

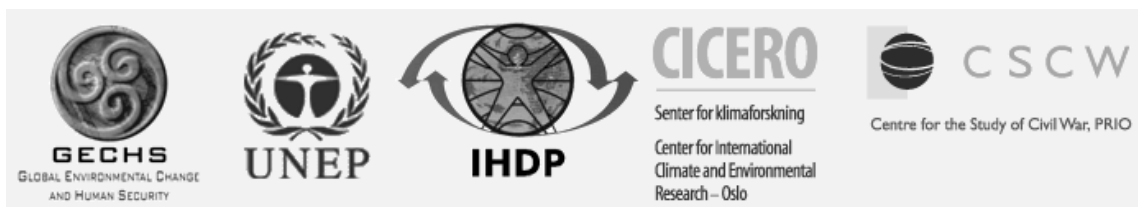
Enhancing Security, Reducing Vulnerabilities: Climate Change and Financial Innovation

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Abstract

How can financial innovation and risk management enhance human security and reduce the ecological vulnerability linked to global climate change linked to global climate change?

The insurance/financial services sector have acquired a wealth of knowledge from managing the risks posed by natural disasters and I argue in this paper that this knowledge can and should be better channelled to enhance human security and reduce ecological vulnerability linked to global climate change. Three specific goals of this paper are to:

- Understand the role the insurance/financial services sector to address the environmental threats and risks posed by global climate change;
- Analyze how the capital market can better evaluate and diversify the risks from climate change more effectively and efficiently;
- Discuss how innovative financial products might be used to manage disaster risks of climate vulnerable countries, particularly those in the developing world

Keywords: Climate Change, Insurance, Risk Management

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Political Ecology of Rich and Poor

When four hurricanes hit the coast of Florida and other states the U.S. in rapid succession in the early fall of 2004, the total damage from these disasters totalled somewhere between US\$22 to \$23 billion. Although natural disasters that cause tens of billions of dollars in damage are not typically seen as good news, it was positive one important way: one natural disaster in the form of Hurricane Andrew in 1992 caused almost US\$20 billion in damages.

Unfortunately, the most economically vulnerable people on our planet are subject to much greater economic and social risks from natural disasters. Around the same time period that four hurricanes - Charley, Ivan, Frances, and Jeanne - hit the continental U.S. in 2004, floods in China caused more one thousand deaths, destroyed an estimated 650,000 village homes, and cost nearly \$8 billion, while catastrophic floods near the Ganges River Delta in northeast India killed 1,500 people and dramatically affected the lives of 63 million people.

When an American resident or a citizen in one of the countries in the industrialized world is affected by a natural disaster; there is an institutional infrastructure that is ready to assist with those in need. Case in point: U.S. Federal Emergency Management Agency delivered more than \$330 million to individuals and businesses and processed more than 600,000 applications for financial assistance in more than 60 recovery centers in the state of Florida within two weeks of the hurricanes (Goodnough 2004). To make a more dramatic comparison, the official death toll from the four combined hurricanes were less than 100, while a far milder weather disturbance lead to more than 1,650 deaths in Haiti. Hurricane Andrew cost America 0.5% of its GDP in 1992, while Gilbert cost Jamaica 28% in 1988 (Economist 2004).

In this paper, I will examine the role the insurance/financial services sector can play in managing the environmental threats and risks posed by global climate change; I will then analyze how the capital market can better evaluate and diversify the risks from climate change more effectively and efficiently; and then discuss how innovative financial products might be used to manage disaster risks of climate vulnerable countries, particularly those in the developing world. The international scientific, policy, and business community urgently need to work together establish risk management solutions to ensure that the economic burden of climate change-related natural disasters do not fall disproportionately on the countries in the developing world.

Managing Risks versus Coping With Disasters

Academic scholars have long debated the scientific merits of how best to respond to the risks of global climate change. The case for early action on reducing GHG emissions has been framed as one of decision-making under uncertainty.² Dramatic reductions in GHG emissions would act, as the argument goes, as a type of ‘insurance’ against possibility of future ecological catastrophes. But, the question remains how much cut is enough and for how long? While this question remains an important global policy dilemma, there is an emerging scholarly and policy consensus that the insurance/financial service sector (**box 1** outlines the important climate insurance concepts) need to play a more engaged role in addressing the climate change-related risks, particularly for the developing world. The need for financial resources for adaptation in the developing countries is addressed in the UN Framework Convention on Climate Change and the Kyoto Protocol. For instance, Article 4.8 of the Framework Convention requires all Convention Parties to fully consider actions, including actions related to insurance, to meet the specific needs and concerns of developing countries with respect to the adverse impacts of climate change.

There are a number of reasons why the poor in the developing countries might be more vulnerable to natural disasters compared to those who might be more economically advantaged. First, the poor often live in areas especially vulnerable to destructive events such floods, hurricanes, and landslides. Second, disasters can severely depress the food production of the rural poor. Third, even small reductions in income can have a dramatic impact on the poor. The poor are unlikely to have enough savings to withstand the economic shocks of large-scale or multiple catastrophes. Fourth, damage to water supply and transport infrastructure hurt the poor more than they hurt the wealthy (Freeman et al 2003).

However, insurance as an adaptation tool can potentially play an important role to increasing the human security and reducing the ecological and social vulnerabilities linked to global climate change. Carlos Jaeger (2004) proposes that revenues from emissions trading be used to buy insurance for adaptation costs and disburse payments to countries that are adversely affected by climate change: “To deal with the inevitable uncertainties involved in climate change, the receipts from selling permits should be used to finance insurance pools to cover adaptation and damage

² For example, see Alan Manne and Richard Richels 1992 Buying Greenhouse Insurance: The Economic Costs of CO2 Emission Limits (Cambridge, MA: MIT Press)

costs. Negotiations will be necessary to define and allocate the relevant property rights”, while an influential UK Department for International Development (DFID) working paper argues in favour of using insurance as a means of spreading climate change risks and disaster management (DFID 2004).

Intergovernmental Panel on Climate Change (IPCC) has long been an advocate in trying to create better awareness of the links between climate change and the insurance/financial services sector (see **figure 1**) and in its 2001 Third Assessment Report noted that: “The financial services sector - defined as private and public institutions that offer insurance, banking, and asset management services - is a unique qualitative indicator of the potential socioeconomic impacts of climate change because the sector is sensitive to climate change and offers an integrator of effects on other sectors”. The report goes on to stress that “climate change and anticipated changes in weather-related events perceived to be linked to climate change would increase actuarial uncertainty in risk assessment. Such changes would trigger increased insurance costs, slow the financial services into developing countries, reduce the availability of insurance for spreading risk, and increase the demand for government-funded compensation following natural disasters” (IPCC 2001a, see **figure 2**).

IPCC report also makes the important distinction between weather-related insurance losses and human suffering. While the bulk of the weather-related insurance losses occur in the wealthy industrialized countries (those with per capita income of more than US\$9,360), most of the human suffering occurs in the poor developing countries (those with per capita income below US\$760). Between 1985 and 1999, the wealthy countries accounted for 57 percent of the US\$984 billion in total economic losses and 92 percent of the US\$178 billion in insured losses whereas only 25 percent of the economic losses and 65 percent of the 587,000 deaths took place in the poorest countries (IPCC 2001b, see **figure 3**).

In order for the extension of climate disaster insurance to the climate change-affected communities and countries in the developing world to be effective, however, a number of important hurdles have to be overcome. First, there is little to no viable disaster insurance sector through which to build the climate risk insurance market in many developing countries. Disaster insurance is largely confined in many developing countries to wealthy individuals and large state-owned enterprises. While the U.S. where more than 50 percent of the direct losses from catastrophes are insured, insurance coverage drops to less than 10 percent in countries with per capita income less than US\$10,000 and to 1 percent in countries with per capita income under US\$760. (Freeman et al

2003). Second, the sheer scale of potential losses from climate-related natural disasters can make risk management and spreading difficult. Because of the immaturity of the insurance market in the developing world, a single large disaster or a series of small disasters might make it difficult to spread the risks. For instance, in the 1990s, Caribbean countries experienced insurance rate increases between 200-300 percent due to the insurance cover shortage stemming from large hurricane and earthquake losses worldwide (Pollner 2001). Third, incentives to purchase insurance are hampered by the fact that losses will eventually be picked up or be compensated by the national government and/or donor countries. The “Samaritan’s dilemma”, which are expectations by households and businesses that the relevant governments or international agencies will come to their rescue in the event that disasters strike, often results in underinvestment in important preventive measures [e.g. not building in land prone to high weather disaster risks] (Freeman et al 2003).

Dealing With Weather & Climate Disaster Risks: Challenges and Options

A number of countries and regions in the developing world with the assistance of international development banks are experimenting with insurance and financial risk management tools to hedge against climate change and any weather-related natural disaster risks. For example, Commonwealth and Smaller State Disaster Management Scheme was established in 2002 and is designed to provide affordable insurance so that the outstanding public sector loans can be continued to serviced for up to three years following natural disasters. Payouts will be triggered by extreme weather events (of the 1 in a 100 probability) based on independently verified meteorological data. Mexico established the Fund for Natural Disasters (FONDEN) in 1996 to help subsidize the cost of insurance for poor farmers and urban dwellers. Based on studies undertaken in Ethiopia, Morocco, Nicaragua, and Tunisia, the World Bank is investigating the possibility of providing weather index insurance for the agricultural sector. Instead of basing claims on crop losses, the new insurance plan will pay out for extreme weather events (e.g. where rainfall is dramatically lower than the regional average) (DFID 2004).

There are also a number of different insurance and financial instruments to address weather and climate disaster type risks in the international private capital markets including: catastrophe bonds; contingent surplus notes; exchange-traded catastrophe options; catastrophe equity puts; catastrophe swaps; and weather derivatives (see **box 2** for a short description of these financial instruments). The most promising model in terms of climate risk mitigation is arguably the catastrophe bond, which was developed after Hurricane Andrew devastated the insurance industry

in 1992. Through these bonds, investors are able to essentially bet on the likelihood of hurricanes, earthquakes, and other natural disasters. Most of the bonds are intended to protect insurers from disasters that happen once or maybe twice in a century. They are somewhat riskier than other more mainstream bonds, but they also pay unusually high interest rates – between 5 to 15 percent, which makes them attractive to many institutional investors (Kahn 2004). In 1999, the cumulative volume of weather-related bonds and derivatives was \$3 billion growing to \$12 billion by 2003, of which catastrophe bonds accounted for nearly half (DFID 2004).

Towards a New Global Protocol of Managing Weather & Climate Disaster Risks

When Hurricane Andrew hit Florida and other American states in 1992, 11 American insurers were forced out of the business. In response, the Florida state government created the Hurricane Catastrophe Fund, an industry-financed reinsurance program that brought much needed liquidity to the insurance market and offered coverage that was significantly cheaper than the cost of private reinsurance. Even in the U.S., which is one of the most well-developed insurance market, one cannot expect the private insurance/financial services alone to provide the public benefits of insurance at an affordable rate to its residents. Unfortunately, in the foreseeable future, there will likely be no Federal Emergency Management Agency and no government or private insurance schemes for the many countries that are most vulnerable in terms of weather disaster and climate change risks.

While trying to put in place policies to curb greenhouse gas emissions on the global level, the international scientific, policy, and business community urgently need to work together establish risk management solutions to ensure that the economic burden of climate change-related natural disasters do not fall disproportionately on the countries in the developing world. Insurance and other market solutions to manage risks from natural disasters need to be re-directed so that people who are most at risk from climatic change - i.e. the poor in the developing world - can utilize them. As with the international policy challenge of stabilizing greenhouse gas emissions, U.S. and other advanced industrialized countries need to take the lead in creating a global risk management solutions are adopted, catastrophe fund so that the developing countries in Asia and elsewhere can better manage their natural disaster risks as an integral part of their economic development strategy.

Box 1 Key Climate Insurance Concepts

The cost of insurance is dependent on the supplier's view of the expected loss, the frequency of that loss, and the costs of administering the scheme. Premiums are calculated in order to ensure that insurance schemes are financially sustainable.

To be sustainable, insurance schemes must collect more in premiums than they pay out over a number of years, although this may not be the case for individual years. International re-insurance through global financial markets enables schemes to survive in high cost years. Insurance becomes unsustainable when premium costs rise beyond what the target customers can afford, either due to increased frequency or damage from events, or administrative costs.

Moral hazard is where an individual's behavior changes in a way that increases the chance of disaster simply as a result of taking out insurance. For example, individuals may fail to protect property against floods; governments may not enforce precautionary measures such as building codes and zoning, which would reduce vulnerability.

Administration costs are often forced up by problems of **asymmetric information**. This is where the insured and insurer have different information about the circumstances of a loss, such as a fall in crop yield – and the extent to which weather or other practices are to blame.

Covariate risks are those that affect whole communities, regions, or countries at the same time, raising the cost of providing insurance. Weather events and disasters are covariate. High costs in individual years must therefore be offset through the reinsurance market.

Adverse selection is where the premiums offered are higher than low-risk individuals are prepared to pay. Only high risk individuals or institutions will seek insurance, leading to even higher premiums

SOURCE: UK Department of International Development - DFID (2004)

Figure 1

SOURCE: SwissRe, 2003

Weather-related Economic losses 1970-2002 (in US\$B, indexed to 2003 prices)

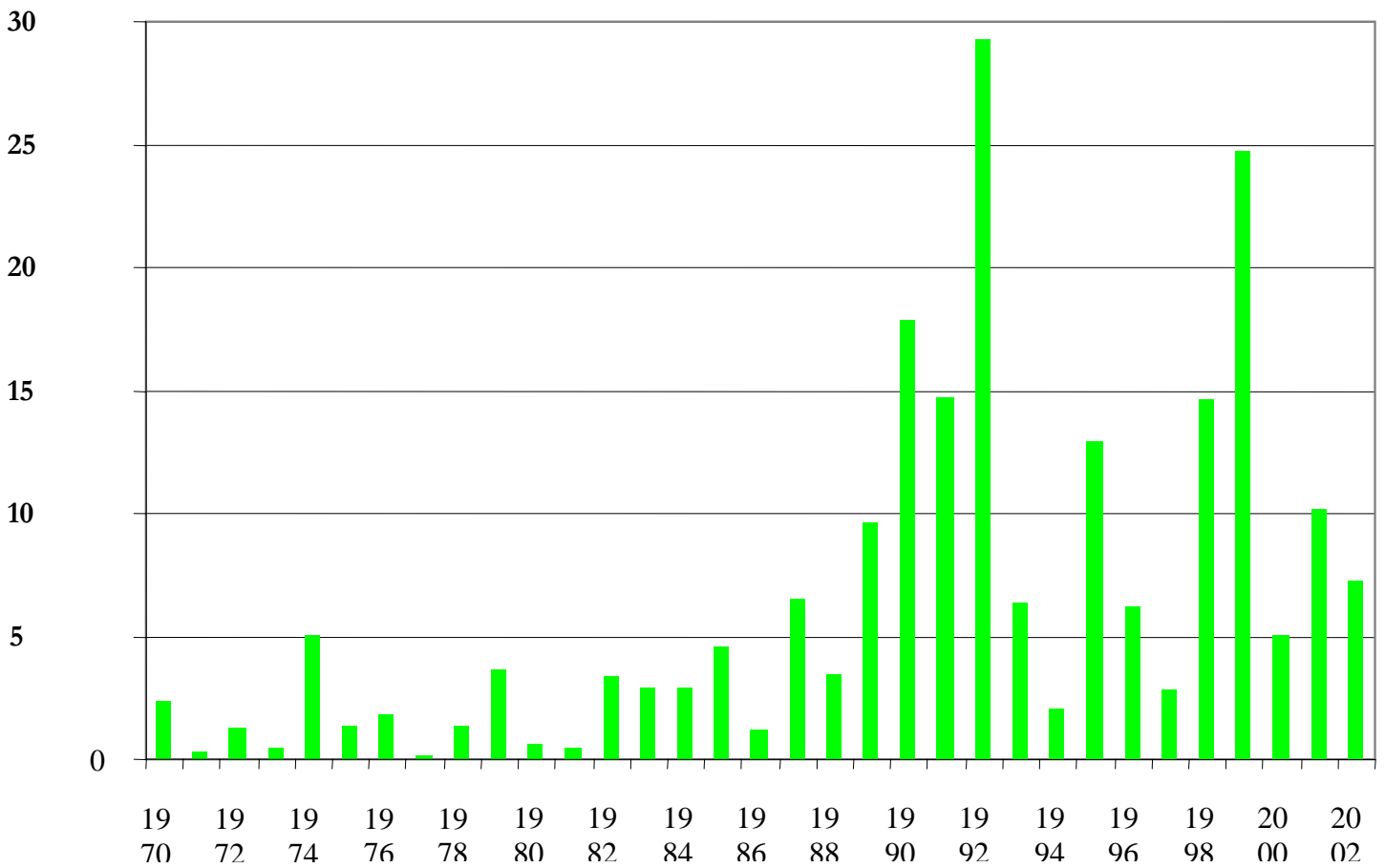


Figure 2

SOURCE: World Bank (2003)

Insured versus Economic Losses: Major Natural Disasters

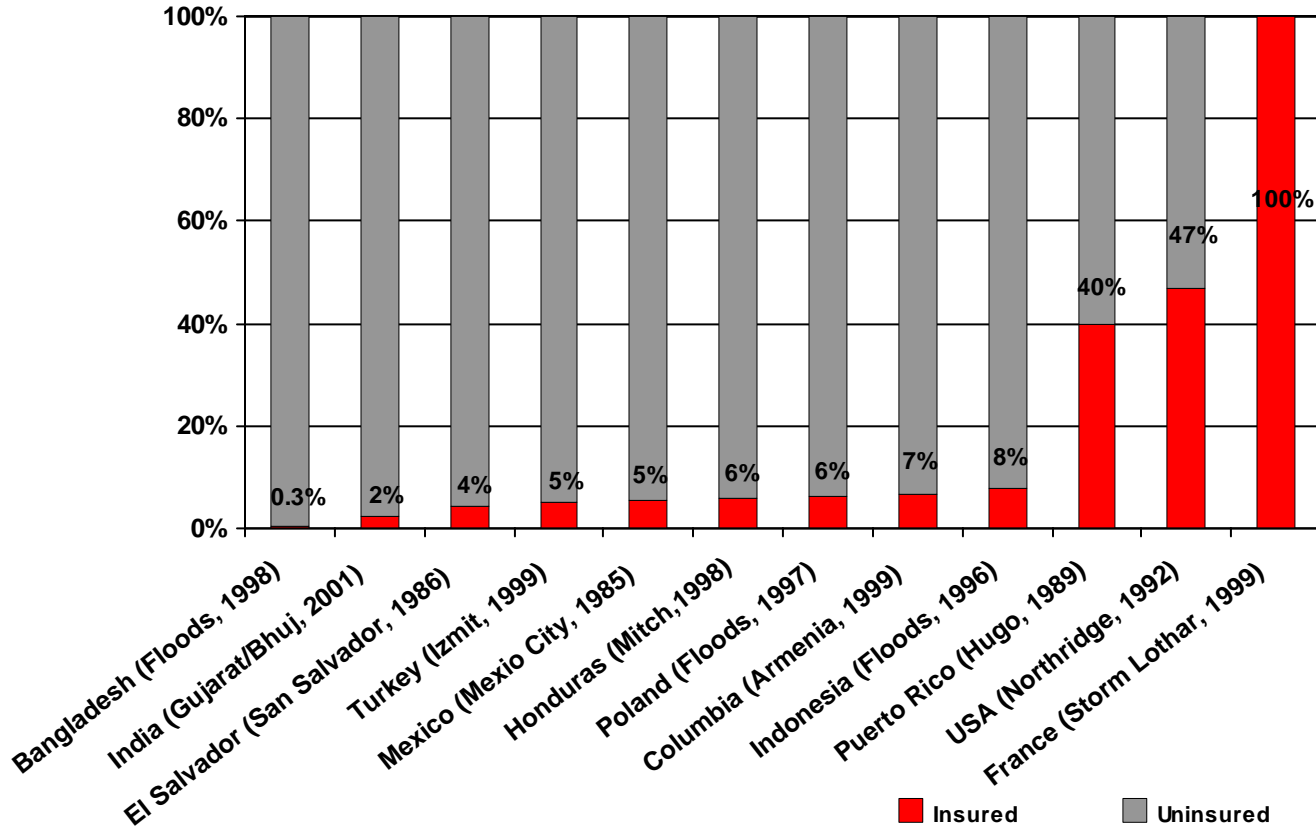
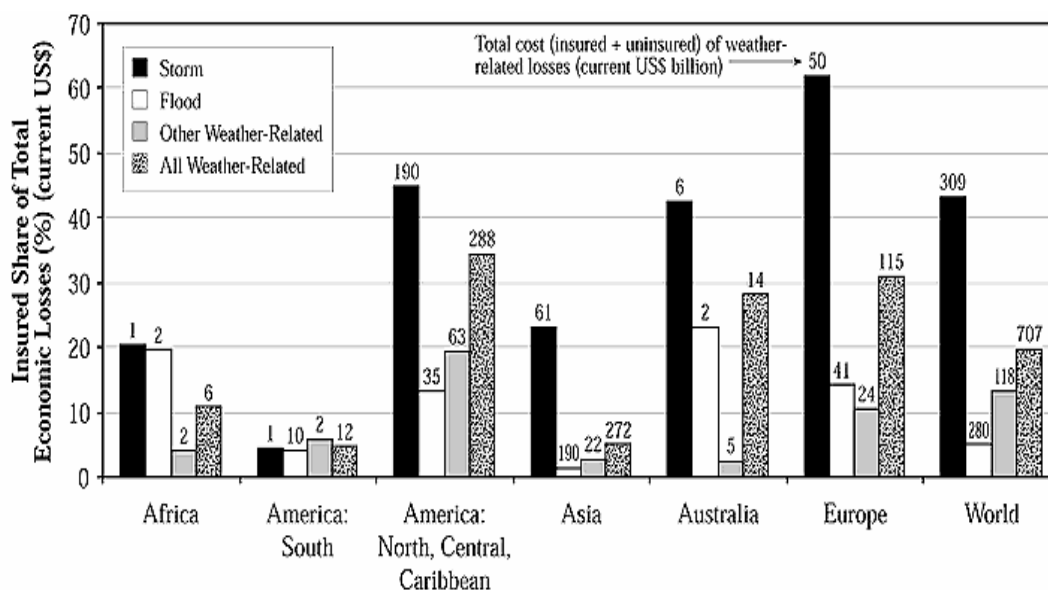


Figure 3

SOURCE: IPCC Third Assessment Report
http://www.grida.no/climate/ipcc_tar/wg2/340.htm

Total Cost (insured + uninsured) of Weather related Losses



Number of Events	810	610	2,260	2,730	600	1,810	8,820
<i>Weather-Related</i>	91%	79%	87%	78%	87%	90%	85%
Fatalities	22,990	56,080	37,910	429,920	4,400	8,210	559,510
<i>Weather-Related</i>	88%	50%	72%	70%	95%	96%	70%
Economic Losses (current US\$ billion)	7	16	433	433	16	130	947
<i>Weather-Related</i>	81%	73%	84%	63%	84%	89%	75%
Insured Losses (current US\$ billion)	0.8	0.8	119	22	5	40	187
<i>Weather-Related</i>	100%	69%	86%	78%	74%	98%	87%

Box 2

New Financial Instruments to Hedge Against Climate and Weather Disaster Risks

Catastrophe bonds are subject to default if a defined catastrophe occurs during the life of the bond but are attractive to investors because of their correspondingly high yields

Contingent surplus note are essentially “put” rights that allow the notes’ owners to issue debt to pre-specified buyers in the event of a catastrophic event

Exchange-traded catastrophe option allow purchasers to demand payment under an option contract if the index of property claims service options traded on the Chicago Board of Trade surpasses a pre-specified level

Catastrophe equity puts are a type of option that permits the insurer to sell equity shares on demand after a major disaster

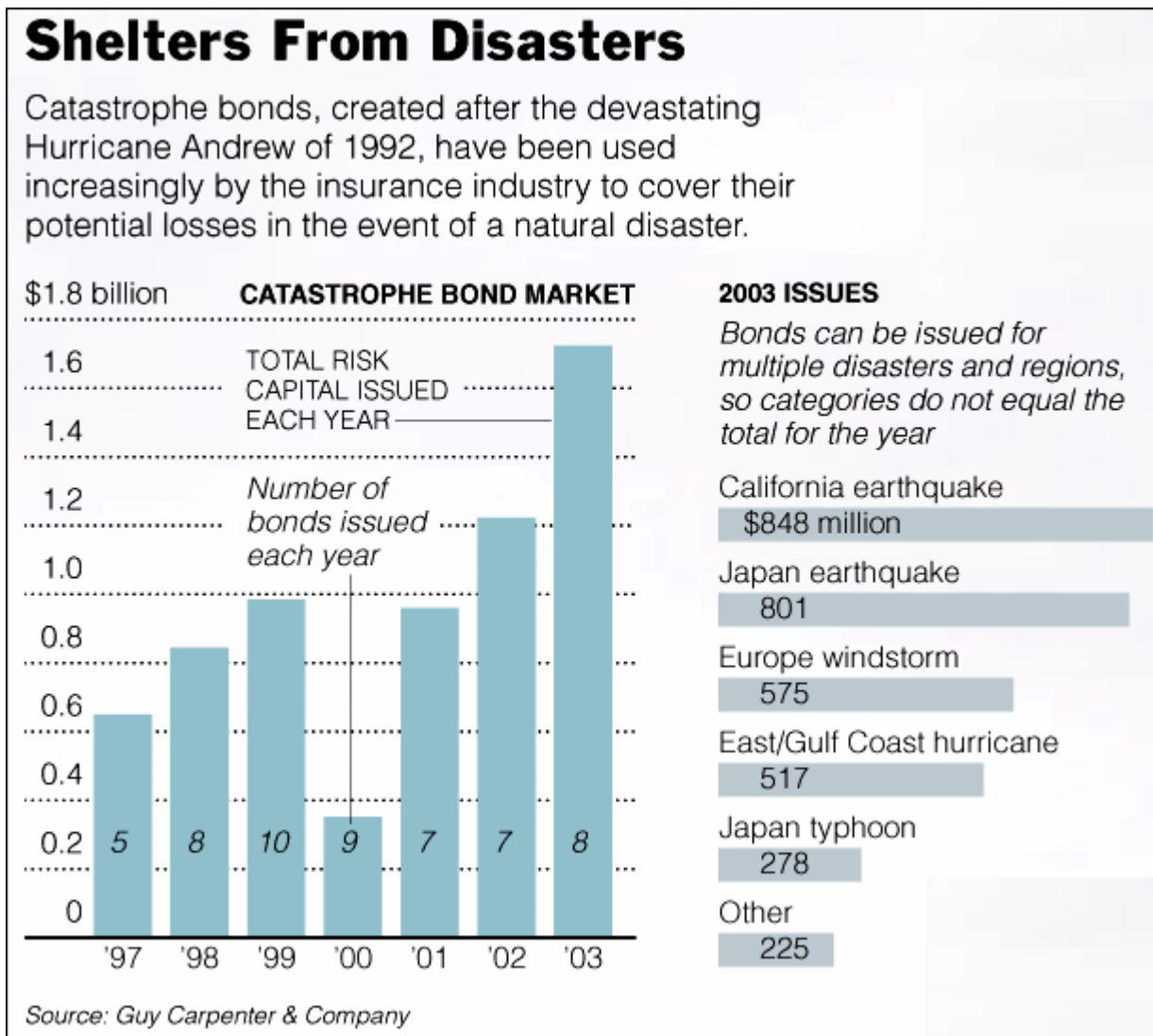
Catastrophe swaps are derivatives that use capital market players as counterparties. An insurance portfolio with potential payment liability is swapped for a security and its associated cash flow payment obligations

Weather derivatives are contracts that provide payouts in the event of a specified number of days with temperatures or rainfall above or below a specified trigger point

SOURCE: Pollner (2001)

Figure 4

SOURCE: Jeremy Khan, "Storm Chasing Wall Street",
New York Times, Sept. 19, 2004



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