Special Symposium: Catastrophe Risk and Market Solutions†

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Introduction

Major catastrophic events in recent years have served as a wake-up call for property insurers, reinsurers and regulators. It would appear that after several relatively quiet decades, the severity and frequency of natural catastrophes are again on the rise. In addition, development in catastrophe exposed areas has increased dramatically. The result is that not only is it reasonable to expect the frequency of catastrophe-related losses to increase, it is also reasonable to expect the severity of these losses to increase.

Consider that Hurricane Hugo resulted in a reported loss in excess of $4.2 billion ($5.4 in 1997 dollars). Shortly thereafter, in 1991, fires in California resulted in a reported loss in excess of $2 billion ($2.7 in 1997 dollars). Then again in 1992, Hurricane Iniki resulted in a reported loss in excess of $1.6 billion ($1.8 in 1997 dollars) while the infamous Hurricane Andrew resulted in an insured reported loss of $15.5 billion ($17.5 in 1997 dollars). The Northridge earthquake

† The authors wish to thank Ross Davidson for providing useful data on trends in catastrophe losses.

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in 1994 resulted in a reported loss of $12.5 billion ($13.4 billion in 1997 dollars).

After a relatively quiet 1997, the Property Claims Service has estimated catastrophe related losses for the first half of 1998 at $4.4 billion, with the second half of the year including an active hurricane season and unusual flooding in several parts of the country. All told, catastrophe related losses paid by insurance companies has run in excess of $80 billion over the last decade. Moreover, the Federal government reported paying disaster assistance to individuals, communities and small businesses of more than $140 billion during the same period. The number of catastrophes and their related costs, as defined and estimated by the Property Claim Service since 1982 are shown in Table 1. When looking at these data, it is useful to remember that this period reflects a relatively calm meterological and seismic period in our history.

Of greater concern is that the news could have been much worse. For example, had Hurricane Andrew made landfall a relatively few miles north, in the densely populated Miami-Ft. Lauderdale area, it is estimated that the resulting losses could have been well in excess of $50 billion. And finally, there are predictions of major seismic activity along the New Madrid fault line and the San Andreas fault line in the foreseeable future. When combined with predictions of other natural catastrophes including hurricanes and floods, the magnitude of possible losses is staggering. It is reasonable to prepare for a catastrophic loss in the $50 to $100 billion range in the near future.

The paramount question for insurers and regulators is obvious. In 1997, the property casualty insurance industry wrote $286 billion in net premiums ($107 billion in catastrophe related lines) and reported an industry surplus of $326 billion, according to data from the National Association of Insurance Commissioners. Moreover, in 1997 reporting reinsurers wrote some $22 billion in premiums and reported approximately $28 billion in policyholder surplus. With these resources, can the industry absorb the losses associated with major catastrophic events? If not, what remedies are either available or possible that would equip insurers to weather the huge loss exposures discussed previously and remain solvent? Evidence to date suggests that the industry, with current plans and programs, can absorb catastrophe losses in the $25 to $35 billion range. Beyond that, there is a need for additional sources of loss coverage financing.

TABLE 1
Insured Catastrophe Losses from 1982 to 1997

Year	Number of Catastrophes	Estimated Loss Payments ($ billions)
1982	33	1.5
1983	33	2.3
1984	26	1.6
1985	34	2.8
1986	26	0.9
1987	24	0.9
1988	32	1.4
1989	34	7.6
1990	32	2.8
1991	36	4.7
1992	36	23.0
1993	36	5.6
1994	38	17.0
1995	34	8.3
1996	41	7.4
1997	25	2.6

Source: Property Claims Service.

In response to this issue, several relatively new programs and financial instruments have been created, and still, others are being proposed. Some state governments have created catastrophe- related pools and other similar mechanisms (e.g., the Florida Hurricane Catastrophe Fund and the California Earthquake Authority). While offering additional protection, there is some concern that these government facilities may simply not offer enough cushion to absorb very large catastrophe losses. Moreover, where they exist, they may have in many cases supplanted private insurance.

There is discussion and planning underway to create a tax-deductible accounting reserve for catastrophic losses. The argument for this reserve is to allow insurers to be able to stockpile a cushion on a tax deferred basis. Thus, when claims must be paid following a major catastrophe, the industry will have the funds on hand to do so.

Finally, within the last three years, a few innovative attempts have been made to access funds from the private capital markets to

finance losses exposures for major catastrophes. The rationale for this movement is that the capital markets have more than sufficient capacity to absorb these major catastrophic losses. Indeed, a $100 billion dollar loss, which would be devastating for the insurance industry's surplus and guaranty funds, would, in theory, be easily absorbed by the capital markets, where literally trillions of dollars trade globally every day.

At the fall 1998 meeting of the National Association of Insurance Commissioners in New York, a special symposium was convened to address the use of the financial markets for the management of catastrophic risk. In the articles that follow the financial instruments, the market issues, and the public policy and regulatory questions that arise are addressed. A number of panelists from the insurance industry and the financial markets offered their insights and perspectives on the role of the financial markets. As well, a collection of articles and reference material was included for symposium attendees. The articles that follow in this special issue draw from both of these sources. Initially, Christopher Lewis and Peter Davis begin by chronicling the evolution of "catastrophe structures" as a way of transferring and pricing risk. They then review the major developments in this market over the last five years and offer a forecast of near-term developments they expect to occur.

The next article, by Ross Davidson, offers the perspective of a sophisticated insurer on the management of catastrophic risk. Mr. Davidson's firm, USAA Insurance, is a pioneer in the use of capital market instruments to hedge catastrophic risk. This article discusses the broad dimensions of the risk financing problems confronting insurers, special funds, taxing authorities and regulators. His proposed catastrophic reserve accounting system could be used in conjunction with the capital market instruments to promote overall catastrophic management by insurers.

Gail Belonsky, with Swiss Re, offers the perspective of another pioneer in securitization of potential catastrophe loss as a risk-financing tool. This article explains how reinsurers can use "special purpose facilities" to transfer risk out of traditional reinsurance mechanisms and clearly explains the incentives for reinsurer involvement with this market and these instruments.

Finishing this symposium is an article by Vincent Laurenzano. Mr. Laurenzano was until recently a senior financial regulator with the New York Insurance Department and offers issues that his reg-

ulatory colleagues are now working to clarify. He singles out understanding risk transfer and credit worthiness as the key areas for regulators to focus on. He also discusses the implications of the instruments for Risk-Based Capital standards.

Capital Markets Background

For those unfamiliar with recent innovations in financial engineering that have helped reshape the global capital markets, the terminology and the instruments can seem confusing at best. In this section, we will attempt to alleviate that confusion by identifying and defining some of the common terms and ideas that are at the heart of these new instruments. We begin with the capital market instruments themselves, and then move into a discussion of the "derivative" markets.

At the base of most of the catastrophe related market financing is the concept of the securitized asset. Through the process of securitization, illiquid assets previously held on the firm's balance sheet can be repackaged and placed with market investors. Though relatively new to the insurance industry, the securitization process has an established history in other industries and arenas. As part of the process to help resolve the international debt crisis facing US banks in the early 1980's, illiquid loans were repackaged and sold into the capital markets through what have become known as "Brady" bonds. In the mortgage market, federal mortgage agencies have long securitized illiquid mortgage loans, reselling them into the capital market through Mortgage Backed Securities. More recently, some banks have begun securitizing credit card receivables and automobile loans.

The securitization process itself is conceptually straightforward. A portfolio of reasonably homogenous assets currently held on a firm's balance sheet are segregated from the rest of the assets on the balance sheet. Homogeneity is usually defined around a common risk factor, common underlying borrower and/or geographical region. The idea is to ensure that the cash flows accruing to these underlying assets have a fairly high degree of commonality. Segregation of the assets is achieved by conveying ownership of the assets to a third party, who then uses these assets as collateral to borrow funds in the capital market. These borrowed funds are then trans-

ferred from the third party back to the firm that originally held the assets. In the case of catastrophe-related instruments, the most common third party is known as an SPF, or Special Purpose Facility (sometimes also referred to as Single Purpose Entities (SPEs) and Special Purpose Vehicles (SPVs)).

In the case of catastrophic risk, the insurer would sell a bond to the SPF that would pay interest and return principal like an ordinary debt instrument. The SPF, in turn, would resell the bonds to investors in the market and manage the cash flow payments from the bond. The catastrophic protection comes from a feature in the bond contract that would allow the insurer to reduce the interest and/or principal if a specified catastrophe of a given size or in a given region should occur. This contract feature is also an example of an embedded option, named so because the issuer of the bond has the option of altering the nature of the investment vehicle under carefully defined conditions.

Of course, the existence of embedded options such as these would require investors to demand a higher rate of return on these bonds than they would require on otherwise similar issues that did not contain these options. The additional cost is referred to as an option premium. In the case of catastrophe bonds, the marginal analysis required is to compare the cost of this type of protection to the cost of more traditional reinsurance contracts.

As cash flows, in the form of interest payments, sinking fund payments, and return of principal, pass from the issuing company through the SPF, the SPF can, if contractually permitted under the terms of the bond, direct where the cash flows go. In a general pass-through arrangement, all payments would go to all bondholders on a proportional basis. Other types of arrangements allow different classes of the bonds to be paid first or last or somewhere in between. These different classes of bonds are referred to as tranches in the language of securitized assets. The article by Lewis and Davis expands more on this idea within the context of catastrophe protection.

Another type of instrument growing in popularity is the swap arrangement. Swap arrangements themselves simply allow two entities to trade promised cash flows either paid or received. Swap arrangements have been used for some time to manage interest rate risk (by parties swapping fixed interest payments for floating interest payments or vice versa) and in currency exchange risk management (examples would include exchanging a US dollar cash flow for a Ger-

man mark cash flow). An intermediary, such as a commercial bank or investment banker, would facilitate the payments between parties. The primary source of risk in these transactions is known as the counterparty risk. If for example, a German firm wanted to swap a US dollar-based series of cash flows for mark-denominated cash flows, it would likely be able to find a US firm willing to swap its mark-based cash flows for dollar-based cash flows. The counterparty risk is the risk that one of these two firms does not actually make the payments expected under the swap.

These swap arrangements are beginning to be used by companies wishing to swap one risk exposure for another. Though new, they appear to offer real promise as a catastrophic risk management instrument. The Belonsky article develops the characteristics, uses and markets for these instruments from a reinsurer's perspective.

Other new instruments are being developed that make use of the contractual features and market trading systems found in the derivative markets. Derivative market instruments are relatively simple securities that only accomplish one of two things. They allow or require investors to be able to contract to either sell something in the future or buy something in the future. The thing being bought or sold with these instruments is known as the underlying asset. These securities are known as derivative securities because, in and of themselves, they have no underlying value. Rather, the value they have results from the value of the underlying asset. The two main categories of derivative securities germane to the catastrophic risk market are the option contract and the futures contract.

An option contract allows the holder (investor) the opportunity, but not the obligation, to buy or sell the underlying asset at some point in the future at a price established today (the exercise, or strike, price). A call option allows the holder the right to buy the asset in the future at the strike price. A put option allows the holder the right to sell the asset in the future at the strike price. Whoever created and sold the call option (the call writer) may be obligated to sell the asset at the strike price. Similarly, the put writer may be required to buy the asset at the strike price.

The option can be acquired for a small fraction of the face value of the protection offered. The price paid for the option is the option premium and goes to the writer of the option. By purchasing the option, the holder has created a low cost "insurance" policy against adverse movements of the value of the underlying asset. Both the

Lewis and Davis and the Belonsky articles speak more to the use of options, both direct options and embedded options, as catastrophic risk management tools.

In contrast to the option contract, the futures contract requires the holder to either buy or sell a certain amount of the underlying asset at some point in the future. In essence, one can today establish a price at which one can buy or sell the underlying asset at a future point in time. Again, as these have no underlying, intrinsic value, the acquisition cost relative to the dollar value of the asset under control is small. As such, it can also be used as a form of price "insurance" by those unwilling or unable to assume large amounts of price risk.

Currently, there are a few catastrophe related derivative securities available. The Chicago Board of Trade offers a catastrophe option, known as the Catastrophe Insurance contract, that is exchange traded. The underlying asset(s) on these options are the index value of regional catastrophic activity as defined by the Property Claims Service Index. A variety of contracts are available, with differences in expiration dates, strike price and underlying regional indexes combining to make a relatively wide variety of exposure coverage available.

On an over the counter basis, contingent equity options, that allow the holder to issue new equity if a qualifying catastrophe occurs, are being developed. As well, option notes, that allow debt funds to be borrowed, at a set rate, if a qualifying catastrophe occurs, are now available. Most of the following articles address the nature and use of these instruments.

Summary and Conclusion

Innovations in the financial marketplace, combined with advances in technology and enhanced risk management strategies, have resulted in a number of new advances in catastrophe risk management. Of particular interest here is the integration of the capital markets with catastrophe risk management. To date, early catastrophe instruments have proven popular with insurers and investors.

It is likely premature to reach final conclusions on the long-run viability of these instruments, if for no other reason than there have been no catastrophe claims against them. No investor in the market

has yet lost money with one of these securities. As such, the extent to which these instruments are useful in a permanent risk management program and the degree to which the regulatory environment accepts and/or encourages these innovations are, as of now, unanswered questions. In the articles that follow, these instruments, along with the opportunities and issues they create, are explored from a positive viewpoint by an insurance company, a reinsurer, financial market experts, and a former regulator. Admittedly, not all perspectives are offered here. Certainly, over time, this issue will continue to receive a considerable amount of attention at state insurance departments, the National Association of Insurance Commissioners, and among trade and professional associations.