

# Catastrophe Insurance and Mitigating Disaster Losses: A Possible Happy Marriage?

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Natural disasters are inevitable. Losses from them are not. Provided the right incentives are in place, individuals, businesses, and governments can mitigate losses of disasters, although they almost certainly cannot eliminate them.

Catastrophe insurance can play a role in generating an appropriate degree of mitigation—that is, policies and actions whose expected benefits outweigh their costs. This is not apparent at first blush. The availability of insurance entails a well-known moral hazard: knowing they have the insurance, insureds have less incentive to avoid losses than they would without coverage. Providers of insurance recognize this problem and seek to minimize it by requiring deductibles (so that insureds bear a certain amount of initial loss before they collect on their policies) and by tying the premiums they charge to the risks of loss. In turn, if government policymakers allow premiums to truly reflect risks—a major qualification—then insurance can provide incentives in the form of lower premiums for homeowners and businesses to take precautions to minimize their catastrophe losses.

This chapter addresses the prospects for using insurance to promote mitigation against catastrophes in the developing world. There are several significant challenges to doing so. Insurance against catastrophe risks entails particular problems, spelled out below, even for developed economies such as the United States (with which the author is most familiar). But for developing countries the problems are compounded by the shortage of adequate loss and frequency data that permit

the estimation of appropriate premiums for insurance and reinsurance against catastrophe risks. In addition, because insurance is likely to be a luxury good over some range of income—that is, demand for it increases faster than income—it is not surprising that insurance generally, even for noncatastrophe risks, is not widely used or available in developing and emerging market countries.

For these reasons, policymakers concerned about mitigating catastrophe losses in developing country markets probably will need to emphasize more direct measures, such as land use planning and zoning controls, and possibly judicious use of subsidies. Nonetheless, over the longer run insurance may play a role. This chapter attempts to provide a framework for thinking how that might be possible.

## Special Problems Insuring against Catastrophe Risks

Insurance is well suited to spread the risks of frequent low-consequence events, such as auto accidents, fires, and routine storm damage to residential and commercial property, and major health expenditures by individuals. Using the law of large numbers, actuaries can predict with reasonable accuracy the likely payouts from a given insured population. Insurers take those estimates of expected losses, factor in the rates of return they can earn on loss reserves, and then set premiums at levels that can provide adequate compensa-

tion for the capital that must be devoted to bearing the risks of providing the insurance.

The law of large numbers can easily break down, however, when confronted with infrequent, but very large, catastrophes—such as major hurricanes or earthquakes. Because these events are infrequent, it may be difficult to calculate their probability. In the case of hurricanes in particular, historical weather patterns may not be predictive at all of future losses. Earthquakes tend to have more regular cycles, but these cycles may be hundreds or thousands of years in duration, and geologists often do not know precisely when the last major earthquake along particular fault lines may have occurred. An additional complication is that, at least in the United States, population and construction has grown disproportionately faster in regions of the country that are exposed to especially high catastrophe risks (for example, coastal areas, which are susceptible to hurricanes, and California, which is exposed to earthquakes). As a result historical losses from events of a given magnitude are no longer reliable indicators of likely losses should the same or similar events occur in or near the same locations.

But even if catastrophes and their losses could be accurately predicted, insurers and reinsurers confront another major problem known as “timing risk”: the catastrophe may occur before the insurer has built up sufficient reserves to reimburse all of the claimants for all of their losses. If insurers or reinsurers could borrow against future premiums into perpetuity, they would be able to bridge the timing risk. This is not possible, however. Lenders will not finance insurers once they have been forced into insolvency. Knowing this, insurers may purchase reinsurance to cover very large losses to which they may be exposed. But reinsurers, too, face timing risk and thus charge premiums that are multiples of expected losses. Insurers that are unwilling to pay those high reinsurance rates go naked, running the risk of insolvency in the event of very large catastrophe losses.<sup>1</sup>

Two of the states in which catastrophes pose perhaps the largest risks—California and Florida—have stepped into the breach with their own programs designed to make insurance coverage for catastrophes more affordable and thus more available.

California has established an earthquake fund (the California Earthquake Authority, or CEA) that offers coverage directly to residents (and is marketed by insurance companies). The fund is financed by insurers—whose liability for catastrophes is capped—and by layers of bonds and reinsurance. The price of the reinsurance coverage (sold to Berkshire Hathaway) demonstrates the existence of timing risk: it reportedly is at least five times expected loss. The coverage provided by the fund originally was capped at \$10 billion (and has since been lowered somewhat), with any losses above that threshold prorated between policyholders and the fund. As a result, even those California homeowners who buy earthquake coverage from the CEA bear significant risks. They may not collect 100 cents on the dollar if they suffer losses during a very costly earthquake. In addition the typical earthquake policy carries large deductibles, on the order of 10 percent or more of the value of the house.

Florida has adopted a different program, one that theoretically covers all homeowner losses from hurricanes above the relevant deductible, and instead shifts the risk of large losses to insurers. In Florida hurricane coverage is a mandatory part of homeowner policies (in contrast to California, where earthquake coverage simply must be *offered*). The state operates a reinsurance pool for insurers doing business in the state (who face restrictions to keep them from leaving). Primary insurers *must* purchase the reinsurance for hurricane losses in excess of \$3 billion. If the state fund runs out of money, insurers are assessed after the fact to make up the difference, with the fund having the authority to borrow \$6 billion to tide it over in the meantime. At this writing the Florida fund would have insufficient resources to cover the costs of another hurricane the size of Andrew, which cost insurers more than \$15 billion, and certainly insufficient to cover the \$50-100 billion costs of the megastorms recently projected for the next decade by Dr. William Gray, one of America’s leading hurricane forecasters.<sup>2</sup>

That is not the only problem with the Florida system. As in a number of other states residential property insurance rates in Florida are tightly regulated. (In most states the rates are filed by the insurers but not subjected to a regulatory ceiling.) Although hurricane

losses are not likely to obey historical patterns, Florida regulators nonetheless continue to use historical experience, rather than more recently developed models used by insurers, to set rates. As a result, property insurance rates in Florida almost certainly are suppressed by regulation below actuarially appropriate levels. This regulatory practice not only inhibits insurers from recovering the costs of future claims but also dampens incentives for mitigation, especially location away from coastal areas.

### Enter the Capital Markets

The high cost of reinsurance and the limited coverage of the state funds has led to growing interest in the United States in the capital markets as a source of financing for catastrophe risks. In recent years a number of insurers—USAA, St. Paul, among others—have issued “CAT bonds.” CATs, or catastrophe bonds, are debt instruments whose principal and/or interest is subject to reduction and even cancellation in the event of large catastrophe losses either to the company or based on some regional or national index. (The latter types of triggers are less susceptible to manipulation by the insurers and thus should be preferred by investors over company-specific triggers.) In addition a number of corporations reportedly are interested in issuing their own CAT bonds, bypassing the insurance market altogether.

When CAT bonds initially were offered in 1998, they carried interest rates that were well above the risk-free rate—for example, 500-600 basis points on CAT bonds with principal subject to cancellation. Now that investors have greater familiarity with the bonds, the interest rate premium reportedly has fallen to the 200-300 basis point range.

Still, the CAT bond market is relatively immature. As of mid-1998, there were only six CAT bond issues outstanding, worth a total of \$1.1 billion.<sup>3</sup> Many investors—even large institutions—are not familiar or are uncomfortable with the bonds. Accordingly, CAT bonds still carry interest premiums implying a cost to the issuer that is several multiples of expected loss. This no doubt discourages some insurers from issuing the bonds.

From the investor side, the key question is what will happen to demand for these bonds when the cancellation-triggering events actually occur. Defenders of the bonds assert that the market can and will withstand the shock because investors—typically institutions—put only small portions of their portfolios in the bonds. Indeed, they should do so, according to the investment bankers’ pitch, since the returns on the bonds are not correlated with those available in the equities markets or with general interest rate movements.

Skeptics about CAT bonds (I count myself as one) respond that thin and relatively untested markets are subject to contagion and redlining once investors get burned. The recent flight of investors from Asian currency markets provides a good example. In the case of CAT bonds—especially those that cancel the principal in the event of a large loss—investors who counted on superior returns could find themselves out their entire investment, or a significant portion thereof, if the triggering catastrophe occurs. Portfolio managers who bought the bonds for institutions would then be forced to explain to their superiors why they purchased a security that had the potential for becoming become worthless. No doubt they would be reminded that even the junk bonds of troubled companies typically do not suffer a loss of 100 cents on the dollar. Some of those who bought the bonds would find, therefore, that they had made a “career-ending” decision.

Accordingly, there is a significant risk that the CAT bond market could evaporate or shrivel significantly once investors are hit with a big loss. Indeed, the more weather forecasters of such repute as Dr. Gray forecast large hurricane losses, the more nervous CAT bond investors may become—and thus begin to demand higher interest rate premiums to compensate them for the risk.<sup>4</sup>

### Government-Supplied Reinsurance

For all the reasons given, both reinsurance and CAT bonds—at least in the United States—continue to be priced at several times expected loss, reflecting timing risk. For this reason, many primary insurers lack

reinsurance for very large losses and thus remain exposed to insolvency in the event of major catastrophes.

It has been claimed recently that the property-casualty industry nonetheless is well-capitalized and could easily withstand very large losses. Total surplus (the equivalent of shareholders' capital, which is available to absorb losses beyond those set aside in loss reserves) stood at \$250 billion at year-end 1998, more than total annual premiums in the industry.<sup>5</sup> The total figures are misleading, however. They include surplus backing all lines of property-casualty insurance, not just those relating to property. Monoline property insurers by definition cannot benefit from surplus backing other lines of insurance. Multiline insurers also often offer different coverages through separate companies, so they too may be legally constrained (and restricted by their regulators) from using the surplus dedicated to one line to subsidize or bail out another.

The imperfect insurance market for large-scale losses in the United States therefore has several implications:

- Where they can, primary insurers limit their coverages for large-scale events —such as in California, where deductibles for earthquake insurance are high and where the state plan requires insureds to bear losses pro rata above the threshold of coverage supplied by the CEA. Insurance is thus less available than it otherwise might be.
- Well-capitalized insurers that can withstand large catastrophe losses are exposed not only to claims of their own policyholders but also to paying claims owed by insurers that may be rendered insolvent by such events. This is because state guaranty plans designed to protect policyholders when their insurers fail assess healthy insurers after-the-event if the total losses exhaust the resources in the funds.
- Taxpayers in the United States also are exposed to future tax liabilities to cover disaster payments by the federal government, which so far has provided them following every major disaster. These tax liabilities might be avoided if more private individuals and businesses purchased insurance than is now the case. In addition, in a truly large disaster, even

the remaining solvent insurers may find their surplus positions so weakened that the government might find it necessary to provide some subsidy to shore up their balance sheets. The federal government collects no premium revenue from the tax-paying public or the insurance industry, however, to defray the costs of these possible payments. This not only shortchanges the government but also reduces incentives for mitigation by potential catastrophe victims.

A few countries (France and Japan, for example) have recognized these problems by having the government step in to supply catastrophe insurance directly. I will not discuss those plans here for two reasons: I know little about them and I do not believe they are relevant for developing countries, which, in the absence of large-scale international assistance, lack the resources to finance them. Instead, I will briefly summarize the response in the United States, where the Congress at this writing is considering legislation (H.R. 21) that would authorize the federal government to sell catastrophe reinsurance.

The main rationale for government-provided reinsurance is that unlike private insurers, government does not face a timing risk. It can issue bonds safe in the knowledge that the revenues from future tax collections will be sufficient to service the debt.

The proposal currently being considered in the House Banking Committee is illustrative of where the debate in the United States now stands. Briefly, the proposal would enable the Treasury to sell two types of reinsurance contracts: individually negotiated contracts to state catastrophe plans (such as those in California and Florida) and regional loss contracts auctioned to primary insurers. Both types of contracts would be proportional excess-of-loss contracts. In other words they would cover 50 percent of losses over some threshold, currently defined as one-in-one hundred year losses, or those with less than 1 percent annual probability of occurrence. The dollar level of the 1 percent threshold, of course, would vary from state to state and region to region. A special commission would be established to advise the Treasury on what minimum rates should be set on the contracts, which could be no less than twice expected losses plus an allowance for ad-

ministrative expenses. The proposal would cap the total amount of annual coverage offered under the plan, which is currently \$25 billion.

In principle, because the reservation price of the reinsurance would be twice the expected loss, the House proposal should entail no federal subsidy. However, the official budget scorekeeper in the United States, the Congressional Budget Office (CBO), has expressed skepticism about the ability of the commission to accurately estimate expected losses based on existing models and believes that the commission and the Treasury would be subject to political pressure to keep rates below their actuarially fair levels.<sup>6</sup> Accordingly, CBO believes the plan would involve some subsidy (of undetermined amount). This assumption is important, because Congress may be reluctant to endorse any proposal that “scores” on the budget.

At this writing the fate of the catastrophe reinsurance proposal is unclear. Nor is it clear what impact a major disaster in the meantime would have on the bill’s political prospects. On one hand, a large-scale event would dramatize the need for the legislation. On the other hand, such an event would highlight the federal government’s financial exposure for large payments if the program were in place. It thus could dampen support (notwithstanding the fact that the catastrophe most likely would trigger large federal disaster payments in any event).

### Applications to Developing Countries

The mitigation of catastrophe losses in developing countries arguably is even more important than in the developed world. Developed economies generally are more resilient in the face of natural disasters. Their building codes typically are more stringent. Typically, fallback mechanisms or redundancies are in place. As a result even very costly hurricanes, earthquakes, or droughts barely affect gross domestic product in developed countries (The Kobe earthquake in Japan, given its size, may be an exception.) In contrast, natural disasters in developing countries can have devastating impacts, measured not only by the value of

wealth destroyed and human suffering and deaths but also by the loss in real output for several quarters, or even years, following the event.

The contrast between developed and developing countries is also evident when it comes to insurance. Given their relatively low per-capita incomes, insurance—even for routine losses, let alone catastrophic events—is not widely demanded or available in many developing or emerging market countries. Insurance may also be difficult to provide because many individuals and even firms in these countries lack formal titles to their property and thus have no formal proof of their holdings.<sup>7</sup>

Developing countries face special hurdles when it comes to catastrophe coverages, whether in the primary or reinsurance markets. Seismological, weather, and property data are even spottier for developing countries than for the developed world. In addition it is difficult, if not impossible, for insurers to diversify catastrophe risks in small countries, whether developed or developing. This contrasts with the United States, where insurers doing business nationwide can offset losses from, say California, against net income generated by policies written in other states.

The problems unique to catastrophes spill over into the ordinary primary insurance market. If the underlying data and loss models are poor and the opportunities for diversification are limited, then insurers either will refrain from offering insurance even to cover ordinary property losses, or if they provide the insurance, it will be on terms that exclude losses from hurricanes, earthquakes, and other natural disasters and at high prices with high deductibles. To the extent national regulators inhibit insurers from following any one or a combination of these latter strategies, insurers have strong incentives to avoid offering coverage altogether.

### Role for the International Financial Institutions in Promoting Catastrophe Insurance

The impediments to the development of catastrophe insurance in developing countries, and thus the use of

insurance markets to provide incentives for mitigation, therefore would seem insurmountable. This may well be true in the short run. But it does not have to be the case over the longer run, especially if the international financial institutions (IFIs), specifically, the World Bank and perhaps the regional development banks, provide the right kind of assistance to developing countries.

At a minimum it seems appropriate and necessary that the IFIs assist the development of geographically coded data bases on property values, as well as research aimed at establishing more precise probabilities of major disasters. Depending on the sophistication of insurance markets, it may also be useful to support data collection and loss projection projects for more routine losses. The information generated from these projects should not remain proprietary, but should be made widely available to actual or potential insurers, who can then choose to supplement the data as they believe appropriate.

A more ambitious project—one that is not feasible until the data collection and modeling effort is further down the road—might be to assist developing countries that alone, or ideally in concert with neighboring countries, offer reinsurance for high-end catastrophe risks to primary property insurers doing business in these countries. The reinsurance program could be modeled on the proposal now being discussed in the United States, but with appropriate modifications to suit the preferences of each country. Given the problems of diversification for small countries, the IFIs should give strong preference to multicountry consortia, which would permit a broader sharing of the risks and the costs.<sup>8</sup>

The purpose of the reinsurance program would be to provide primary insurers with the financial tools to manage their own risks and thus to enhance the availability of insurance they offer to local residents. At the same time, however, if the insurance is to be effective in promoting mitigation, countries must resist the temptation to suppress rates. Some rate regulation may be necessary if local insurance markets are dominated by one or two firms. But in the more usual case where there are a number of competitors, a hands-off approach to rate regulation is in order.

### Mitigation in the Meantime

Since the further development of insurance as a device for both compensation and mitigation most likely is some years off for developing countries, other measures to promote mitigation are appropriate and necessary in the meantime. Two deserve mention.

The more traditional “command and control” approach to mitigation, and one that should entail relatively little government cost, is to develop and enforce land use regulations and building codes. To the extent possible new buildings should not be constructed in high-risk areas. This is probably easier to accomplish in the case of earthquake risks (few people want to live on or close to a fault line if they can help it) than for hurricane risks, which are highest in coastal areas, where many people want to live and commercial developers want to build (to service tourists).

Building codes, meanwhile, are an important means of mitigation. But as the damage wrought by Hurricane Andrew in Florida demonstrated, codes alone are insufficient; enforcement is critical. Another role for the IFIs might be to assist governments in hiring and supervising inspectors, so they are not subject to bribes. In addition, the codes themselves must be suited to the risks of loss in each country. Other factors being equal, higher-risk countries should have tougher codes.

There may also be incentive-based approaches to mitigation that the IFIs might encourage, but these may require financial assistance to individual governments. In particular, I have in mind suggestions made by Howard Kunreuther that governments subsidize loans to residents and businesses that invest in mitigation or purchase homes or buildings designed to withstand earthquakes and hurricanes. Here, too, however, inspection and enforcement is necessary. Without proof that the mitigation measures actually have been implemented, the subsidies will amount to little more than handouts.

### Concluding Thoughts

Insurance-based incentives for mitigation of catastrophe risks in developing countries may not yet be ready

for prime time. However, the IFIs can take steps now—notably, the support of data collection and modeling efforts—that can lay the foundation for the development of a viable general-purpose insurance market, and perhaps later the development of catastrophe insurance and reinsurance. In the meantime the IFIs should work with local governments to enhance mitigation efforts in other ways.

#### Notes

1. Reinsurance rates have come down significantly over the past several years—to the point at which a recent survey article by *The Economist* suggests that reinsurers are chasing too much risk. Nonetheless, my understanding is that reinsurance prices still remain well above expected losses, confirming the existence of timing risk.
2. Dr. Gray made this projection in testimony before the Housing Subcommittee of the House Banking Committee on April 28, 1999.
3. “Catastrophe and the Capital Markets,” *Wharton Alumni Magazine* (Summer 1998), pp. 7-12.
4. CAT options are another instrument that insurers theoretically may use to hedge against some of their catastrophe exposure. However, the market for these options—which were introduced on the options exchanges in the early 1990s—has not yet taken off and remains very thin.
5. “Capital Punishment,” *The Economist*, January 16, 1999.
6. The experience with state rate regulation in Florida, which as already noted has suppressed property insurance rates, would appear to support CBO’s skepticism. However, unlike the Florida regulators who have rejected the use of models in favor of historical loss experience in setting rates, the federal catastrophe proposal implicitly embraces models for rate-setting. Moreover, the final premiums for the regional contracts would be determined by the market through auction, not through regulation.
7. The well-known Peruvian economist Hernando De Soto wrote about this problem in his widely acclaimed *The Other Path*. De Soto has prepared a new book, *The Mystery of Capital*, devoted specifically to the absence of property titles in the developing world. It will be released in September 2000.
8. In principle, it might also be appropriate to encourage the development of a CAT bond market in developing countries. However, I have doubts about that approach for two reasons. First, for reasons already given, I have doubts about the long-term viability of CAT bonds in the United States, let alone for other markets. Second, and perhaps more important in the short run, capital markets in general are not deep in developing countries. These countries need first to further develop markets in plain-vanilla government and corporate debt. CAT bonds, if they do prove viable in the developed world, can always come later. They probably would be offered first in U.S. and European markets before being offered to investors in developing and emerging market countries.







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