us down the right path. A Wall Street Journal article titled *The Insurance Industry Has Been Turned*

Upside Down by Catastrophe Bonds by Leslie Scism and Anupreeta Das, in fact, shows just how well we are doing with these bonds, with coverage reaching \$72 billion in 2016 and it's only expected to keep increasing (see 'Bond Boom' figure above).

Unfortunately even with these promising numbers there is still going to be folks that directly profit from these disasters. Some are who we would expect, those investing and working towards renewable energy and those sustainable resources, the others are those who invest in bets against certain insurances and properties who continue to profit in the event of a disaster. I don't think there can be much done about that, it may just be a fact of life. Sometimes we just have to take the good with bad, all we can do is plan for the worst and hope for the best.