

Risking House and Home:  
Disasters, Cities, Public Policy

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Editors

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Cover: Loma Prieta Earthquake, October 17, 1989. San Francisco, California.  
Collapsed and burned buildings at Beach and Divisadero streets in the city's  
Marina District.  
Photograph: C. E. Meyer, US Geological Survey

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# Financing Catastrophe Insurance: A New Proposal

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*The structural causes of market failure in disaster insurance are said to derive from information and timing problems in the broader capital markets. These challenges include the imprecision of probability estimates, the inherent interdependence of various risk categories, and the infeasibility of forcing current annual premium flows to pay for worst-year losses. Two existing proposals for improving government interventions are: requiring that insurers indemnify catastrophic losses on the same basis as standard property risk; and having government participate as reinsurer of last resort. The authors advance a new proposal, namely, that the government promise to act as “lender of last resort,” shoring up those insurers incurring cataclysmic payout burdens but unable to access equity refinance quickly enough. In such circumstances, the government should offer unsecured (but carefully regulated) lines of credit.*

## Introduction

Catastrophic risks, whether natural (floods, hurricanes, earthquakes) or man-made (wars, terrorist attacks), have always presented challenges for private markets of insurance. A catastrophic event causes a sudden, large loss of capital reserves, and insurers have typically responded to this by refusing, at least temporarily, to underwrite this line of business.

The absence of catastrophe insurance has consequences well beyond the insurance industry, and these consequences in many cases lead to a demand for public intervention. For example, commercial lenders will not advance loans to enterprises unable to purchase insurance against catastrophic loss. This potentially reduces employment and growth in these exposed sectors, and modern

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governments, because of their commitment to policies of full employment, must then take an interest in this market failure.

Individual citizens and voters may have expectations that, if they suffer a catastrophic loss, someone will provide *ex post* compensation. If private markets for catastrophe insurance are not operating, claimants may look to governments to provide this relief (see, e.g., Litan, 2006a). Governments are aware of this and, with a desire to minimize the public budget implications of a catastrophic loss, they again have a direct interest in the smooth functioning of the private catastrophe insurance market.

The governments in most developed countries, including the federal U.S. government and the individual states, have put in place programs either to support or, in some cases, to supplant private markets in catastrophe insurance, (see, e.g., OECD, 2005a and 2005b). These programs vary in their details, but in many cases they are ad hoc compromises brought on by a crisis of nonavailability. Legislated in haste, they are not always based on accepted principles of efficient insurance-market design. For example, risk-based pricing and adequate reserving, the backbones of market-provided insurance, are frequently absent in these state schemes.

Perhaps for these reasons, public and public-private programs have recently come under increasing scrutiny. The problems of the National Flood Insurance Program (NFIP), for example, have been widely discussed. This federal program, set up in 1967 to replace the private flood insurance market that had not been in full operation since the Mississippi floods of 1927, was never a true insurance scheme. Subsidies were legislated into this program (up to \$10,000 per policy) and actuarially computed reserves against future losses were not held. The program was backstopped by a \$1.5 billion line of credit with the US Treasury, but Hurricane Katrina has already required further Treasury loans of \$18.5 billion, so that those who bought this so-called insurance are now almost as dependent on taxpayer largesse as those who did not.

In California, the California Earthquake Authority (CEA), the public-private scheme set up to provide residential earthquake insurance, is now grappling with the problem that less than fifteen percent of homeowners buy such coverage, and although legally the CEA budget is separate from the general state budget, this low take-up rate clearly puts the state budget at risk in the event of a major loss.

Florida's Citizens Property Insurance Corporation, a public agency set up in 2002 to provide hurricane insurance of last resort, collected \$1.2 billion in premiums during 2004 and 2005 but paid out more than \$3.9 billion in claims for damages, amassing a \$2.2 billion deficit. To offset this deficit, Citizens imposed an *ex post* levy on policyholders for 2004, and would have had to do so again for 2005 losses. This provoked such a strong political backlash, the state made good \$715 million of this deficit from general funds. As a result, the state is once again grappling with the problem of how to place hurricane insurance in Florida on a sound financial basis.

Finally, as Kunreuther and Michel-Kerjan (2006) have shown, because of the way in which they structure the government reinsurance function, the Terrorism Risk Insurance Act of 2003 (TRIA) and its 2005 extension (TRIAE) would not

prevent serious financial problems for individual insurers, even though this was their explicit purpose.

All of this suggests that it may be timely to examine a more systematic approach to how governments might intervene in catastrophe insurance markets. In this chapter we revisit two recently proposed approaches and examine a third new approach which we believe has merit as an alternative solution.

### **Reform Proposal 1: Compulsory All-Risk Policies**

In Chapter 4, Kunreuther discusses the benefits of a plan that would alter the legal framework of property casualty insurance contracts to prevent exclusions for catastrophic events. This plan would require insurers of certain lines to offer so called “all-risk” policies in which a catastrophic loss due to, say, a flood or a terrorist attack, is indemnified on the same basis as any other standard loss such as a fire. A scheme with this structure, the *Cosorcio de Compensación de Seguros* (CCS), has operated in Spain since the Spanish civil war (Machetti, 2004).

Despite the apparent success of the Spanish arrangement, it is not clear why the private insurance industry in the US would be more willing to offer catastrophe insurance bundled with standard property insurance than it is to offer it as a stand-alone line. From the viewpoint of an insurance company’s book of business, there is no difference between “fire + catastrophe” and “fire” + “catastrophe.”

Of course, it has long been known from the “bundling” literature (e.g., Stigler, 1963; Adams and Yellen, 1976) that a multiproduct monopolist can increase profits by selling goods in bundles, even when there are no demand-side complementarities or supply-side economies of scope. However, it is not clear how applicable this literature is to the insurance industry. In the first place, this insurance is highly competitive, leaving little room for monopolistic pricing. In the second place, if bundling really increases profits, presumably firms would do it voluntarily.

More likely, the public policy proposal to require bundling stems from a desire to prevent competitive insurers from cherry-picking the most profitable lines. If catastrophe insurance was priced at its true marginal cost, such cherry-picking would be unnecessary, but if regulatory pressures cause catastrophe lines to be underpriced, bundling will force insurers who seek the profits from standard lines to somehow use these profits to make up for the unprofitable catastrophe line.

In the absence of monopoly pricing power, it is not easy to see how this would work, and indeed we already have one example of the failure of forced bundling in a competitive industry. In California, residential property insurers were required to offer earthquake insurance as an option to buyers of standard home insurance. Following the Northridge earthquake of 1994, this option to buy became so onerous, insurers threatened to abandon the entire homeowner’s line in the state, rather than be required to offer it. The CEA was born of this crisis, and although bundling is still a legal requirement in California, the terms of the CEA limit the total earthquake-loss exposure of the industry to \$4 billion. This limiting

of liability to a manageable sum is key to the continued participation of the state's property insurers<sup>1</sup> in the earthquake line.

If a nationwide all-risk policy is to be palatable to insurers, it would seem that some limit on liability will also need to be guaranteed. In Spain, for example, under the CCS, private insurers can choose to cede the catastrophe portion of the risk to the Consorcio if they do not wish to hold it themselves. Also, the Consorcio acts as a guarantee fund for any private insurer that does cover the risk but is unable to pay it due to bankruptcy.

For a comprehensive all-risk policy in the US, Kunreuther outlined a four-tier financing scheme, with individual states and the federal government being liable for the upper tails of loss. Some financial contribution from the public sector is clearly a *sine qua non* of success, but in this case it is not clear where the benefit comes from bundling. In particular, if states and the federal government take responsibility only for the catastrophe portion of the all-risk policy, it will need to be unbundled anyway.

Lastly, it should be noted that a comprehensive all-risk policy will generate political issues for consumers and voters, especially those who live in states not exposed to catastrophic loss. In principle this should present no problems. The low level of earthquake risk in New Jersey, for example, would result in a negligible earthquake component for the comprehensive premium in that state. Distortions brought about by regulation of rates, however, overlay market solutions (see, e.g., Jaffee and Russell, 2002), and it will require a high degree of sophistication from consumers to accept that although they are being forced to buy unwanted coverage, they are not in fact being charged for it.

## **Reform Proposal 2: Government as Reinsurer of Last Resort**

It is clear that if insurers are to offer catastrophe-risk coverage, they must have some way of quickly replacing capital lost to a catastrophic event. Traditionally the mechanism for this has been the market for reinsurance, but today the reinsurance market for many catastrophes is limited. In that case it is natural to look to the government as the reinsurer of last resort.

One interesting proposal for organizing such a scheme is the excess of loss (XOL) auction first proposed by Lewis and Murdock (1996; see also Cummins, Lewis, and Phillips, 1998). This scheme has two key features. First, each year the government auctions a limited number of \$1,000 catastrophe reinsurance contracts to cover losses in the range \$25 billion to \$50 billion. Second, contracts have a reserve price that is actuarially fair. If losses exceed premiums, the government must pay the difference.

The scheme has the benefit that, in principle, it is self-financing. Taxpayers are required to contribute, on average, only if the contracts are underpriced. On the

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<sup>1</sup> In 2006 Allstate Insurance, for example, temporarily dropped earthquake coverage in all states except California until it located a satisfactory reinsurance source.



other hand, these contracts are quite difficult to price. Cummins et al. (*op. cit.*) note that an XOL contract is a call option spread on an event with very high parameter uncertainty. The XOL auction program was revived in the US House of Representatives (as the Homeowners Insurance Availability Act of 2005 [HR846]), but as before it failed to generate enough support to guarantee its passage.

Obviously, though, the debt-raising capacity of the government is a very powerful instrument in accessing the large amounts of capital needed by catastrophe insurers. The government can use this power to play the role of reinsurer, however, without using this auction scheme. The government can simply issue general purpose bonds and offer reinsurance in much the same way private reinsurers do. The state of Florida, in fact, has been providing a reinsurance plan since Hurricane Andrew in 1992.

Alternatively, following the recent example of Mexico, the government could issue catastrophe bonds and use these proceeds to fund reinsurance. (In Mexico, the catastrophe bond proceeds were used to finance the government's own post-earthquake needs [Malkin, 2006].) To the extent that the catastrophe bond market continues to grow, the government could offer to buy catastrophe bonds issued by private insurers using regular debt to make this purchase, in effect making a catastrophe bond swap.

Once the government enters the reinsurance market, however, it must be recognized that the taxpayer is bearing risk. Even XOL contracts cleverly designed to minimize taxpayer exposure offer some risk if the auction price is too low. We now raise the question of whether the government might not be able to maintain an active, primary, private, catastrophe insurance market without at the same time making the taxpayer bear the underlying risk.

### **Why Is Catastrophe Risk Uninsurable?**

Proposals 1 and 2 are responses to the view that private markets will not provide catastrophe risk insurance unless the government acts as reinsurer of the high end of the loss. Many reasons have been given for this market failure including lack of precision of the probability estimates, lack of independence of risks, and others (Gollier, 2002). Some catastrophe risks however are insured. Swiss Re, for example, issued earthquake catastrophe bonds to finance the CEA in 2005 (Jaffee and Russell, 2005), and flood insurance is privately insured in the UK. It is difficult to see why the reasons given for uninsurability, such as lack of precision of probability estimates, cannot be overcome by simply raising the premium. The challenge is to explain why insurers are unwilling to offer the line at all.

Recently Litan (2006) has argued that catastrophe insurance is not offered because of timing risk. This echoes an argument we have made elsewhere, that the fundamental problem with catastrophe insurance is the inability to pay annual

losses out of annual premiums. This mismatch between premiums and losses makes for a very volatile loss ratio (Jaffee and Russell, 1997).

It should be pointed out, however, that this mismatch in itself would not be a problem if capital markets worked smoothly. Indeed, the whole point of capital markets is to smooth out the intertemporal cash flows of the timing problem Litan describes. Suppose that annual premiums are set to provide a normal rate of return. Then a well-functioning capital market would allow the stream of future premiums to be capitalized, making the timing of a large loss a matter of indifference to the insurance provider.

To make this more explicit, note that a one-hundred year event causing \$50 billion in loss spread over ten million policyholders (e.g., Hurricane Katrina) implies individual premiums of \$50 a year. But if the event occurs in the first year, the insurance industry will have collected \$500 million in premiums and will need to pay out \$49.5 billion in indemnities. Where is this sum to come from?

In standard industry thinking, there seems to be a view that such a payout can come only from previously accumulated reserves. And because this pre-accumulation cannot be guaranteed, the risk is declared to be “uninsurable.” But there is no reason why “capacity” should be defined by previously accumulated reserves. Future premiums are also capitalizable and, as was seen after Katrina,<sup>2</sup> capital will flow into these lines if there is a profit-making opportunity.

There are limits, however, to the speed with which new capital can be raised, and this “financing gap” means that the lost reserves cannot be made up instantly. It is this financing gap that we propose be filled by government action. Using this borrowing power, governments can extend temporary loans to the insurance industry and, in this way, allow the industry to continue writing these lines. These loans must be at market prices to guarantee that capital is efficiently allocated to this line. Under this arrangement taxpayers bear no insurance risk, though they do bear the credit risk that the loan may not be repaid. We discuss this further in the next section.

### **A Temporary Loan Scheme for Catastrophe Insurers**

The financial system is no stranger to a program of temporary government loans. Central banks, for example, have long guaranteed the stability of the commercial banking system by acting as temporary lenders of last resort. The problems caused by a bank run have many features in common with the problems of catastrophic loss discussed in the last section. Private capital markets ought, in principle, to be able to meet the sudden liquidity demands brought on by mass withdrawals of deposits, but in practice they cannot. By discounting illiquid loans, the central bank can facilitate the orderly liquidation of assets. Indeed by

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<sup>2</sup> Kunreuther (2006) notes that as of December 2005, nineteen insurers announced plans to raise \$9.95 billion and eleven start-ups in Bermuda and one in the Cayman Islands sought to raise an additional \$8.5 billion.

standing ready to provide liquidity in a potential crisis, the central bank may eliminate the crisis in the first place.

Of course, there are differences. A solvent bank faced with a run has a balance sheet with sound, pledgable assets in the form of bonds and loans. The existence of these assets allows the lender of last resort function to be performed by discounting. An insurer, however, having paid out its reserves after a catastrophe, has no such accumulated assets to discount.

This difference, however, is one of degree and not kind. If private capital markets worked smoothly, solvent banks would be able to obtain needed liquidity without public intervention. Indeed, as Mishkin (1995:32) notes, bank runs are an example of systemic risk, which he defines as “the likelihood of a sudden, usually unexpected, event that disrupts information in financial markets, making them unable to effectively channel funds to those parties with the most productive investment opportunities.”

Just as such events cause a flight to quality among potential providers of liquidity to banks, they have the same effect on potential providers of capital to catastrophe insurers. Though made in the context of banking, the following recent statement by the former chairman of the board of governors of the Federal Reserve System applies equally to catastrophe insurance:

Policy practitioners operating under a risk-management paradigm may, at times, be led to undertake actions intended to provide insurance against especially adverse outcomes. . . . When confronted with uncertainty, especially Knightian uncertainty, human beings invariably attempt to disengage from medium to long-term commitments in favor of safety and liquidity. . . . The immediate response on the part of the central bank to such financial implosions must be to inject large quantities of liquidity.

—Alan Greenspan, 2004

The value of such injections of liquidity to the optimal allocation of capital has recently been noted by Caballero and Krishnamurthy (2006), the source of the Greenspan quote.

### **Reform Proposal 3: Government as Lender of Last Resort**

Suppose, then, that policymakers decide to extend the lender of last resort function to providers of catastrophe insurance. How would such a system work? There are at least three important questions.

- What collateral can an insurance company offer?
- What should be the terms and conditions of the loan?
- What should be the role of the regulatory agencies?

**Collateral**

As we have noted, an insurance company that has just paid out a large claim does not have the quantity or quality of assets of a solvent bank. The public lending agency will therefore need to offer unsecured loans. This, in turn, will require that the public lender be the leading creditor in the event of a bankruptcy. Even so, taxpayers will bear credit risk, but this risk is likely to be smaller than the risk borne by taxpayers if the government were itself to provide direct insurance or reinsurance.

**Term and Conditions of the Loan**

The purpose of this loan is to provide time for the insurer to access equity capital markets. For that reason, the loan must be of short duration, two to three years at maximum. Moreover, the purpose of the loan is to overcome a problem of nonavailability of capital, so there is no need to subsidize insurers. The loan should therefore be at market rates.

Since the loan has the explicit purpose of temporarily providing policy writing capacity, it should be required explicitly that during the loan period the borrowing insurance company raise equity capital and provide additional coverage. Indeed, the loan agreement could explicitly provide incentives for the firms to do so, for example, by lowering the loan rate as the firms raise the equity base.

**Regulatory Agencies**

Under normal circumstances the insurance regulatory agencies would be troubled by the presence of debt and the absence of equity on the balance sheets of the insurers. Since the public loan is temporary and linked to a future issue of equity capital, regulatory agencies must be asked to see this debt as equity in waiting and give their ratings accordingly.

\* \* \*

Clearly a loan scheme such as this has many details requiring further attention, but it is of some interest that a scheme with many of these features has recently been instituted by the state of Florida. To encourage private insurers to write hurricane insurance, SB1980 creates a \$250 million capital build-up incentive program for one year. Loans in the form of surplus notes to new or existing residential property insurers are made available under specified conditions.

- a. The insurer must apply to the state Board of Administration and agree to contribute new capital to its surplus at least equal to the surplus note.

- b. The amount of the surplus note may not exceed \$25 million or twenty percent of total funds available to the program.
- c. The surplus note must be repayable to the state, with a twenty-year term, at the ten-year treasury bond interest rate.
- d. The insurer must commit to meeting a 2:1 writing ratio of net written premium to surplus.
- e. The state would become a preferred creditor if the insurer becomes insolvent.

If an insurer applies for a surplus note after July 1, 2006, but before June 1, 2007, the note is limited to one-half of the new capital contributed by the insurer.

Except for the term of the loan seeming unnecessarily long, this Florida program could be a model for a federal scheme.

### **Conclusion**

The many benefits of a well functioning private insurance market have led to a number of proposals concerning how governments might help private insurers overcome their reluctance to insure catastrophe loss. In this chapter we have outlined a new proposal to extend government's existing lender of last resort function beyond the banking system, in order to break the capital market logjam by making temporary loans available to catastrophe insurers.

Such a proposal goes to the heart of the market failure: the temporary unwillingness of suppliers of capital to commit sufficient resources to what is otherwise a viable profit making endeavor. By furnishing elastic capital in the same way that the Federal Reserve System furnishes an elastic currency, it is to be hoped that governments will provide to catastrophe insurers the same stability that banks have enjoyed since the introduction of the lender of last resort function of the Federal Reserve System.

