

**Policy Issues in Insurance**



# **Catastrophic Risks and Insurance**



PROCEEDINGS

Policy Issues in Insurance

# **Catastrophic Risks and Insurance**

**No. 8**



ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

# ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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## *Foreword*

The last few years have witnessed, on a world-wide basis, a number of large-scale disasters. Some were man-made, either intentional- such as the terrorist attacks of 11 September 2001 in the United States and the 11 March 2004 Madrid bombings - or accidental, such as the explosion that ripped through the AZF (Azote de France) factory on the outskirts of Toulouse in 2001. Others resulted from natural hazards, including the tropical storm Allison in 2001 in the US, the severe floods across large parts of Europe in summer 2002, the May 2003 earthquake in Algeria and the Bam earthquake in December 2003. Most recently, 2004 marked a record year in terms of human and economic losses resulting from natural disasters, with, in particular, the devastating tsunami in the Indian Ocean on 26 December 2004, leaving 280 000 dead or missing, a series of 13 hurricanes in the US, of which 4 major ones ravaged Florida in August and September, and 10 typhoons in Japan and neighbouring countries.

Both the frequency of such disasters and the severity of the losses involved have tended to increase since the mid 1980s, and there are strong arguments to expect this trend to continue in the future. While they have well-known positive effects, technological innovation, the globalisation of economic activities, the growing interdependency of critical networks, the high concentration of populations and assets, among others, dramatically increase vulnerabilities to natural, technological and terrorism hazards. Possible evolutions in climatic trends as well as in geopolitical patterns are others sources of concern. Moreover, the 21<sup>st</sup> century will have to cope with the emergence of new threats, such as epidemics of previously unknown infectious diseases, technical failures causing major disruption to critical infrastructures, or new forms of terrorism, including chemical, nuclear, biological, or radiation weapons of mass destruction and cyber attacks.

Recent events have increased the awareness among OECD member governments that risks associated with large-scale disasters can inflict considerable damage to the vital systems and infrastructures upon which our societies and economies depend. They have also made clear that modern catastrophic risks raise financial challenges of unprecedented magnitude to policymakers and a wide range of private sector players, including insurance and reinsurance companies.

For a wide spectrum of economic, social and political risks, private insurance has indeed emerged in developed countries as a highly efficient tool to manage risks through its pooling and diversification capabilities. While events like the 11 September attacks have highlighted the crucial role that a well-capitalised insurance sector can play in disaster risk management, the series of recent large-scale catastrophes has also cast doubts on the ability of the private insurance and reinsurance market to alone absorb losses resulting from large-scale disasters in the future. The severity and frequency of the catastrophes may overwhelm insurance and reinsurance market financial capacity, at least in the short run, while the unpredictability of new forms of terrorism risks in particular makes its modelisation hazardous.

Against this backdrop, the OECD organised a conference on 22-23<sup>rd</sup> November 2004 in Paris, to stimulate high level policy discussion between representatives of governments, the private sector and the academia from OECD and emerging economies on ways to handle losses caused by large-scale catastrophes.

The conference brought together some 150 participants, including experts from relevant ministries and supervisory authorities, institutions in charge of catastrophe or specifically terrorism risk compensation, representatives of the insurance and reinsurance industry, brokers, modelling firms, rating agencies, security firms, etc. as well as leading academic experts and representatives from various international organisations.

Three core issues were addressed:

- Are catastrophic risks still insurable?
- To what extent can financial markets help address the risks of both natural disasters and terrorism?
- What should be the role of governments in the covering of catastrophe risks?

These issues are highly relevant for both OECD member and non member countries; the development of efficient solutions to compensate for disasters may be a need even more compelling for the emerging economies that are prone to catastrophes and have limited access to financial resources.

This volume provides a selection of papers and reports presented at the conference<sup>1</sup>. The combination of leading academic analysis and information

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<sup>1</sup> The following four papers by the consultants to the OECD Task Force on Terrorism Insurance are published in a separate volume entitled Terrorism insurance in OECD

and experience sharing by government and private sector representatives involved in the financial management of catastrophe risks makes of this publication a unique reference tool.

The Conference concluded discussing the need to develop further work and policy dialogue on the compensation of catastrophe risks as well as on prevention/mitigation and crisis management strategies. The devastating tsunami that hit South-East Asia one month after the conference confirmed the necessity for reflection and action at international level, and not merely reaction after a disaster. In this perspective, the OECD is setting up an International Network on Financial Management of Large Scale Catastrophes. The Network will aim to promote partnership between public and private initiatives and improve coordination between countries (both OECD and non OECD economies). It will allow exchange of information and experience and development of policy analysis on how to improve risk anticipation, prevention and mitigation, as well as enhance reactivity after a disaster, crisis management and compensation capacity.

The OECD Conference on catastrophic risks and insurance was organised by Cecile Vignial and benefited from the support of Alberto Monti<sup>2</sup> and Yosuke Kawakami, all working for the Financial Affairs Division in the Directorate for Financial and Enterprise Affairs. Both the conference and this publication have been co-sponsored by the Japanese Government. The OECD is grateful to the authors of papers and reports for their contribution to this publication, and more generally to all the speakers at the conference<sup>3</sup>. The views expressed here are the sole responsibility of the authors and do not necessarily reflect those of the OECD Insurance and Private Pensions Committee, the Secretariat or the member or non-member countries. The publication has been prepared by Flore-Anne Messy<sup>4</sup> and Cécile Vignial with the assistance and technical support of Claire Dehouck, and Edward Smiley.

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countries (OECD, 2005): *Insurability of terrorism risk : challenges and perspectives*, by Howard Kunreuther and Erwann Michel-Kerjan *International financing solutions to catastrophic risk exposures*, by Torben Juul Andersen, *Potential role for governments in terrorism coverage*, by Dwight Jaffee, *Public-private partnerships to cover terrorism risks in OECD countries*, by John Cooke.

<sup>2</sup> On leave from the Bocconi University.

<sup>3</sup> Power point presentations summarising papers included in this publication as well as other presentations made at the conference are available on the conference web page: <http://www.oecd.org/daf/insurance/>.

<sup>4</sup> Working for the Financial Affairs Division.



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\* Background Note of Mr Kawachimaru's presentation (NIPPONKOA Insurance Company Ltd), based on *Governmental Earthquake Insurance System in Japan*, from *Earthquake Insurance in Japan*, written and published in March 2003 by Non-Life Insurance Rating Organization of Japan.



## PART I

### **Insurability of Catastrophic Risks**

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by B. Garston.



# PART I

## *Chapter 1*

### **Some Aspects of the Economics of Catastrophe Risk Insurance**

*by*

**Christian Gollier\***

**University of Toulouse**

The ability to share risk efficiently in the economy is essential to welfare and growth. However, the increased frequency of natural catastrophes over the last decade has raised once again questions associated to the limits of insurability in a free markets economy, and to the relevance of public interventions on risk-sharing markets. This chapter explores the potential reasons for the lack of insurance specifically associated to catastrophe environmental risks. The final aim is to link each source of possible market inefficiency to its possible remedies.

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\* Professor, LEERNA (INRA) and IDEI.

## 1. Introduction

The standard economic model of risk exchanges predicts that competition on insurance markets leads to a Pareto-efficient allocation of risks in the economy. In particular, it states that all diversifiable risks in the economy will be washed away through mutual risk-sharing arrangements. All risks will be pooled in financial and insurance markets. Moreover, the residual systematic risk in the economy will be borne by the agents who have a comparative advantage in risk management, as insurers and wealthy investors. In short, it means that all risks are insurable. This prediction is obviously contradicted by casual observations. Many diversifiable risks are still borne by individuals. Indeed, individual consumption levels are not perfectly correlated in the population, i.e., for every shock in the economy, they are “winners” and “losers”. This is symptomatic of an inefficient risk sharing *ex ante*. To illustrate, it is believed that most of the supply of insurance coverage against terrorism risk would have disappeared without a public intervention in the United States after September 11, 2001. Also, there is ample evidence that only a limited fraction of homeowners purchase insurance coverage against earthquakes, floods and other natural damages in countries without strong public interventions. Finally, without a considerable internationalization of insurance and financial markets, we may expect that risks associated to climate changes will be favorable to some countries and detrimental to others.

The adverse consequences of the limits to insurability are generally overwhelmingly underestimated. The management of risks and the management of production cannot be disentangled without efficient risk-sharing markets. It forces small entrepreneurs to bear the risk linked to their investment. It yields a reduction in investment, employment and growth. In addition, the inability of our economies to efficiently transfer risks affecting human capital forces households to bear a larger risk over their lifetime. Given risk aversion, it has a dramatic adverse effect on welfare.

The possibility to transfer a risk on the market place is contingent upon whether the buyer is ready to pay a larger price than the minimum price at which the seller is ready to sell. Consequently, the concept of a limit to insurability cannot be defined only on the distributional characteristics of the risk, but it should also take into account the economic environment. Berliner (1982) enumerates the criteria to define insurability. The actuarial view on this problem is usually summarized by stating that a risk is insurable if the Law of Large Numbers is at work. It means that the maximum potential loss may not be infinite, or very large. Similarly, risks should not be too much positively correlated. In addition, it means that insurers should not accept risks with a too low probability of occurrence. Also, the risk must exist: a

realized risk cannot be insured. The legal environment must be stable, or predictable. Finally, an objective distribution function can be estimated.

This definition is not entirely satisfactory. As said before, a transaction on the market is possible if the two parties are willing to transfer the underlying "good" against a specific price. This joint willingness can exist only if the seller and the buyer find it advantageous to exchange. We define a risk as being uninsurable if, given the economic environment, No mutually advantageous risk transfer can be exploited by the consumer and the suppliers of insurance. Partial uninsurability occurs when the parties can exploit only part of the mutually advantageous transfer of risk. Whether there exists a mutually advantageous risk exchange between the two parties is an interesting question that has been examined by several authors as Arrow (1965), Borch (1960), Raviv (1979) and Aase (1993). The basic model is a perfect competitive insurance market in which it clearly appears that indeed the Law of Large Numbers plays an important role to evaluate the social surplus of the transfer of risks. But, contrary to the standard actuarial view, the maximum potential loss and the probability of loss have an ambiguous effect on the size of the transfer of risk at equilibrium. In addition some factors as the degree of risk aversion of the agent, or her degree of optimism, are crucial in the insurability of risks in the economy.

The actuarial view on the limits of insurability appears to be too narrow. After all, the Lloyd's accepted to underwrite the risk of the capture of the monster of Loch Ness, and more standard insurance companies cover the risk of failure of Ariane V, the new European satellite launcher on which no data is available. Moreover, many risks on which the Law of Large Numbers could be used are beyond the limits of insurability. One cannot find insurers that would accept the risks of the absence of promotion, or of divorce.

The objective of this paper is to provide some insights on the recent developments on the economic analysis of the limits of insurability, specifically for catastrophic risks. There is no unified theory for it. Rather, there are a large set of economic reasonings explaining why some risks cannot be insured on the marketplace. All of them are related to a modification of one of the assumption in the Arrow-Borch standard model of perfect competition on insurance markets.

## 2. The classical Arrow-Borch model of efficient risk sharing

Economists<sup>1</sup> have developed during the last thirty years a canonical model to deal with optimal insurance/risk-sharing and risk prevention. Our aim in this section is to review the assumptions and basic results of this simple model.



In the classical risk-sharing model, there is a large number of agents in the economy. Each agent has a risky endowment. Correlation among these risks is allowed. Agents are expected-utility maximizers, with an increasing and concave utility function. The following assumptions are made:

- There is no transaction cost.
- The distribution function of risks is common knowledge.
- The distribution function can depend upon prevention efforts by the agents. Efforts are observable at no cost.
- Losses are observable at no cost.
- There is full liability.
- The model is static, or there exists a complete set of insurance markets for future risks.

Under these conditions, we obtain the following well-known results:

- To each possible event affecting at least one agent, there will be a competitive market for claims contingent to that event. Agents will exchange bundles of state-contingent contracts that can be analyzed as an insurance contract. Competitive markets generate a Pareto-efficient allocation of risks in the economy in the sense that there exists no other feasible allocation of risks that would increase the expected utility of an agent without reducing the expected utility of at least another agent. This allocation will satisfy the mutuality principle which states that everyone's final wealth depends only upon the aggregate wealth of the economy in the corresponding state. Namely, if there are two states of nature with the same aggregate wealth, the distribution of wealth among agents will be the same in the two states. This guarantees that all diversifiable risks are washed away. In particular, if there is no systematic risk in the economy, the aggregate wealth is certain, and by the mutuality principle, so will be the individual wealth levels. If a systematic risk exists, its sharing in the population satisfies a simple risk-sharing rule: the sensitivity of an individual's final wealth to the aggregate wealth in the economy is inversely proportional to its Arrow-Pratt degree of absolute risk aversion. In short, this means that more risk-averse agents should bear a larger share of the aggregate risk. Observe that this implies that all agents in the economy should participate to the bearing of the collective risk<sup>2</sup>.
- Despite risks depend upon efforts to prevent them, there is no moral hazard problem. Indeed, since efforts are observable, each party will condition the acceptance of the contract to strict requirement on risk

prevention by the other party. Contractors will privately trade-off their cost of effort to the benefits of risk-sharing generated by the contract. For example, an insurer will provide a better premium rate to those entrepreneurs who accept to invest in fire sprinklers in their buildings. The competitive equilibrium yields a socially efficient level of risk prevention. To illustrate the idea, if there is no systematic risk, or if there is a risk-neutral agent in the economy, at equilibrium a 1 euro increase in prevention effort by any agent generates a 1 euro increase in expected aggregate wealth in the economy.

We conclude that in the classical problem of insurance and risk prevention, there is no need for public intervention. Risks are efficiently spread in the economy. This means in particular that agents are fully insured if risks are diversifiable. If they are not, the risk will be spread to the largest possible community. Also, agents get the good incentives to invest in a socially efficient level of risk prevention. These results do not fit with the real world. Insurance and reinsurance mechanisms are good in spreading standard risks in a very efficient way over a worldwide community of investors who get a return for the portfolio risk they take. This is the case for automobile, fire and most liability risks for example. This is not the case for most natural risks. In the next sections, we review the reasons why the classical model fails to explain why these risks are hard to insure by the market. We also explore how private-public partnerships can improve efficiency.

### 3. Transaction costs

The prevalence of transaction costs in the insurance industry is a well-established fact. For many insurance lines like automobile insurance, transaction costs amount up to 30% of the premium. This is a striking difference with respect to financial markets, where transaction costs are generally not larger than 2 or 3%. It is easy to understand why insurance markets are faced with much larger transaction costs: insurance contracts are tailored to individual risks, which are difficult to observe. Insurance companies must therefore develop expensive technologies to audit individual risks, both ex-ante and ex-post. These costs are eventually passed on to the policyholder through a loading on the premium. On the contrary, financial contracts organize the sharing of standardized, aggregate risks that are easy to observe at low cost.

The existence of transaction costs is especially crucial in the case of catastrophic risks. Catastrophic risks are likely to trigger waves of claims from policyholders hit by the same event all at the same time. Auditing these simultaneous claims in a reasonable delay requires a large capacity of

auditors. Because auditing technology is expected to exhibit decreasing returns to scale, the expected auditing cost per customer is likely to be larger for catastrophe risks relative to other insurance lines. In the same spirit, the limited auditing capacity will force insurance companies to randomize audits when faced to waves of claims. This is anticipated by opportunistic policyholders who can be tempted to exaggerate their losses when a catastrophe occurs. As a consequence, the problem of transaction costs on insurance markets is magnified in the case of catastrophic risks.

How do transaction costs affect the insurability of risks? There is no doubt that some individuals with a low degree of risk aversion will find these costs too expensive with respect to the benefit of the coverage. In fact, Mossin (1968) proved that it is never optimal to purchase full insurance when the premium contains a proportional loading. Thus, transaction costs are a source of partial uninsurability. More interestingly, Arrow (1965) showed that the optimal form of insurance contract is a contract with full insurance above a straight deductible if the loading only depends upon the actuarial value of the contract, i.e. the expected indemnity. Deductible insurance is a best compromise between the willingness to cover larger risk and the objective to limit transaction costs. The intuition is that the willingness to pay for coverage depends upon the variance of losses. When one reduces the size  $t$  of the risk, the willingness to pay for insurance decreases as  $t^2$ , whereas deadweight transaction costs decrease as  $t$ . It implies that only large risks are insured. This is in contradiction with the observation that one has no problem to find insurance against cracks in one's windshield, but one cannot easily find insurance against much larger risks as earthquake insurance. We conclude that the existence of transaction costs is not a convincing explanation for insurance market failures for large risks.

The above argument holds specifically in the classical expected utility model. This model has been challenged for two decades by some economists and psychologists on the basis that it is only an approximation of households' attitudes toward risk. For example, Kahneman and Tversky (1979) performed experiments that tended to establish that people are much more affected by losses than by gains in wealth. That "loss aversion" should raise the demand for insurance, thereby making the transaction costs argument as a source of uninsurability even less credible.

The question is thus how to reduce transaction costs on catastrophe insurance markets. As explained above, transaction costs are large because the individual indemnity is a function of the individual loss, which is costly to observe. A standard response of the market is to impose a (partially disappearing) deductible, which implies that only policyholders with a loss larger than the deductible will submit a claim. As shown by Gollier (1987),

this is a socially efficient solution when there is a fixed cost per claim. A solution is to relate the indemnity to something that is easier to observe. For example, an insurance strategy would be to offer contracts that are contingent only to an index of aggregate loss in the community to which the agent belongs. Of course, this raises the issue of the management of the basis risk by the policyholders, but it yields the benefit generated by the low observability cost of the aggregate loss index. An extreme example of this strategy is provided by the development of “cat bond” markets during the last decade.

#### 4. Inefficient financial markets

Financial markets are a natural place to organize the sharing of individual risks. In fact, insurers and reinsurers should be analyzed as financial intermediaries that “package” individual risks before transferring it to the market. The wave of securitization of individual risks observed during the last decade raises the question of why financial intermediation is necessary. In addition to the above-mentioned remark that markets may find it hard to monitor individual risks, it has long been documented that financial markets have been quite inefficient to spread risks to the largest possible community of economic agents. Two problems are particularly relevant for managing catastrophic risks: limited participation of individuals to financial markets and the international diversification puzzle. Both problems yield an inefficiently large risk premium in the insurance tariffs for catastrophic risks, yielding in turn an insurability problem.

The existence of various participation costs to financial markets implies that only the wealthier fraction of the population will invest in the stock market. Given that many people do not hold any stock portfolio, they do not hold shares of (re)insurance companies that are considering covering catastrophic risks. The remaining shareholders will require a larger risk premium to participate, because of the larger size of the risk. Since the risk premium increases as the square of the size of the risk, this can generate a sizeable effect on the risk premium, and in turn on the insurability problem.

Another argument is based on the international diversification puzzle, as stated by French and Poterba (1991), and Baxter and Jermann (1997). They reported that US investors hold around 94% of their financial assets in the form of US securities. In Japan, the United Kingdom and Germany, the portfolio share of domestic assets exceeds 85% in each case. Whereas this effect is mitigated by the existence of international reinsurance treaties, it shows that catastrophic risks are not as much geographically disseminated as suggested by the theory. A possible explanation for the home bias of individual portfolios comes from various tax incentives for retirement funds to invest within the country. We believe that relaxing these investment

constraints would alleviate the insurability problem for catastrophic risks by reducing the risk premium requested by shareholders of (re)insurance company to bear them.

We endorse the proposal of Robert Shiller (1993) to create new markets for claims on various indexes related to national incomes, or to these so-called new risks for which the current allocation is obviously inefficient. For example, an international mutualization of the risk of climate change would be very helpful, as we believe that most of it can be diversified away. Such an international risk-sharing can be attained either through a formal risk-sharing treaty among different countries, or through the creation of claims on regional indexes of damages generated by climate changes. Super-terrorism could be treated in a similar manner. A difficulty of the system comes from the moral hazard problem that large risk-sharing arrangements generate. Another difficulty, which is specific to the international treaty system, is due to the long-term commitment that such sharing device requires.

## **5. Asymmetric information**

Since the seminal paper by Rothschild and Stiglitz (1976), it is recognized that the fact that insurers face a heterogeneous population of consumers is a source of inefficiency on insurance markets. Suppose that individual risks are heterogeneous in the population, and the observable characteristic of the agents are not perfectly correlated to the intensity of their risk. The adverse selection problem originates from the observation that if insurance companies calculate the premium rate on the basis of the average probability distribution in the population, the less risky agents will purchase less insurance than riskier agents. In the extreme case, the low-risk agent will find the premium rate too large with respect to their actual probability of loss. They will prefer not to insure their risk. Insurers will anticipate this reaction, and they will increase the premium rate to break even only on the population of high-risk policyholders. The presence of high-risk agents generates a negative externality to lower-risk agents who are unable to find an insurance premium at an acceptable premium rate. The policy recommendation that is relevant to reduce adverse selection is to make public all relevant information about risks. For example, insurers should be allowed to know whether the potential policyholder is highly exposed to some environmental risk.

However, allowing insurance companies to discriminate price according to their information about the risk exposure of their customers raises an ethical issue. Suppose that the riskier group of agents is on average poorer than the less exposed group. Price discrimination on the insurance market would raise the premium rate for poorer consumers. Beside the

redistributional issue, this may yield a solvency problem of the insurance demand. These two problems can be solved by imposing a no-discrimination rule to insurance companies (Rochet (1991)). In order to eliminate the adverse selection problem that this policy recommendation yields, it is necessary to combine the no-discrimination rule with making insurance coverage mandatory. This is what is done for example in France in the case of insurance of natural catastrophes. Given the difficulties to regulate insurance markets in this way, one should think of the alternative policy that would consist in redistributing wealth among low-risk and high-risk customers through a simple tax scheme.

The population of risks can be heterogeneous not only because agents bear intrinsically different risks, but also because they do not invest the same amount of their energy, wealth, or time to risk prevention. In particular, it has long been recognized that individuals that are better covered by insurance invest less in risk prevention if the link between the premium rate and the size of these investments is weak. It will be the case if insurers are not in a position to observe the investment in risk prevention by the insuree. In that case, the premium rate is not sensitive to the effort made by the policyholder to prevent losses. Obviously, contrary to the result of the classical model, there will be an inverse relationship between risk prevention and insurance coverage. The level of risk prevention will be inefficient. This is moral hazard. Anticipating this low degree of prevention and the higher frequency of losses that it entails, insurers will raise their premium rate, inducing policyholders to reduce their coverage. At the limit, no insurance can be an (inefficient) equilibrium. The moral hazard problem is particularly crucial when policyholders have a large control of their risk. To illustrate, this is why it is not possible to insure against many environmental and technological risks.

The policy recommendation to fight against ex ante moral hazard is the enforcement of norms for risk prevention. This is the case for environmental risks in which ships transporting chemical products have to satisfy several safety requirements that are imposed by regulatory agencies. Automobile driving norms are also standard, as speed limits, alcohol-free driving,... Why these norms are mostly organized by a regulatory agency rather than by insurers is not completely clear. One reason is due to the combination of negative externalities and limited liability. If they are more than one principal supervising the implementation of norms, the information among the different principals should be pooled to save on monitoring costs. Heal and Kunreuther (2003) argue that a centralized prevention system can be useful to solve the “tragedy of commons” coming from the fact that each agent’s effort yields an externality on the other policyholders’ risk.

Another policy recommendation is to allow insurers to discriminate prices among different policyholders. Allowing for discrimination is a way to provide incentive to policyholders to invest in risk-reducing activities. In France again, insurers are not allowed to discriminate premium rate for natural risks. The consequences are by now obvious: many households built their house in areas that were secularly known to be flooded periodically. The absence of actuarial insurance pricing was supposed to be counterbalanced by the imposition of strict norms for where to build houses. But these norms have never been written.

## 6. Limited liability

Firms generate environmental risks that are borne by third parties. This raises the question of who should bear the burden of the risk. In most countries, firms found liable to a damage to others must indemnify them accordingly. This is done to force firms to internalize all costs generated by their choice. But indemnification is possible only up to the firm's financial capacity. Limited liability is a way to protect risk-takers against an excessive financial distress. But it has long been recognized that limited liability distorts the decision of the risk-taker in a way that is socially inefficient. This is because the limited liability gives firms the equivalent of a free put option. Put it in simpler terms, under limited liability, an insolvent firm can only benefit from taking more risk, because it does not bear the burden of losses. Therefore, if it is risk-neutral, it will seek to maximize the expectation of a convex function of its equity. As a result, it will systematically exhibit a risk-loving behavior, and adopt a very risky attitude that can be labelled "bet for resurrection". This is a kind of moral hazard problem. Risk aversion mitigates this result, but only for agents who are well capitalized, as shown by Koehl, Gollier and Rochet (1997). To sum up, it is likely that insurance markets for environmental liability risks will not work efficiently, even when risks are efficiently priced by insurance companies. Another way of looking at this problem is that the insurance contract creates a "deep pocket" where victims can find compensation for their losses.

Limited liability thus raises several important questions. How to organize compensation for those who bear the negative environmental externalities? How to build an incentive-compatible mechanism that increases loss prevention by firms? How to force firms not to undercapitalize their subsidiaries which are in charge of managing the riskiest part of the business? Two routes have been used. The first one is compulsory insurance. This solves the misallocation of risk in the economy and the organization of a system to compensate the victims. But, most of the time, compulsory insurance has been funded by a flat, non-discriminatory, non-incentive-compatible insurance tariff. The policyholder's investment in loss

prevention is not observed by the fund, either because it is difficult to get information on it, or because the fund did not get the good incentive to organize an incentive-compatible system.

The second route has been to organize “deep pocket” for decision makers. Under the US CERCLA, when a bank has been closely involved in the monitoring of a firm’s activities, it may be considered as liable for cleaning up the environmental damages generated by the insolvent firm. The objective of this strategy is to force risk-takers to internalize the full cost of potential losses: banks will increase the loan rate of riskier firms, and they will have the good incentive to monitor their environmental risks. However, as observed by Boyer and Laffont (1995), there is no reason to believe that the insurer can monitor the firm at no cost. As a consequence, the CERCLA legislation introduces more asymmetric information on credit markets. There will be more credit rationing, the cost of capital will be larger, and the structure of banking contracts for firms will be affected. Is insurability worth this cost?

The existence of extensive bankruptcy costs on financial markets implies that catastrophe risks cannot be insured without the government paying the role of reinsurer of last resort. This is a key element in the success of both the terrorism risk insurance (TRIA) program in the United States, and the insurance of natural catastrophes in France for example. It is noteworthy that this public intervention to the allocation of risk in the economy is viable only if it is clearly defined ex-ante. This is a prerequisite for the efficient functioning of the (re)insurance markets.

## 7. Lack of predictability

There are many instances in which the random variable describing the risk has no objective probability distribution. This can be due to the absence of historical data. Or because of our imperfect scientific knowledge, for those who believe in a deterministic world. To illustrate, who knows the actual probability distribution of a major leak in some specific type of nuclear plant, the probability of transmission to the human being of the so-called “mad cow” disease, the probability of failure of the new European satellite launcher Ariane V, or the probability of the average temperature of the earth increasing by more than 3 degrees Celsius over the next century? The lack of predictability can also be due to a volatile environment, as is the case for future liability rules of the environmental policy in many countries. The ambiguity about the probability distribution raises several questions. Is it sufficient to explain the insurability problem typically associated to ambiguous risks? How to calculate a fair insurance premium? How to evaluate the benefits of an insurance contract for the insuree? What would be an efficient allocation of risks in the economy?



Cabantous (2003) examined this question through the following experiments. Seventy-eight french underwriters were asked to price two different risks. Risk 1 yields a loss  $L$  with an unambiguous probability  $p = 0.2\%$ . Risk 2 yields the same loss in case of accident, but we don't know the true probability of an accident. It can be either  $p_{\min} = 0.1\%$  or  $p_{\max} = 0.3\%$  with equal probability. Thus, without any additional information, the prior probability of accident is the same for the two risks, i.e., they have the same unconditional actuarial value. In spite of this obvious fact, the french underwriters priced risk 2 at a much larger rate than risk 1. More precisely, risk 1 was priced with a loading factor of 35% on average, whereas risk 2 had a loading factor more than doubled at 78% of the actuarial value. Underwriters seems to behave as if they would put a very large subjective probability of the worse scenario  $p = p_{\max}$ , which is typical of what economists use to refer to "ambiguity aversion". The concept of ambiguity aversion has received a precise theoretical content by the works of Gilboa and Schmeidler (1989). This large premium rate generated by the insurers' ambiguity aversion can potentially explain why the demand for insurance for ambiguous risks is so small at that price.

Notice that if both the policyholder and the insurer have the same degree of ambiguity aversion, they should use the same  $p$  to compute expected utility on one side, and the actuarial value of the policy on the other side. This should not introduce any specific insurability problem. The ambiguity raises the premium required by the insurer to accept to cover the risk, but it also raises the policyholder's willingness to pay for insurance. An insurability problem may occur only if insurers are systematically more ambiguity-averse than consumers. Kunreuther, Hogarth and Meszaros (1993) conducted a series of studies to determine the degree of ambiguity aversion of insurers. They showed that many of them may exhibit quite a large degree of such an aversion. For which reasons this is the case remains an open question. This could for example come from an incentive problem. Underwriters are usually much more penalized when it happens ex-post that they "underestimated" the risk of loss than when they "overestimated" it. Underestimation leads to the much visible problem for the company to face a loss ratio much larger than unity (asbestos in the US, transfused blood scandal in France,...). Overestimation yields unearned potential profits that are usually not even mentioned by the principal. Thus, underwriters would not be "genetically" more ambiguity-averse. Rather, they react to biased incentives. Solving this uninsurability problem requires a modification of incentive schemes for underwriters.

## 8. Dynamic aspects of insurability

### *8.1. Implicit risk-sharing versus insurance*

A substitute for market insurance is to organize an implicit or explicit system of solidarity for the unlucky citizens through an indemnity financed by the taxpayers. Social security is the most obvious example. The decision of the US government to compensate the relatives of the victims of September 11 and the shareholders of airline companies is another example. France is the perfect example of a country that established an implicit system of solidarity for unlucky citizens. Farmers and truck drivers for example can rely on the state to get compensations for adverse shocks to their profits. Victims of floods may expect to get indemnities that depend upon the power of their local representatives at the Parliament.

The solidarity system yields problems that are similar to those of the market insurance: adverse selection, moral hazard and fraud. Moreover, if the system is implicit, it generates some uncertainty about the level of the indemnity, because of the political nature of the intervention. But the most important difficulty is related to the non-stability of the coexistence of the solidarity system. If citizens believe that the state will compensate them for their damages, they will prefer not to insure the risk. Ex-post, the absence of insurance coverage forces the state to intervene. This is a case of self-fulfilling prophecy. One can mitigate this problem by asking the state to specify explicitly the conditions and the limits of national solidarity. However, such a commitment may be difficult. Ex-post, the social pressure for the public indemnification of the uninsured victims of a much publicized catastrophe will be strong. Solidarity kills market insurance. This problem can also be mitigated by offering public indemnities that are not contingent to the existence of an insurance contract covering the victim's loss.

An essential aspect of the policy issue here is thus the ability of the State to commit itself on an ex-post treatment of the victims of natural catastrophes. This commitment can be organized through a specific law organizing solidarity mechanisms under specific rules, as done for example by the United States through the passage of the Terrorism Risk Insurance Act of 2002. Delegating the management of the solidarity scheme to an independent institution is an alternative strategy to this commitment problem.

### *8.2. Realized risk*

Individual risks exhibit serial correlations through time. For example, a site that already experienced many tornadoes is likely to be exposed to other tornadoes in the future. If allowed to do that, competitive insurers will certainly use these historical data to price these individual risks. The

extreme form of this is a “realized risk” in which the evolution of the random variable in the future became deterministic, given the current situation. Obviously, there exists no mutually advantageous risk transfer in this case. In short, one cannot insure a risk ex-post.

The same kind of problem arises from other sources of information. For example, the improvement of our ability to forecast future earthquakes or terrorist attacks inflicts high stress to the sustainable long-term relationship between insurers and policyholders. An international climatic risk-sharing arrangement could be organized only as long as our scientific knowledge is insufficient to predict which countries will benefit from the climate change, and which ones will have to bear most of the damages. Hirshleifer (1971) already noticed that more information can have a negative value for Society. Early information on risks will make these risks uninsurable. This so-called “Hirshleifer effect” may be escaped if insurance could be organized prior to the revelation of the information.

This phenomenon indicates the importance for insurance markets to establish long-term relationships between the buyer and the seller of a risk. Insurance for environmental risks would have a much smaller value if, at any time, one party could renege the contract contingent to new information about the risk exposure of the policyholder. This links this discussion to the assumption made in the classical model that there exist insurance markets for future risks.

### ***8.3. Time diversification and catastrophe loan programs***

Risks can be transferred between individuals, but it can also be transferred through time via the credit markets. Economic agents can forearm themselves in the face of uncertainty by building financial reserves. In the face of random shocks on their future revenues, they can reduce the volatility of their consumption by reducing their reserves in case of an adverse shock, and by increasing their reserves in the absence of catastrophes. This buffer stocks strategy has been examined by Yaari (1976), Deaton (1991) and Gollier (1994) for consumers in a life-cycle model. Yaari (1976) showed that an agent with an infinite time horizon and with risks that are independent through time would “time-diversify” his risks by an efficient borrowing-lending strategy that perfectly smooths his consumption through time. No costly insurance would be necessary in this case.

Contrary to this theory, the “time-diversification” strategy is actually not a perfect substitute to insurance because agents have a finite lifetime, and because consumers face borrowing constraints. In particular, they cannot borrow in case of an “early hit” of damages that dries up their initial financial reserve. This is particularly a problem for catastrophe risks in spite of the low probability of

occurrence, since the buffer stock to build to forearm oneself against the consequences of the damage is necessarily huge. A standard governmental policy in situations where a large population hit by a catastrophe faces a borrowing constraint is to provide subsidized governmental loans. Gollier (2003) considers a standard lifecycle model that can be used to measure the benefit of relaxing individual borrowing constraints. We have shown that the marginal benefit of governmental loan programs is marginal when an efficient insurance market exists, but easing borrowing constraints when risks are difficult to insure may have a large effect on welfare.

This analysis can be reinterpreted for insurance companies determining their strategies of capital accumulation and reinsurance. A starting insurance company has a low capacity to retain risks. It is thus forced to reinsure a large part of its business. If it is not caught by an “early hit” of catastrophic indemnities, its capacity to retain risk will grow. This will increase the capacity of the market. The ability of insurance companies to transfer wealth through time is thus central for organizing time diversification of catastrophic risks. But the modern theory of corporate finance indicates that managers in firms with a large financial reserve will be less efficient than managers in less capitalized firms where their job is at stake. Managerial inefficiencies open the door to raiders who could use the cash reserve of the insurance company for his own purpose. The bottom line is that it can be hard for insurance companies to accumulate financial reserves. This has an adverse effect on the capacity of the insurance market.

When catastrophic risks are difficult to insure, time diversification may provide a good substitute. Because consumers and insurance companies may face difficulties to smooth shocks through buffer stocks and borrowing, the state may be in a better situation to organize time diversification. The state has the credit worthiness and the long time horizon that are necessary to implement time diversification efficiently. As explained before, the best way to do this is likely to ask the state government to play the role of reinsurer of last resort, a backstop, by offering reinsurance contracts with a deductible corresponding to the capacity of the insurance market. The moral hazard problem that it generates should be mitigated by the usual methods (experience rating, norms of prevention,...). A frequent reassessment of the market conditions should be performed in order to leave maximum freedom to the market capacity.

## 9. Conclusion

Insurance plays a key role in the functioning of our modern economies. Insurance contracts transfer individual risks to financial markets through shareholders of insurance companies. It allows for a reduction of risks borne by Society through diversification. It also allows for transferring risks to

agents that have a comparative advantage to bear risks, i.e. more risk-tolerant agents. The added value for the economy is considerable: it directly increases the welfare of the risk-averse policyholders, but it also induces risk-averse entrepreneurs to invest more in risky activities, thereby increasing growth and employment.

This view on the functioning of our economies is idealistic. There are several reasons for why a large proportion of uncertain events cannot be insured efficiently by competitive insurance markets, particularly those related to natural catastrophes. In this paper, we surveyed some of them, and in particular the inability to smooth catastrophic shocks over time due to solvency issues and liquidity constraints, the absence of objective probabilities, the large transaction costs of auditing large waves of claims simultaneously, and the Samaritan syndrome. We also discussed various strategies to remedy the economic inefficiencies that are generated by this insurability problem. The optimal public-private partnership is obtained by combining the advantages of the two systems. Private insurers and reinsurers are good at selecting, pricing and monitoring individual risks and at auditing claims. They can efficiently transfer a first layer of these risks to financial markets. But they are not good at retaining the upper layer of aggregate risks, given the solvency constraints that prohibit them to smooth shocks over time. The State can efficiently do that by using its ability to tax citizens both before and after catastrophes occur, thereby time-diversifying catastrophic risks. This is why it should play the role of reinsurer of last resort. A key element to the success of this public intervention is that the rules defining the conditions of the public reinsurance be completely explicit. This is only in this way that we will put to a minimum the inefficiencies inherent to any public regulation, in particular those related to the crowding out of private insurance by public solidarity.

## Notes

- 1 See Borch (1962), Arrow (1953), Mossin (1968), Raviv (1978) and Gollier (1992).
- 2 See Eeckhoudt and Gollier (1995) for a synthesis on Pareto-efficient and competitive risk-sharings.

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## PART I

### *Chapter 2*

# **Industrial, Technological and Other Catastrophes**

*by*  
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An international reinsurer must be credited with a certain degree of experience with catastrophes. But the question is, given the individual profile and diversity of the scenarios, how far can he meaningfully "process" such experience? This is scarcely possible using actuarial methods alone. It calls for methods that are probably more akin to those of an historian than those of an actuary, scientist, economist, legal or other kind of expert.

The first part of this chapter aims at categorising catastrophe scenarios while presenting comments on some of these categories.

The second part briefly shows how the same or similar catastrophe scenarios are differently handled in various insurance markets and legal systems.

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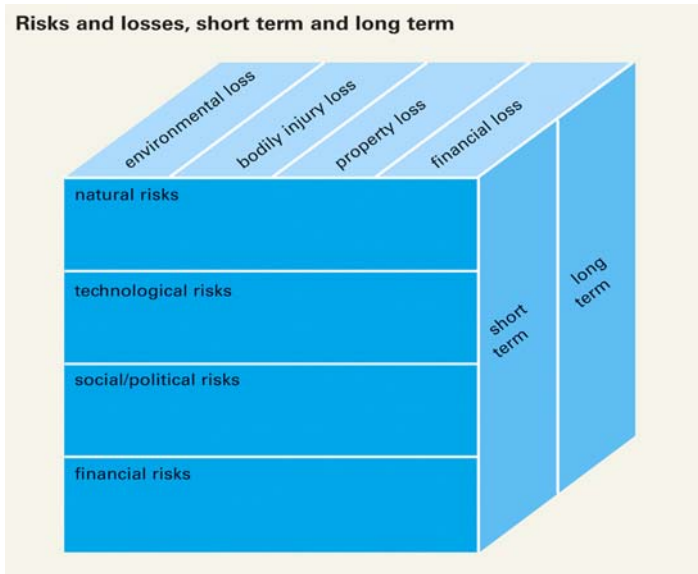
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## 1. Categorising catastrophes

A structured overview of catastrophes differentiates between short-term and long-term risks and losses.

**Figure 2.1**



Risks fall under four categories: natural hazards; technological risks including infrastructural risks such as mass losses arising from road, rail or air transport; social and political risks, and pure financial risks.

The losses can likewise be divided into four categories: environmental damage, personal injuries, property damage and purely economic losses.

A distinction can also be made between short-term and long-term scenarios: accidental pollution versus long-term soil and water pollution or climate change; technological short-term risks (industrial accidents like Bhopal 20 years ago) versus long-term risks (toxic torts like asbestos); political short-term risks like terrorism versus a new type of long-term risk affecting corporations: the trend to rework historical injustice under the aspect of tort law.

There are combinations and fluid transitions: accidents, events arising in the short term, can result in long-term damage, almost unlimited in the case of nuclear accidents, for example. A large number of individual accidents –

such as leaks in industrial plants – can be seen as the result of one continued risky operation. The causes of an industrial fire may be specific to that industry, but they may also be sabotage or terrorism.

Nevertheless such a differentiation appears to make sense. On the one hand, ecological and social/political aspects should each be looked at separately: the technological, ecological and social standards of corporate liability. On the other hand, typical structures should be perceived in large loss scenarios – each of which has a unique individual profile – and adequate claims management methods developed. Everywhere there is the unsolved problem that whilst questions of liability law and insurance cover become too complex for detailed application, it has not yet really been possible – in the reality of extrajudicial ad hoc payments or fund arrangements – to develop satisfactory alternative solutions. Finally, in long-term scenarios it is “abundantly clear that neither the judicial system nor the legislature will ever solve the problem of mass tort litigation until we find a way to resolve the futures problem”<sup>1</sup>, the problem of anticipating future claims when responsible parties insist on “global peace”<sup>2</sup>.

### ***1.1. The dubious ranking of catastrophes***

An earthquake in the Gobi Desert will not cause any damage, however strong it is: an event, not a loss event. On the other hand, the 1985 eruption of the Nevado del Ruiz volcano in Colombia, though relatively harmless on the basis of the Volcanic Explosivity Index, buried a town of 30,000. Nevertheless, the private insurance industry was affected much less by this than by the smashed roofs and dented cars caused by the July 1984 hailstorm in Munich. Ranking of catastrophes depending on the highly specific aspect of private property insurance involvement can be misleading.

### ***1.2. Catastrophes and liability***

In catastrophe scenarios, questions of liability already play a part where natural hazards or political risks are to the fore. Flooding can also be caused as a result of zoning plans being faulty or not properly monitored. The causes of an earthquake cannot be attributed to anyone, but foreseeable or avoidable consequences of construction defects or poor disaster management can. In acts of terrorism, there is liability of “enabling” parties such as negligent security where liability of the perpetrators may be impossible to enforce. In technological catastrophes, liability becomes the core question. In any case, there is a dialectical relation between the risk-sharing functions of insurance and the risk-concentrating “polluter pays” functions of liability law.

### ***1.3. Latent catastrophes and liability***

In what are initially less obvious large loss situations, public pressure builds up in a process we may call "name, blame and claim". Such apportionment of blame may relate not only to exceptional but also to everyday situations, to familiar and long-accepted risks associated with production, consumption and transport. This is often what first creates acute public awareness of a large loss, transforming one of the various latent or accepted grievances into a scandal. In the United States it became strikingly clear how industry and the unions, health authorities and workers' compensation insurers had ignored or hushed up the problem of asbestos for decades until it was picked up in the 1970s as a result of more strictly defined product liability and solved by the bankruptcy of the manufacturers<sup>3</sup>.

### ***1.4. Catastrophes and "event" definitions in insurance and reinsurance***

In insurance and reinsurance, terms like "event" or "loss event", "accumulation loss" and "serial loss" form the subject of abstract, ambiguous contract clauses used to limit, in both contractual relationships, deductibles and retentions on the one hand and sums insured or reinsured on the other. Far-reaching consequences are attached to "soft" preconditions that can be interpreted in different ways.

### ***1.5. Catastrophe as a construct***

The term "catastrophe" is therefore a construct – not only an object of observation but also a concept of observation, or glasses that are put on to identify a specific need for action. The same facts may be assessed for different purposes on the basis of different criteria by ecologists or medics, regional or central administrations, social security and tort law experts, property and liability insurers, primary insurers and reinsurers.

### ***1.6. Catastrophes and mass media***

Mass media contribute to what is perceived as a catastrophe. This includes the interest in scandal, in attributing fault to persons, companies and institutions in an often moralising way, even if a most difficult evaluation of the consequences is involved; fitting things into a certain pattern or putting them under a certain heading so that, when the facts are complex, one particular aspect is emphasized and one of several possible interpretations made; the snowball effect of risk perception when the media reflect each other, when commentaries are commented on, and when statements of opinion are themselves scandalized<sup>4</sup>. In this way, pressure to

take political action is exerted before there has been any opportunity to clarify the issue in factual terms. Then again, through this political action it may be possible to isolate the problem and to demonstrate initiative and efficiency in a state of emergency, instead of struggling with fundamental, commonplace, structural problems.

### ***1.7. Short-term industrial catastrophes***

Hazardous production facilities have always been sited outside urban areas, only to be regularly absorbed again as the cities expand. The older the plant, the more central its location. A centrifugal trend can be observed here, with old manufacturing facilities being continually shut down and relocated further on the periphery. More and more capital cities are now losing their role as the dominant industrial location, as the example of Mexico clearly shows: the capital's share of national industrial production has halved over the last 20 years<sup>5</sup>.

This category includes the biggest civil technological disaster in recent decades, namely the escape of methyl isocyanate (MIC) from Union Carbide's plant in Bhopal (India). Here, in the early hours of 3rd December 1984, a toxic cloud blanketed a city in which most were sleeping and others were still awake in the railway station, teahouses and open-air cinemas, at wedding celebrations and a poetry festival. The case, which was not completely documented, is instructive in all too many respects. To start with, there was an incorrect estimate of the demand from Indian agriculture: an oversized production plant which after a brief period of euphoria was neglected. Unlike with drugs and pesticides, the health risks of an industrial chemical like MIC are not generally investigated as a priority. It was clear, though, that MIC quickly reacts with water, which meant that people's faces and breathing could have been protected with wet cloths. The company did not draw attention to this fact either preventively or when the crisis occurred. For the latter, the loudspeakers of the city's many minarets would have provided a suitable infrastructure. Whilst obvious prevention measures were not taken, a therapy remains unknown to this day. The number of victims was estimated at 12 000 to 16 000 dead and 200 000 injured. Experience gained from treatment was scarcely published. The US concern, which came off well with a settlement package of US\$ 470 million (of which US\$ 200 million was insured), was taken over in 1991 by the world largest chemical group, Dow. Indian legislation has reacted with laws on industrial accidents, information requirements and compulsory liability insurance. Dow was not involved in the accident; but new questions arise, new generations of victims appear, and Union Carbide had disappeared: the open borderlines between legal liability and moral or factual accountability.

The category also includes nuclear power stations. Many lie close to large cities and a few in the surrounding areas of metropolises like Paris, Tokyo, New York or Los Angeles. What becomes particularly clear here is, on the one hand, the limits of disaster plans: evacuation cannot be carried out either as a practice drill or in an emergency. On the other hand, the underinsurance of the obligatory nuclear pools is notorious, their capacity barely exceeding that of the open liability insurance market for other major industrial risks. This is all the more disturbing in view of the fact that September 11 brought to light risks that had evidently been given little previous consideration.

In normal traffic risks, by contrast, unlimited cover is usual in some motor liability insurance markets. This practice is under debate given the risk of catastrophes like the one at Selby in the UK in February 2001, with liability of around €80 million, the transportation of dangerous goods, fires in tunnels (the cost of the accident in the Mont Blanc Tunnel in 1999 is put at some €100 million) and, possibly, motor liability risks in connection with terrorism.

### ***1.8. Long-term technological risks***

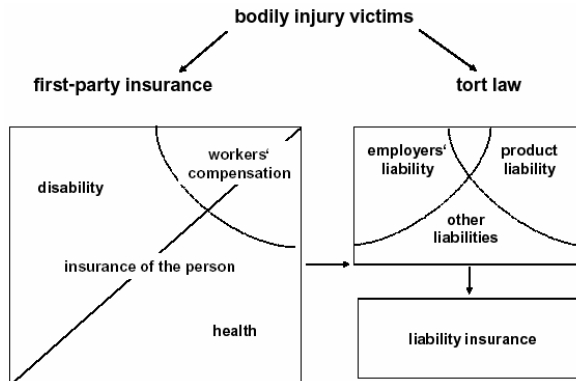
Because of the risks of change when dealing with the consequences of technology and the side-effects of products, this is probably the most complex category of large loss scenarios. Risks of change arise from new technologies like genetic engineering, from new hazardous substances or, more precisely, from new application of long-used substances: the latex problem of the 1990s as a result of the sudden massive demand for disposable gloves to prevent AIDS the discovery of dioxin, notorious through the use of herbicides in Vietnam and the Seveso accident in 1976, in many industrial processes, thanks to more accurate detection methods in the 1980s. Extensively used substances become problems because of their persistence (like CHCs and PCBs in the 1980s, and currently MTBE in the USA), typically first of all in specialist circles, then among the general public, which in turn makes new research budgets possible and results in pressure to take political action. A similar situation exists with respect to pharmaceuticals, when in the sea of side effects and interactions certain relationships are spotlighted and attributed to certain manufacturers. Historical but by no means closed cases involve the damaging effect of pesticides on agricultural workers and the environment. The biggest liability loss ever – personal injury claims due to asbestos – also falls into this category. On the other hand, the comparably high cost of removing asbestos from buildings worldwide has so far had only a marginal effect on the insurance industry, whereas the cost of remedial work on middle- and lower-class dwellings in the US in connection with lead paints and now the problem of toxic mould has placed burden on US homeowners and liability insurers. These examples only hint at the great number of relevant scenarios.

### 1.9. Long-term social and political risks

A new type of liability should not be ignored: the trend to rework historical injustice from earlier or more recent times with respect to liability law: the "sudden appearance of restitution cases all over the world"<sup>6</sup>, consequences of war and colonialism, slavery and discrimination. History becomes a field for political struggle; immunities under public international law which protect not only states but also individuals and enterprises are increasingly being breached by criminal and civil liabilities. An interesting example here are the negotiations to compensate an estimated one million "agent orange" victims in Vietnam. In Germany, the forced-labour lawsuits against German industry gave rise to debates about the different roles of social law and liability law<sup>7</sup>. Criticism has been directed at the foundation system solution<sup>8</sup> for failing to clarify the aspect of legal responsibility, i.e. the opportunity has not been seized to work out principles for the 21st century that make companies responsible vis-à-vis individual injured parties for exploiting state-enabled injustice. Reference is made to the approaches to civil-law liability in the case of human rights violations under US law in the 1980s and 1990s<sup>9</sup>.

## 2. One catastrophe, diverse approaches: the national patchwork compensation systems

On the one hand there is a whole range of catastrophe scenarios. On the other hand, the same scenario may affect many countries, but in different ways. Toxic torts are a good example. State and private prevention standards vary from country to country and also change over the course of time. The same applies to the social and political perception of risks, to the significance attached to them in the public debate. State and private compensation systems function differently. Thus, the same or similar catastrophes produce a puzzle made up of different insurance and liability situations in each country.



The compensation of asbestos victims, for example, differs from country to country: mainly covered by general disability and health insurers in the Netherlands, by workers' compensation insurers in Germany, by employers' liability insurers in UK and Ireland, by product liability insurers in USA.

With property insurance, the most striking difference compared to insurances of the person is that the background of state provision and state social security is largely absent. It is well known that in the 20<sup>th</sup> century, the world's governments tried, not always successfully, to establish Bismarck- or Beveridge-style models of pension, health and workers' compensation insurances. Certain historical models of using property insurance as social insurance were largely forgotten. Property insurance is, accordingly, the domain of private insurance.

Now it is precisely the risk of natural hazards, like earthquake or flood, and political risks, like terrorism, where the need for government involvement in compensating property damage is seen. Appropriate measures may be developed on an ad hoc basis, leading to one-off arrangements. Such ad hoc solutions may be welcome from the political point of view: to isolate a problem and to demonstrate initiative and efficiency in a state of emergency, instead of struggling with boring, commonplace structural problems. An example is the flood situation in Germany in Summer 2002, right in the middle of an election campaign. Or these systems are institutionalised, as in the various specific terrorism pools, mostly with mixed state and private involvement.

### **3. Some final considerations**

1. The wide range of catastrophe scenarios relativises the value of statistical statements.
2. A catastrophe may affect many countries (toxic torts) or occur in a similar way in various countries (accidents), but will be processed differently in the historically evolved and further evolving national patchwork systems. This also applies within the EU and there is no sign of harmonisation.
3. The combination of a) and b) means that each catastrophe is an unrepeatable historic event.
4. "Insurability knows no basic formula". Statements on insurability are statements on risk segmentation: who pays for what, a definition of specific markets.
5. Statements on insurability should either be cross-line and also include social security, or should explicitly name the line of business which they refer to.

## Notes

- 1 Mullenix, *Back to the futures: privatising future claims resolution*, University of Pennsylvania Law Review (Vol.148:1919, 2000).
- 2 Fn.1, 1922.
- 3 Brodeur, *Outrageous misconduct, The asbestos industry on trial* (1985). Rosenberg, *The dusting of America: a story of asbestos carnage, cover-up, and litigation*, [1986] Harvard Law Review 99, 1693.
- 4 Cf. Luhmann, *Die Realität der Massenmedien* (1996), pp. 53-81; Dunwoody/Peters, *The Mass Media and Risk Perception*, in: *Risk is a Construct: Perceptions of Risk Perception*, ed. by Bayerische Rück (1993), pp. 293-317.
- 5 Typical fire and explosion risks:
- A fireworks explosion at a large informal market in Lima's old town on 29 December 2001 caused 463 fatalities and destroyed four entire blocks:
  - A dynamite explosion at a barracks in a very densely populated area of Lagos (Nigeria) on 27 January 2002 resulted in over 500 fatalities. A similar accident in Cali (Colombia) in 1956 left over 2,000 dead.
  - An explosion on 21 September 2001 in the ammonium nitrate store of a fertilizer factory operated by the TotalFinaElf Group in Toulouse resulted in 100,000 claims, 27,000 damaged homes and 10,000 bodily injury losses, including 4,800 occupational accidents and 30 deaths. The overall loss, most of it insured, came to more than €2bn. Exactly 80 years earlier, on 21 September 1921, a similar ammonium nitrate explosion at a BASF plant caused the biggest civil accident in German industrial history – 561 dead and 1,952 injured, with windows apparently being shattered as much as 90 km away in Frankfurt.
  - Fire and explosions in petrochemical plants, like the explosion on 19 November 1984 in a storage facility for propane and butane situated within the municipal area of Mexico City, in which more than 500 people died and around 7,000 were injured. Most of the dead were found within 300 m of the plant. Since 1962, 40,000 people had moved into the originally uninhabited area surrounding the storage facility. Some dwellings were only 130 m away, whereas some vertical gas tanks were hurled up to 1,300 m through the air. A comparable accident at a Petrobras plant in São Paulo in 1985 also claimed more than 500 lives.
  - Fire at a plastic toy factory in Bangkok in 1991 in which more than 200 workers – mainly young women – were killed. This case also serves as an example for numerous industrial fires that occurred in the 1990s in the industrial areas of Southeast Asia.
- 6 Barkan, *The Guilt of Nations* (2000), p. IX.



- 7 Wolf, *Großschadenregulierung zwischen präventivem Rechtsgüterschutz und sozialrechtlichem Lösungsansatz, dargestellt am Beispiel der Zwangsarbeiterentschädigung* (Major loss settlement between preventive protection of legal interests and solutions based on social law; using as an example, compensation for victims of forced labour); in: Koch/Willingmann (eds.) *Modernes Schadensmanagement bei Großschäden*, 2002 (Modern loss management with major losses), 125-148. The contribution describes an exemplary liability case from the 1950s that is little known and barely discussed in the literature (Wollmann v. IG Farben). In many points it anticipates the current debate.
- 8 Cf. <http://www.stiftungsinitiative.de/>.
- 9 Based on the *Filártiga v. Peña-Irala* case, 630 F 2d 876 (2d Cr 1980); cf. Beth Stephens, *International human rights litigation in US courts* (1996); Terry, *Taking Filártiga on the Road*, in Craig Scott (ed), *Torture as Tort: Comparative Perspectives on the Development of Transnational Human Rights Litigation*, 109,115.

## PART I

### *Chapter 3*

# **Recent Trends in the Catastrophic Risk Insurance / Reinsurance Market**

*by*

**Patrick Murphy O'Connor\***  
**Benfield**

Over the last years the insurance and reinsurance markets have been deeply affected by a series of non-correlated factors: the aftermath of the World Trade Center terrorist attacks, the increasing frequency and severity of natural disasters, major disruptions in financial markets and concerns related to liability uncertainty. Against this backdrop this chapter seeks to provide a synthesis of these issues and challenges and to consider their consequences on the insurance and reinsurance market for catastrophic risks coverage including terrorism risks and on the trends in the pricing of these contracts.

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\* Global Customer Relationships.

## 1. Setting the scene

Recent catastrophic events have reinforced the need for reinsurance and therefore show that insurance and reinsurance are inextricably linked so enabling the insurer to spread their local exposures around the global market by way of reinsurance. However, the reinsurance market has gone through many fluctuations over the last few years with record income and profits being announced by some while others have either dismantled their global networks or collapsed.

This has obviously led to confusion amongst the buyers of commercial insurance and reinsurance. Prices are approaching highs. While some prices are continuing to rise, some types of insurance, and therefore reinsurance, have become prohibitively expensive or even just not available. Just to consider one such area, that of the Pharmaceutical industry, some companies have got together to form their own mutual insurer. In addition, there are the examples of the Government supported Catastrophe Pools in California for earthquake and Florida for windstorm. Notwithstanding this increase in pricing, it is interesting to note that some of Europe's largest companies continue to report disappointing results.

This has been created by a combination of events. The World Trade Centre loss on 11th September, 2001 gave rise to the largest ever property loss to the insurance industry at around USD 40 billion. Most of this was covered by insurance. Shortly afterwards, the market had to also deal with a major collapse in the global investment market. The financial losses wreaked havoc on the asset side of insurers' balance sheets, extracting perhaps another USD 100 billion from the industry's accumulated wealth. This was to be followed by a third equally damaging factor, that of reserving.

It is well known that for certain types of insurance, that is the so-called liability classes, insurance companies cannot know with certainty the final cost of their product. This can take a number of years, even decades. Insurers try to calculate their best estimates of the loss and set money aside to cover the ultimate total. If for any factor, such as changes to the litigation environment or new risks emerging, the ultimate ends up as greater than the reserve, then insurers will make a loss.

It has become clear over the last couple of years that some, even many, insurers have seriously under-reserved, particularly for their US exposures. Classes such as Medical Malpractice and Directors and Officer's liability have been very poor. In addition, exposures to claims from asbestos related diseases have also risen disastrously. Major actuarial reviews are still investigating the potential size of the losses but there is no doubt that

provisions will have to be made for increase in reserves of billions of US Dollars for policies dating back to the 1950s.

Other major factors behind this “correction” in pricing and coverage are the reduction in investment income due to the worldwide lowering of interest rates together with a general realisation that the insurers seriously under-priced their products during this period.

## **2. Social, economic and environmental trends**

As population and wealth concentrates in high risk areas, accurate exposure information is critical. In the US, it is as if every third person wants to live in an earthquake zone or in the path of a hurricane. According to the US Census, the three fastest growing states are California, Texas and Florida, which are expected to see population growth of 17.7m, 8.5m and 6.5 m respectively in the next three decades.

The international picture is similar. The United Nations forecasts that by 2015, half the world’s population will be concentrated in urban areas. Tokyo, considered to be the highest risk city in the world in terms of Natural catastrophe exposure, is expected to be the largest city with 27.2m inhabitants. Sao Paulo, Mexico City, New York and Mumbai are each likely to have populations exceeding 20m.

This concentration of people and wealth is increasing insurers’ exposure to major catastrophes and also potentially exacerbating the adverse effects of climate change. The expansion of major cities is changing the hazard. Cities create “heat islands” which may lead to more waves, severe storms, and flash floods. Research is still continuing into this area and it remains a hotly discussed subject.

Weather related events appear to be becoming more extreme. In autumn 2000, rainfall in England and Wales was the highest since records began. Unprecedented floodwaters rose in central Europe in August 2002. Temperature records were shattered in much of Europe and the Western US in July and August 2003, even as South African temperatures reached record lows. September 2003 saw Typhoon Maemi strike Korea. It was the strongest ever recorded there, and caused total damages of 4 trillion won (USD3.5 billion). Pusan, the country’s largest export port, was devastated.

Ostensibly smaller catastrophic events, such as severe thunderstorms and tornados, are demanding more attention from insurers. For example, a record 412 tornados – twice the previous high – cut across central US in May 2004. Insured losses were at least USD 1.55 billion. Only two years before, a series of severe thunderstorms across 16 states cost insurers around USD 1.7 billion. At the other end of the scale, the very largest catastrophes

can produce substantial losses across a portfolio, including in lines of business that are uncorrelated at lower levels, such as personal accident and workers' compensation, as the World Trade Centre disaster starkly showed.

Faced with these changes, mathematicians and modellers are developing sophisticated new portfolio analysis tools. Some can measure the probable impact of a mega-catastrophe on an insurer's whole account, others the risk of loss accumulation in a personal accident portfolio arising from an earthquake that destroys a convention centre. Such tools reinforce the increasingly technical approach to catastrophe underwriting, which should check competitive price cuts, and facilitate alternative forms of risk transfer, which should help to limit extreme price rises.

### **3. How has demand been affected by recent events?**

Taking into account the comments made in the first two sections, there is no doubt that the demand for insurance, and in particular catastrophe insurance, is strong and growing. Some data relating to 2003 will illustrate this development.

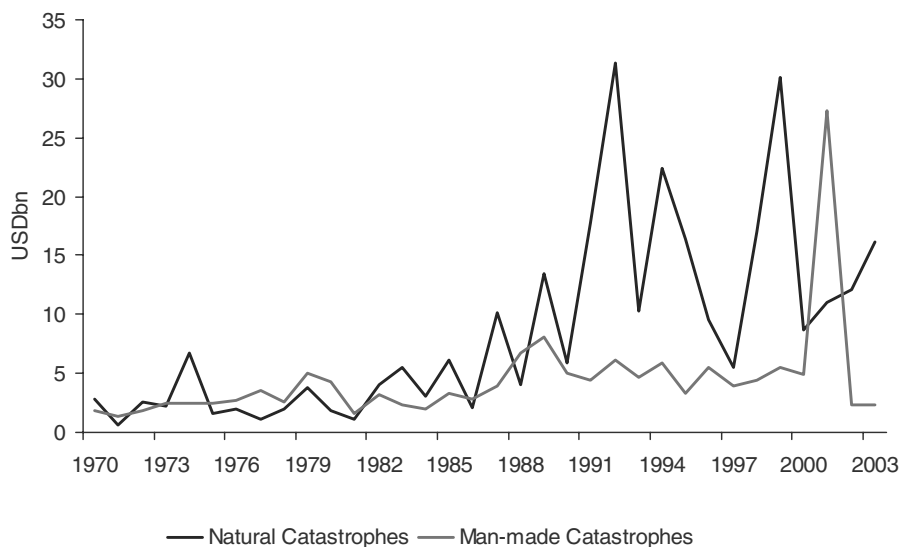
There were 51,500 deaths from natural catastrophes, with 8,000 from man-made catastrophes

Total losses were USD 70 billion of which USD 16.2 billion was insured Property losses caused by nature and USD 2.3 billion was caused by man-made disasters

This is, of course, only the latest in a series of continuing expensive years for the insurance industry since 1987 and, as we now know, is continued into 2004 with the series of Hurricanes to hit the Caribbean and the south-eastern states of America. This would seem to indicate an increase in extreme weather events consistent with predictions of a warmer climate.

Whilst it is reasonable to say that the World Trade Centre disaster had an eye opening effect on the consciousness of the world with regard to "man made" scenarios, the current data does not seem to indicate an increase in the quantum of loss to be carried by the insurance industry.

However, we remain extremely vulnerable to man made disasters, whether by accident or to effect threats for political purposes. There have been a number of examples if this in the recent past such as the power outages that hit the US, UK, Denmark and Italy, the arson attack on the subway in the South Korean city of Taegu or the poisonous gas leak in the Chinese province of Sichuan.

**Figure 3.1**

Source: Swiss Re sigma 2/2004

#### 4. What are the factors affecting whether supply meets demand?

So, what effect has this had on the market's ability to respond to these crises? Notwithstanding, the culmination of all the scenarios listed above, the market does seem to a large extent to have survived and even to have moved forward slightly. There has always been a reasonable balance of power between suppliers and demanders and shifts in this power base, through competition or legislation, have led to the so-called cycle in market terms and conditions.

As rates have increased as a direct and necessary result of the recent years, then this has created, whether real or imaginary, an illusion of potential profit. As the insurance industry is, on the whole, an easy market to enter, very quickly new competition is attracted. The new entrants have only to satisfy reasonably forgiving financial and legal requirements to set up. Some tax efficient zones around the world have particularly aided this such as Bermuda and Dublin to name but two.

The new entrants need to be able to acquire business and therefore market share. While, initially, this will be at the new attractive pricing, very quickly, the competition will force prices down.

In the past, this has led to prices being forced down below that which is sustainable causing the withdrawals and company failures as mentioned earlier.

As the insurance industry has been increasingly more transparent, especially to the Rating Agencies who are becoming more disillusioned at this perceived lack of discipline and are therefore recommending to the shareholders to insist on a business model that can deliver value in a more consistent way than even before. Insurance companies cannot rely on factors that have helped them in the past such as investment income but rather need to demonstrate clearly how they are going to perform over the long term.

All these factors are driving a fundamental shift in the way insurers and reinsurers operate. The market has shifted towards a more “banking” type thought process and senior positions are now often held by professionals from this area. Capital Allocation tools are becoming “de rigour” and a much greater awareness of price versus risk assumed is demanded. Investment income assumptions play a diminished role in this.

The way business is transacted seems to be fundamentally changing. The old style relationships in the guise of “continuity” which have always existed are not being allowed to have the same influence. Quarterly accounting and greater shareholder awareness and demand for technical profitability will not allow this. It could well mean the death knell for the old cyclical pricing trend.

Since 2002, profits have been healthy and combined ratios have been low for most of the companies which did not require enormous reserve additions. The new entrants have performed well and have not had to lower prices to enter the market. The technical underwriting approach seems to be more consistent and moves to tighten various terms and conditions such as unlimited covers are a major move forward to protect the value given to shareholders and ultimately therefore to providing a steadier market place.

The insurance and reinsurance cycle will never be totally removed as market forces will always play some part in the renewal negotiations. However, there is clear optimism for a more stable and predictable market in the future. This can only be in the consumers’ best interests.

## **5. Pricing and availability of cover**

Very rarely has history showed that some level of cover was unavailable. In general, supply has always been able to meet demand albeit on a limited basis. Even in the early 1990s, following a sequence of major catastrophic losses in different years from 1998 onwards and in different

classes and different countries, the market was able to supply some level of cover.

At this time, the insurance market had relied on the reinsurance market to supply a cheap and all-encompassing style of cover, while the reinsurance market correspondingly relied on an equally “forgiving” retrocessional market. With inadequate pricing and very low levels of retention, the market effectively imploded giving rise to the death of the now infamous “spiral” market.

Over the next year or so, as the retrocession market evaporated, the reinsurance market took time to evaluate its position and inevitably, available capacity dropped dramatically to its lowest ever level as against demand. At this time, demand massively exceeded supply.

Other examples of this scenario were firstly, during the mid 1980s when US liability coverage was temporarily unavailable due to legislation which amended retroactively and introduced joint and several liability. Secondly, after the September 11th attacks, airline terrorism coverage was practically unavailable.

However, it is clear that these scenarios were only temporary and that very quickly solutions emerged to solve the problem. This has been a major feature of the insurance market and continues strongly today.

When supply is only equal to or less than the demand, then the market goes through a period of heavy price rises. This is in fact common with a number of other industries and as yet has not given customers or government agencies any reason to intervene. Of course, market forces, as explained above, take effect.

However, the 9/11 attacks with its unexpected and massive aggregations did not cause industry meltdown and therefore it would appear the systemic risk is not as high as was originally thought. There is no doubt though that PMLs on California quake (USD 80 billion +) and some terrorist scenarios are much higher than the 9/11 loss. Modelling of natural catastrophe scenarios has, in recent years, typically failed to predict the scale and/or frequency of major event losses e.g Hurricanes Lothar and Martin in Europe and the recent US hurricanes. It is encouraging to know that all of these events have been well within the capital base of the industry.

## **6. Terrorism and insurance**

The International Olympic Committee’s decision to purchase insurance coverage for the first time for the Athens Olympics was hardly surprising given the perceived additional threat from terrorist attacks. That the



USD170mn global placement, including disruption or cancellation due to terrorism, was completed successfully, illustrates how far the market for terrorism coverage has developed since 9/11.

A mix of commercial and government response to terrorism risk has emerged since 9/11; new insurance pools were established in France, Germany, Austria and Switzerland while the coverage offered by the UK's Pool Re was extended. Like the UK, Spain already had a state insurance facility, the CCS (Consortio de Compensacion de Seguros), which covered the losses caused by the Madrid bombings. In Australia the Terrorism Insurance Act 2003 set up a scheme to replace terrorism insurance coverage for commercial property and business interruption. Insurance companies are able to reinsure the risk of claims for eligible terrorism losses through the ARPC (Australian Reinsurance Pool Corporation).

In the USA, the Terrorism Risk Insurance Act (TRIA) was enacted in November 2002. The Act requires US insurers to 'make available' the coverage specified by TRIA for the first two years of the programme, i.e. 2003 and 2004. The Act covers three years only and its expiry in 2005 had caused uncertainty in the US market, but in June this year a bill was introduced in the US House of Congress which would extend the federal backstop provisions of TRIA, under which the government would recompense insurers for 90% of terrorism related losses above a deductible, until the end of 2007. The US Treasury also confirmed that it would require insurers to offer terrorism insurance to commercial customers on the same basis as other risk for a further twelve months until the end of 2005. Under the new bill, the overall US insurance industry retention level will continue to increase year on year, reaching US\$20bn in 2007.

Many insurers in various markets are now providing increased capacity for terrorism risks within their general property covers, although coverage remains much more restricted than pre-WTC. The market for stand alone terrorism cover, which was pioneered by Lloyd's and a few large US and Bermudian insurers, has become cheaper as more capacity and competition has entered the market. While exceptional risks like the Olympics are priced at a substantial premium to the norm, the problem of identifying an appropriate base level for more typical terrorism exposures has raised concerns on pricing, with some analysts highlighting the lack of historical data on which to price such exposures.

However, buyers with more mundane exposures still tend to see the coverage on offer as too costly and general demand for terrorism coverage remains lower than expected in most markets. Luxembourg-based Special Risk & Reinsurance, which was set up in April 2002 by six major reinsurers to provide commercial terrorism coverage, announced in March 2003 that it

had closed to new business, citing the increased availability of terrorism cover in the commercial market and the emergence of government backed schemes as the main reasons for its closure. In the US, take up of terrorism coverage has increased but remains low despite decreasing rates. At the end of last year only one in three US companies were buying terrorism coverage despite a substantial fall in rates. US businesses with total insured property values between USD500 mn and USD1 bn are most likely to purchase terrorism insurance. Of these firms, 39.7% obtain terrorism insurance, compared to only 18.2% of those with insured values below USD100 mn. The sector with the highest level of terrorism insurance is energy companies, with more than 40% buying coverage<sup>1</sup>.

However, buyers' lack of enthusiasm for terrorism coverage could prove misplaced, as recent analyses suggest that the financial impact of future terrorist attacks could dwarf the estimated US\$40bn loss generated by 9/11. For example, Risk Management Solutions (RMS)<sup>2</sup> estimates that a major anthrax attack in a US city killing more than 100,00 people could generate an insured loss of nearly US\$55bn to life, accident, health, and workers compensation (re)insurers alone, excluding related property losses. A recent study by Tillinghast<sup>3</sup> also concluded that the private workers compensation industry does not have the capital to cover a major terrorism loss, which could reach US\$90bn, as against only US\$30bn in workers compensation insurers' capital.

In general, reinsurers have remained averse to taking on such catastrophic terrorism exposures. Some have resorted to alternative methods of risk transfer. In December 2003 Swiss Re announced the first ever insurance linked security relating to life insurance risk, which provides contingent capital of up to US\$400mn in certain extreme mortality risk scenarios, including nuclear, chemical and biological attacks.

An assessment of the greatest risks currently facing the USA by Risk & Insurance<sup>4</sup> concluded that a cyber attack on corporate America and a conventional terrorist bomb attack on Chicago's transport system ranked in the top ten, and the US insurance industry has highlighted certain plausible terrorist attack scenarios which could cost over US\$250bn, far exceeding the industry's total capacity.

Rating agencies too are taking the threat of terrorism losses seriously. This year A M Best introduced a supplemental rating questionnaire which requires (re)insurers to give details of their projected aggregate exposure to terrorist attacks including modelling of losses for various terrorist attack scenarios.

For (re)insurers, the challenge is how to answer such questions. In the absence of the historical data available on natural catastrophes it is difficult

to apply the modelling techniques used to predict and price catastrophe risk. While some terrorism models try to provide a return period for terrorist events and any losses, others focus more on quantifying the likely impact of an attack rather its probability, such as Benfield's EXPECT<sup>5</sup> (EXPosure Evaluation and Control Tool), which enables insurers to monitor concentrations of terrorism risk in their property portfolios.

While commercial capacity now appears adequate to meet relatively low levels of demand in most markets, most industry observers continue to see commercial capacity as inadequate for catastrophic terrorism exposures. It seems likely that government involvement in providing backing for commercial schemes and in augmenting excluded coverage will continue to be a key aspect of terrorism insurance.

## Notes

1. Marketwatch: Property Terrorism Insurance 2004, Marsh, May 2004.
2. The Impact of Catastrophes on Workers Compensation, Life and Health Insurance, RMS.
3. Workers' Compensation Terrorism Reinsurance Pool Feasibility Study, Tillinghast, February 2004.
4. Risk & Insurance, Today's 10 Greatest Risks, April 15 2004.
5. For more information on EXPECT please visit [WWW. BenfieldGroup.Com](http://WWW.BenfieldGroup.Com) or contact Benfield ReMetrics Software Team on +44 207 578 7425.

# PART I

## *Chapter 4*

### **Insurance of Atmospheric Perils – Challenges Ahead**

*by*  
**Peter Zimmerli\***  
Swiss Re

The (re)insurance of damage caused by weather related risks has a long history and is well established in all mature insurance markets. A fundamental characteristic of atmospheric perils like hurricanes or European winter storms is their potential for extreme event loss accumulations. In fact, up to early 2004, the most costly natural catastrophe of all time for the insurance industry was hurricane Andrew in 1992 with total (un-indexed) insured losses of some USD 20 billion. Events of this size occur with very low frequencies and hence only a limited historical record is available. Probabilistic loss models based on state-of-the-art scientific knowledge must be utilised for the risk assessment of such perils. Growing uncertainty due to climate change, the increasing use of alternative risk transfer solutions and the rapidly developing insurance markets of China and India are seen as the key challenges of the near future.

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## 1. Characteristics of natural hazards insurance

The principle of insurance is quite simple: take all insured losses, add the administrative costs of the insurer (acquisition, claims settlement) and spread this amount evenly over all insured clients. Thus every individual pays a comparatively small amount for the insurance coverage against loss events of possibly livelihood-threatening size.

Conventional insurance perils like “fire” are unpredictable and happen at random. The probability of an individual building suffering a fire loss is very low. In the case of an entire insurance portfolio, however, these losses occur relatively frequently, and both the sum of losses as well as the number of affected policies will be fairly consistent over a given unit of time (e.g. annually). The insurance company will find out quite quickly whether or not the premium level is sufficient to cover the losses and can adjust the premium level if necessary.

While natural catastrophes too are random and unpredictable, the probability of an insurance portfolio being affected by a particular event – such as a major hurricane – can be extremely low. This means that after years or even decades without notable losses there may suddenly follow a year with an enormous event loss. Therefore, as opposed to fire losses, the natural hazard loss burden will typically fluctuate radically from year to year. As a consequence, an insurer can not rely on the loss history for the calculation of corresponding risk premiums.

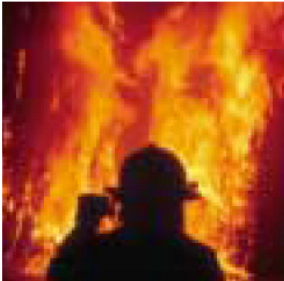
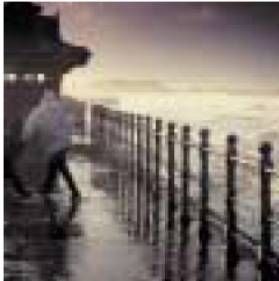
In addition to the difficulty of assessing the annual expected loss (AEL) the insurance company faces a second major challenge. Natural catastrophes typically cause losses across vast geographical areas (ranging between 10'000 and 100'000 km<sup>2</sup>) and damage numerous individual objects. The term “catastrophe accumulation” is used in the insurance industry to describe this phenomenon. The sum of all individual losses – i.e. the event loss – can reach enormous proportions, even multiples of the entire annual premium income of an insurance company. A precise estimate of the size of such potential extreme event losses (often referred to as “estimated maximum loss” or “EML”) is a vital precondition for the economic survival of the company. The claims arising from the event must be backed by corresponding loss reserves or by means of risk transfer (e.g. reinsurance).

Furthermore, the natural hazard risk can vary enormously over short distances. Attention must therefore be paid, not only to the extreme fluctuations in the annual loss burden and the danger of catastrophe accumulation but also to the geographic factors. In fire insurance, while market, sector and structural factors play a role in determining an adequate premium, the location of the building is not of crucial importance: ultimately

it is irrelevant for the insurer whether a warehouse is located in Florida or in California. In natural hazards insurance however, the location of the insured object becomes a vital consideration: whilst hurricanes represent a major threat in Florida during the summer months, the population of California – though spared this particular hazard – faces the risk of highly destructive earthquakes.

When assessing natural hazard risks, all of the special factors previously mentioned must be borne in mind (Figure 4.1). It is impossible to arrive at a reliable estimation of average and extreme loss burdens on the basis of a few years' data. Rather, probabilistic loss models based on state-of-the-art scientific knowledge are employed to achieve this end. Substantial progress has been made in assessing natural hazard loss potential over the past decade – not least due to the tremendous increase in computer power. Today several commercial providers, brokers and reinsurers have developed software tools for modelling natural hazard insurance losses.

**Figure 4.1. Summary of the most important differences between fire and natural hazard insurance and their consequences.**

	Fire	Natural hazards
		
<b>Differences</b>		
Occurrence frequency	High	Low
Event size	Individual risk affected (Individual building or complex of buildings)	Entire portfolios of risks affected
Location	Low importance	High importance
<b>Consequences</b>		
Pricing	Minor fluctuations in the loss burden; therefore, burning cost analysis and exposure rating are sufficient	Major fluctuations in the loss burden; therefore, scientific models are required
Loss potential from single event	Low to medium	Very high
Geographical distribution	Minimal impact on losses, no accumulation control required	Major impact on losses, accumulation control important

## 2. Recent developments and challenges ahead

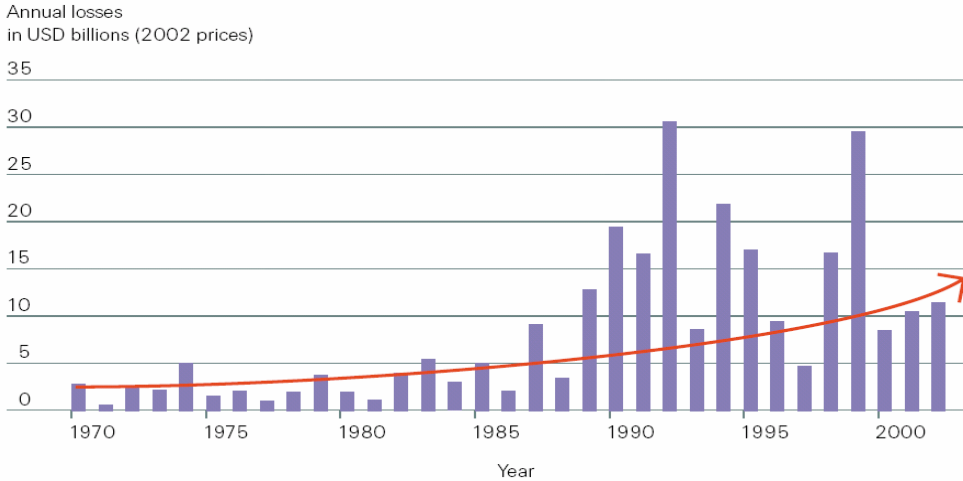
The (re)insurance of damage caused by weather related risks has a long history and is well established in all mature insurance markets. In fact, the very birth of the insurance industry is connected to weather related hazards. When medieval traders insured their ships against “not arriving at the target port”, then one important reason for a loss apart from piracy and fire must certainly have been adverse weather conditions. Despite this long history, the development of weather related risk management is far from over. Some key issues arising over of the next few years are discussed in the following section.

### *2.1. Climate change*

In spite of huge annual fluctuations, a clear trend emerges from insurance loss statistics of the past 30 years. These indicate that insurance losses caused by natural catastrophes have risen dramatically (Figure 4.2). This increase is principally a result of higher population densities, widening insurance coverage, an increase in the density of high valued property in high-risk areas and the high vulnerability of some modern materials and technologies<sup>1</sup>. Given that these trends have been constant, it is assumed that natural hazard losses will continue to rise. However, the fact that losses are on the increase should not necessarily lead us to conclude that the number and/or intensity of natural catastrophes per se has increased.

Yet, a growing body of scientific research would seem to support the view that the frequency and intensity of certain natural catastrophes can be expected to rise beyond the normal cyclical fluctuations. Temperature measurements indicate that, overall, the earth’s lower atmosphere has warmed up over the past hundred years. A large proportion of this temperature increase is, in all probability, attributable to human activities. In particular, greenhouse gas emissions such as carbon dioxide (CO<sub>2</sub>), produced through the combustion of fossil fuels, are thought to be responsible for global warming. Due to the physical characteristics of the atmosphere, it is highly probable that a global temperature increase will lead to an intensification of the hydrological cycle. Global climate models predict increased and more frequent seasonal precipitation in various regions of the world<sup>2</sup>. The fear is that this might lead to more frequent and/or more extreme flood events and a general increase in temperature might also aggravate storm activity.

**Figure 4.2. Development of insured losses attributable to natural hazards over the past.**



All probabilistic risk assessment models available are benchmarked against historical hazard activity in one way or another. Currently there does not seem to be enough conclusive scientific evidence to justify a deviation from the historic basis. However, as the leaders of the insurance industry observe and partly sponsor scientific research in this area, it is not beyond reason to assume that probabilistic loss models will be adjusted once a change in hazard activity becomes noted. This can be illustrated by two recent examples:

In March 2004 a fierce storm hit the coast of southern Brazil, killing at least three persons and damaging thousands of houses. Based on historical experience the southern Atlantic has been considered as free of hurricanes and meteorologists had an intense debate about whether or not this storm can be classified a “hurricane”. However, irrespective of the true internal structure of this storm, insurance companies will rethink their South Atlantic risk assessment if more of these events occur in the next few years.

Half a year later Hurricane Jeanne, with winds of up to 190 km/h, made landfall in Florida, making it only the second time in recorded history that a US state was affected by four hurricanes in one season - the first being Texas in 1886. Should the next few years yield again such a high concentrations of land-falling hurricanes, then loss model developers will certainly re-evaluate their current assumptions. Whilst annual expected losses may remain unchanged, an increase in model uncertainty would lead to a more conservative risk perception.



## ***2.2. Alternative risk transfer solutions***

Insurance-linked securities (ILS) are seen as an effective way of increasing insurance capacity, especially for highly improbable low-frequency, high-severity natural catastrophe events. Since its inception in 1996, the market for ILS has witnessed worldwide issuance in excess of USD 9.5 billion. The largest number of the securities issued has been in the form of catastrophe bonds (cat bonds)<sup>3</sup>. The market for cat bonds was first developed in the wake of reinsurance capacity shortage following two major catastrophic events, Hurricane Andrew in 1992 and the Northridge earthquake of 1994. Cat bonds increased the ability of insurers to continue providing insurance protection by transferring the risk to investors. Initially considered "esoteric", cat bonds have gained wide acceptance reflecting their attractiveness to both sponsors and investors. For insurers, reinsurers and an increasing number of corporations, cat bonds provide multi-year protection against natural catastrophes with no counterparty credit risk. To investors cat bonds offer the potential to diversify and reduce their portfolio risk, since cat bond defaults are essentially uncorrelated with defaults of most other securities. While initial growth expectations of this alternative risk transfer option have not been entirely met, a steady increase is expected for the near future.

In contrast to cat bonds, which essentially substitute conventional reinsurance under certain preconditions, so called "weather derivatives" are basically a new risk transfer product involving atmospheric conditions. For many companies weather related losses can have a major impact on earnings. Weather derivatives are an effective means of reducing this risk of volatility and hence function as a cash flow insurance against "adverse" weather conditions. Depending on the industry looked at, "adverse" weather may be cold summers (e.g. ice cream manufacturer) or warm winters (energy provider) or dry winters (ski resort) and so on. The number of transactions as well as the notional value of this type of "insurance" has seen a steep rise in the past few years, led by the US market and followed by growing demand from European and Asian customers.

## ***2.3. Emerging insurance markets of China and India<sup>4</sup>***

Among the emerging markets, China and India have been drawing intense attention over the past few years due to their remarkable economic growth and due to the opening up of their previously protectionist insurance markets. China and India are the most populous countries in the world, together being home to 2.35 billion people, more than one-third of the world's total population. Premiums written have seen an annual increase of 17.9% and 10.9% over the past decade in the Chinese and Indian insurance market respectively. The bulk premium income in non-life insurance is

attributable to fire and motor policies covering mainly commercial and industrial customers with personal lines remaining still at an embryonic stage.

China and India are both prone to natural catastrophes, with tropical cyclones a prominent risk. Furthermore the two countries both have areas that are among the most hazardous hail storm exposed regions. Between 1994 and 2003, these two markets accounted for 25% of the global economic losses from natural catastrophes. With respect to insured losses however, the contribution of these adverse events was minimal, amounting to less than 1% of global insurance losses over this period. It is clear that the continuing development of these markets will trigger a demand for more accurate probabilistic risk assessment models over the next few years.

## Notes

- 1 *Sigma* No. 2/2003: “Natural perils and man-made disasters in 2002”, Swiss Re.
- 2 IPCC(Intergovernmental Panel on Climate Change), Third Assessment Report, 2001.
- 3 “Insurance-linked securities”, Swiss Re Publication, 2003.
- 4 Information of this section taken from “Exploiting the growth potential of emerging insurance markets – China and India in the spotlight”, *sigma* 5/2004, Swiss Re.



## PART I

### *Chapter 5*

# **National Security and Compensation Policy for Terrorism Losses**

*by*

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Much research and policy on terrorism insurance compares terrorism to natural catastrophes, but this obscures the national security dimension of terrorism insurance. In this chapter, it is argued that government support of terrorism insurance and compensation can impact national security in several ways. It can increase resilience after terrorist attacks, demonstrate solidarity with victims, and affect incentives for security precautions. Thus terrorism insurance policy may be an important element of the strategy against terrorism, particularly as terrorists increasingly focus on economic targets.

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\* Co-Director.

## 1. Introduction

Much of the literature on terrorism insurance public policy has described terrorism as a catastrophic risk analogous to hurricanes, earthquakes or floods. The lessons learned from earthquakes and hurricanes provide important strategies to understand this risk, as illustrated by the growth of the terrorism risk models out of the natural catastrophe risk modeling industry. There are also important differences in the risk characteristics between terrorism and natural disasters that present challenges for insuring against terrorism, such as the difficulties in predicting frequency and the concentration of risk. However, the analogy to natural catastrophes obscures a critical distinction between terrorism and natural disasters: the national security dimension.

To motivate the national security considerations, it is useful to distinguish between the immediate goals of terrorists and the ultimate goals of terrorists. The immediate goals of terrorists are the terrorist acts, such as hijacking an aircraft to use as a missile against a landmark building, or detonating backpack bombs on public transportation. In contrast, the ultimate aims of terrorists are strategic. Terrorism scholars have described various ultimate aims, but one prominent example is from Bruce Hoffman (1999, 2004) who describes the ultimate aim of terrorists as to change the policies of governments by dividing them from their citizens through the use of fear.

The immediate effects of terrorist events are analogous to those stemming from natural disasters. With some understanding of terrorist capabilities and trends in targeting, it may be possible to describe the risk characteristics associated with the immediate aims of terrorists and to ultimately price insurance policies that property owners and other businesses may be willing to purchase. To the extent that insurers and government support may facilitate this market, there are natural catastrophe institutions that provide a precedent for dealing with the immediate aims of terrorists, such as the California Earthquake Authority or the French Natural Catastrophe Law.

Thwarting the ultimate aims of terrorists is a matter of national security. To the extent that government support of terrorism insurance, or direct government compensation of terrorism victims, is part of a portfolio of policies intended to thwart the ultimate aims, a different set of policy considerations is needed. Take-up rates for insurance policies or consequences for businesses or insurance companies that may be acceptable for natural disasters may be unacceptable if they can be seen to promote the ultimate aims of the terrorists. However, the relationship between national

security and government support of insurance or direct compensation of victims remains largely unexplored.

Accepting Hoffman's description of the strategy of terrorists as to divide citizens from government through fear, it is not difficult to imagine that showing solidarity with victims through compensation or insurance can be seen as a way to counter this. In addition, the existence of terrorism insurance or compensation programs in many countries where no program for other catastrophic risks exists, such as in the United Kingdom, suggests that governments may at least implicitly recognize this connection. In the United States, Kenneth Feinberg, the Special Master of the 9/11 Victim' Compensation Fund (VCF), has described the VCF, as "vengeful philanthropy"<sup>1</sup> – showing the terrorists that they cannot hurt us or divide us because our country will support the families of the dead and seriously injured. However, little scholarly research exists to understand this connection or to explore what policies serve the goal of frustrating the ultimate aims of terrorists, and which do not.

In this chapter, the links between national security and the compensation system are explored and it is argued that the national security should be considered in developing compensation policies for terrorism. In the next three sections, the discussion is generalized from insurance to the larger *compensation system*, of which insurance is one part; describe its performance during 9/11; and discuss the situation since 9/11 in the United States. In the following two sections the relationship between national security and compensation is discussed in the context of terrorism, and discuss recent trends in terrorism and their implications for terrorism compensation and national security. A final section concludes.

## 2. The compensation system

The institutions, programs, and policies that provide benefits to businesses and individuals affected by an accident, natural disaster, terrorist attack, or other type of loss can be thought of as a system composed of four primary compensation mechanisms: insurance, the tort system, government programs, and charity. Together these mechanisms determine the fraction of losses borne by injured parties, who pays for the losses, and the time to payment and the transaction costs associated with the transfers. Together they also create incentives for physical and financial risk management for both businesses and individuals (Dixon and Stern, 2004, p. 5, pp. 145-149). Ultimately, their combined operation contributes to the resilience of a country to a catastrophe.

The role that each compensation mechanism plays in the United States varies by the type of injury or loss. For example, the tort system and life

insurance play the lead role in providing benefits to individuals who are killed or injured in commercial aviation accidents. In contrast tort does not play a major role in compensating losses caused by floods. Instead, flood insurance, FEMA disaster assistance programs, and charities provide benefits to flood victims. It may be stating the obvious, but in the absence of benefits from insurance, tort, the government or charity, the business or individual harmed bears the loss.

### **3. The response of the system in the United States after 9/11**

The September 11<sup>th</sup> attacks caused tremendous loss of life, health, property, and income to individuals, businesses, and public assets. The attack also resulted in a massive multi-pronged compensation response. Insurance payouts to businesses, to homeowners, and to individuals injured or killed in the attacks (including loss adjustment expenses) are expected to total \$32 billion, the largest amount for any single event in U.S. history<sup>2</sup>. Congress limited the role of the tort system in compensating losses after the attacks and set up the September 11<sup>th</sup> Victim Compensation Fund to provide compensation to those who were killed or suffered seriously physical injury after the attacks. Overall, the Fund distributed over \$7 billion to survivors of 2,880 persons killed in the attacks and to 2,680 individuals who were injured in the attacks or in the rescue efforts conducted thereafter (Feinberg, et al. 2004). The federal government also provided billions to compensate businesses, and workers, and to rebuild New York City. The charitable response was unprecedented. Approximately two-thirds of U.S. households made contribution to charities for victims of the September 11 attacks, and charitable donations exceeded \$2.9 billion (Renz, Cuccaro, and Marion, 2003)<sup>3</sup>.

The economic effects of the 9/11 attacks were far-reaching, but the compensation response after the attacks arguably reduced economic impacts and sped economic recovery compared to what would have occurred in the absence of such programs. Insurance payments for property damage and business interruption allowed businesses to repair damage and pay their workers for at least part of the time that operations were interrupted. Government grant and incentive programs encouraged small businesses to return to Lower Manhattan when the prospects for Lower Manhattan were extremely uncertain after the attacks. The response of government, insurers, charity, and plaintiff lawyers who donated their time to help victims apply to the Victim Compensation Fund, was a demonstration of national solidarity against the aims of terrorism. Arguably, the response limited the effectiveness of the attacks in causing economic damage, and therefore to some extent, frustrated the ultimate aims of the terrorists.

The insurance system provided more than half of the total payout of the compensation system after 9/11. This is because terrorism was not yet recognized as a distinct peril by insurers (despite the previous attempt to destroy the World Trade Center in 1993), and therefore was neither excluded nor priced as a stand-alone policy. In addition, insurers decided not to invoke war damage exclusions. As a result, all insured businesses and individuals received payouts on their policies (Dixon and Stern, 2004). This, too, contributed to the national response and likely improved resilience from the attacks.

#### **4. The United States terrorism compensation system since 9/11**

There is no ongoing government-supported program to compensate victims of terrorism in the United States. The benefits to those who were killed or injured or who suffered financial losses due to the September 11<sup>th</sup> attacks was a unique combination of benefits from insurance, government programs, and charity. There is no guarantee that a similar mix of resources will be available for victims of future attacks.

While the Victim Compensation Fund and other government programs put in place after 9/11 may create a precedent for programs that might be adopted after a future attacks, there is no guarantee that similar programs will be adopted in the future. For example attempts to extend the VCF retroactively to past terrorist attacks (such as the 1998 bombings of the U.S. embassies in Africa or the Oklahoma City bombing in 1995) have been unsuccessful. In addition, many aspects of the Fund have been criticized, such as the amount paid to each victim and the use of tort-style damages which track economic losses instead of a fixed amount for each victim. (Dixon and Stern, 2004; Feinberg, et al 2004). Thus, if a new program is created, it is likely to be different in style, and the implications for the functioning of the compensation system are difficult to predict.

As noted, insurance played a leading role in provided compensation after 9/11, but the magnitude of insurance payments in the event of a future attack is highly uncertain. Even with the Terrorism Risk Insurance Act in place, purchase of terrorism insurance after 9/11 has been spotty<sup>4</sup>. The Terrorism Risk Insurance Act is set to sunset at the end of 2005, and if it is allowed to expire, the insurance may not play a significant role in compensating losses caused by future attacks (Dixon et al., 2004).

The charitable response to 9/11 was unprecedented and played a critical role filling many gaps in the compensation system, but charities provided a relatively small portion of the total payout. Whether the public would be so generous after a future attack, which may not seem as unexpected, is uncertain. In addition, the creation of the VCF after 9/11 may raise the



expectation that a similar fund will be created, limiting the motivation to contribute to charity, whether or not a similar fund is created the next time.

There is no general agreement in the public policy community about the role each compensation mechanism should play in compensating victims of future terrorist attacks. Ongoing crime victim compensation and social insurance programs (such as Unemployment Insurance) in the United States would provide limited compensation for losses. Workers' compensation, intended to compensate workplace injuries, will pay limited compensation, though in the case of some particularly catastrophic attacks (such as nuclear or biological attacks), many insurers have raised the concern that the workers' compensation insurance industry will be destabilized by an attack (Dixon et al, 2004).

In the absence of a strategy for compensation losses, the tort system may be the primary recourse for injured parties in the United States for injuries caused by terrorist attacks. After 9/11, due to the limitations on lawsuits imposed by Congress and due to the high participation in the VCF (which excluded recipients from suing third parties), tort litigation was not a significant factor in the compensation system. As other alternative (or competing) options are unavailable, litigation may become a more a central compensation response to future terrorist attacks.

Fortunately, no terrorist attacks have occurred in the United States since the September 11<sup>th</sup> attacks. If an attack does occur, however, compensation may not be available to facilitate rapid recovery, absent new policy interventions. From a national security perspective, the question is whether the lack of a comprehensive compensation strategy will further the ultimate aims of terrorism.

## **5. What we do know about the link between compensation and national security**

The links between compensation for terrorism and national security are just beginning to be explored. Initial examination of potential links suggests that compensation may be linked to national security in a number of ways.

- The compensation system can alter incentives to reduce physical vulnerability to terrorism.

This connection between terrorism and national security is the most direct and obvious, but the ways in which it works or can work are new and important areas for further research. One important issue is that extensive government assistance after an attack may reduce the incentive of a firm to avoid risky situations, leading firms to underprotect against terrorism. This observation is common for government programs that compensate natural

disasters , and a prominent statement of this argument in the United States for terrorism insurance is provided by Congressional Budget Office (2005).

There are, however, specific issues with terrorism that make the comparison to natural disasters less salient. For instance, given that terrorists undoubtedly adapt their strategies in response to security measures, securing one target may just cause terrorists to switch focus onto another target. This leads to a security arms race that results in excessive amounts of protection. Government subsidy of terrorism insurance in this context reduces the incentive to overprotect and can lead to appropriate levels of security<sup>5</sup>. The complex relations between compensation, incentives to adopt security measures, and the net effect on national security illustrate the need for careful consideration of compensation policy for terrorism. This is an area where simple analogies to other types of risks may be particularly unfruitful.

The physical security incentives from terrorism may be seen as relating to the immediate aims of terrorists. Other ways in which the compensation system may affect national security are related to the ultimate aims of terrorists. These are more speculative, and are important areas for future research. The first can be referred to as *resilience*:

- By helping the economy rebound after an attack, the compensation system can reduce economic vulnerability to terrorism.

Improving resilience (reducing economic disruption) is likely to reduce fear of future attacks. This can be regarded as a counterterrorism measure in the broadest sense, insofar as it does not directly deter attacks, but does reduce the ability of attacks to cause fear, which reduces their effectiveness. It is not inconceivable that this could ultimately reduce the likelihood of attacks.

The second connection between the compensation system and national security may be referred to as *solidarity*.

- By restoring some of the losses experienced to the victims, the compensation system can reduce the amount of social fragmentation caused by attacks.

Kenneth Feinberg's "vengeful philanthropy" is an example of this. Terrorists aim in part to create divisiveness and fear in the hope of altering U.S. policy. Compensation policies that encourage cohesion may frustrate the terrorists' aims in this regard. For example, policies that spread the cost of providing compensation broadly across the nation may further the perception in the U.S. that terrorism is an attack on the nation as a whole.<sup>6</sup> Furthermore, compensation by government or government support of insurance can serve to signal to victims (and therefore to others who fear they could be victims) that the government (or the nation) stands with them.

As above, this does not immediately deter future attacks, but could in the long run.

Further investigation is needed to understand the complex role that resilience and solidarity play in security against terrorism. In addition, it is unclear which specific approaches to insurance or compensation are more or less effective in improving resilience or solidarity. For instance, Feinberg has noted that paying different amounts to victims, as was done in the VCF, may increase divisiveness. Further investigation is needed to (1) relate particular policies with solidarity and resilience and (2) relate improved solidarity and resilience to the inability of terrorists to achieve political goals, and ultimately to deterrence of future attacks.

## **6. Trends in terrorism and implications for terrorism compensation policy**

Information about the trends in terrorism is important for terrorism insurance and compensation public policy at multiple levels. Returning to the distinction between the immediate ends and ultimate ends of terrorists, knowledge of trends in the immediate ends is needed for pricing, exposure assessment and other characteristics of private markets. For instance, there is a need to know the trends in the technical capabilities of terrorists, as well as the types of targets (e.g., commercial, or government) and the cities or locations most likely to be targeted. However, some recent trends may be relevant for regarding government support of terrorism insurance and compensation as part of a portfolio of counterterrorism strategies. In this section, this aspect of terrorism insurance and compensation public policy is examined. The terrorism trend information discussed briefly in this section is documented at greater length in Chalk, Hoffman, and Kasupski (2005).

Since 9/11, al Qaeda's ability to strike many of its traditional targets has been degraded. This is on the one hand due to the significant damage inflicted on al Qaeda's Afghanistan safe haven, their top leadership, and their ability to operate unnoticed or unimpeded. On the other hand, it is due to the dramatic increase in security at many of the traditional targets, such as embassies and other government properties. The security is referred to as "hardening," and many terrorism experts have noted that the hardening of one kind of target displaces risk toward other, "softer" targets. This displacement of risk phenomena has been used to explain al Qaeda's targeting of, for instance, nightclubs and hotels.

One prominent characteristic of the displacement of risk toward softer targets is that the softer targets are typically private, while the harder targets are more likely to be government. This implies that there has been a displacement of risk toward targets that are more likely to result in private

sector losses, and if insured, insurance losses. Ultimately, the displacement of risk to the private sector is one part of a set of broader policy questions that are only now being explored by researchers and policymakers alike: the appropriate allocation of security resources across targets, and the vehicles for encouraging this allocation. Among the unexplored questions are if government policy tends to displace risk to the insured private sector, does government support of terrorism insurance encourage a more appropriate allocation of security resources?

A second recently observed trend in terrorism is the increased interest by al Qaeda in wreaking economic damage. As discussed in Chalk *et al* (2004), Osama bin Laden commented since 9/11 on the economic damage that the attack caused, and he argued that this exposed the United States as a “paper tiger,” akin to the Soviet Union during its ill-fated occupation of Afghanistan. As a result, causing economic damage is believed to have become a goal for future planned attacks. The manifestation of this targeting shift has many examples, including the alleged plots against financial institutions in New York and New Jersey, as well as the interest in attacking targets that would lead to economic disruption that exceeds the losses to the particular target, such as airlines, oil shipping, and tourism.

As with the displacement of risk through hardening of government targets, the increased focus on causing economic damage has also shifted risk to the private sector. While this involves some increased risk to insured property and assets, it also increases risk in a way that is truly without a parallel in natural catastrophes, and for which no insurance exists. In particular, much of the follow-on economic losses, such as increased hotel vacancies as a result of decreased travel, are uninsured.

If terrorism is going to be increasingly targeted at private sector assets that will also have additional economic consequences from the ensuing disruption, policymakers must not confine themselves to physical security measures to counter the attacks. Financial security measures, including but not limited to government support of terrorism insurance, must be explored as part of the portfolio of potential responses. In other words, one as yet unexplored role for government support of terrorism insurance or government compensation is as a *strategic* response to terrorist targeting intended to lead to economic damages.

## 7. Conclusion

Much of the debates over government involvement in terrorism insurance in the United States have focused exclusively on economic efficiency grounds (see, e.g., Smetters, 2005). On these grounds, one must identify market failures in order to justify a government program. At the

same time, few economists dispute the need for a role for government in national security. If terrorism insurance serves national security goals, it would not be surprising for government support to be justified. In this paper, some ways in which national security goals and strategies are relevant for policy regarding the broader compensation system are explored (including terrorism insurance).

A primary distinction lies between the immediate and ultimate goals of terrorism. The immediate goals of terrorists are the success of particular attacks. The ultimate goals of terrorists can be described as to change the policies of governments by instilling fear in the citizens. Thwarting the ultimate goals of terrorists is the realm of national security. It is argued that economic efficiency may be the only relevant consideration if terrorism insurance or other means of compensating losses are only intended to disrupt the immediate goals of terrorists. However, if the compensation system is relevant to policies to frustrate the ultimate goals of terrorists, then economic efficiency must be balanced against national security goals.

It is suggested in this chapter that terrorism insurance (as well as direct government compensation as in the 9/11 Victims' Compensation Fund) ought to be considered part of the portfolio of policy measures available to policymakers to counter the threat of terrorism. Particularly in light of evidence that recent trends in terrorism suggest increased risk of economically-motivated attacks against private sector targets, government support of the compensation system may be a means of protecting financial assets in a manner that is complementary to the physical protection of targets and the direct disruption of terrorist activities.

While this chapter has demonstrated that terrorism insurance and compensation are relevant for national security policy, and therefore that government involvement may be warranted for reasons other than market failure, the concepts are new and in need of further exploration. An example of the style of question that would be fruitful for further research is the extent to which universal terrorism insurance coverage increases the successful recovery from terrorist attacks (increased resilience). If this is established, it is still necessary to balance the national security considerations against economic considerations, e.g., to what extent does a rapid recovery reduce the ability of terrorists to instil fear in the citizenry, and how does society value this outcome against potential inappropriate allocation of resources from universal insurance coverage. Many of the economic arguments for and against various approaches to catastrophic insurance, such as universal coverage, have been well-developed by analogy to natural disasters. The national security arguments for and against various approaches have not been available for catastrophic terrorism, and need to be explored before the appropriate policy choices can be made.

## Notes

- 1 Quote from Manhattan Institute Center For Legal Policy Conference, “9/11 Victim Compensation Fund: Successes, Failures, and Lessons for Tort Reform,” Thursday, January 13, 2005, transcript forthcoming.
- 2 The Insurance Information Institute currently projects that insured losses due to the 9/11 attacks will total \$32.5 billion (Hartwig, 2004). The second-largest insured loss is the \$20 billion for Hurricane Andrew in 1992 (Thillinghast-Towers Perrin, 2001).
- 3 For a detailed evaluation of the performance of the compensation system after 9/11, see Dixon and Stern, 2004.
- 4 In the second quarter of 2004, Insurance broker Marsh and McLennan found terrorism insurance take-up rates of 37 percent for firms with total insured value (TIV) of \$5 to \$100 million, 52 percent for firms with TIV between \$100 million and \$500 million, 68 percent for firms with TIV between \$500 million and \$1 billion, and 44 percent for firms with TIV greater than \$1 billion (Marsh 2004).
- 5 See Lakdawalla and Zanjani for further discussion of this possibility (Lakdawalla and Zanjani, 2003).
- 6 It is also possible that spreading losses broadly could encourage resentment in areas where the terrorist threat is low.

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## PART I

### *Chapter 6*

# **Current State of the Coverage for War and Terrorism Risks in the Aviation Sector**

*by*

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The aftermath of the 11th September events has deeply affected the aviation insurance market, requiring government intervention at least in a recovery period. Immediately after the events, insurance companies cancelled policies with war risk covers and introduced exclusions clauses for war risks in new contracts or/and limited damage claims to a maximum of US\$50m. Many governments had to provide for a temporary period free insurance guarantees for these excess third party covers. At the same time prices for this type of coverage became hardly affordable for some airlines companies. Progressively though, additional capacity was raised in the market above the mentioned ceiling and governments – except the US until the end of 2005- withdrawn the free guarantee. Today, in spite of a couple of market and public/private initiatives, capacity for third party liability is only available from a few insurance companies, prices are still high and there are projects to introduce new exclusion clause. These trends could considerably threaten the smooth functioning of the aviation industry in coming years.

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## 1. The nature of aviation insurance

Airlines purchase aviation insurance to cover risks associated with the ownership, operation and maintenance of their aircraft. The principal insurance coverages are:

- Hull – damage to the aircraft itself.
- Passenger – liability for death or injury.
- Third party – liability for death and bodily injury and property damage external to the aircraft.

Aviation insurance is a specialized form of insurance written in a specialized insurance market, predominantly in the London market.

The aviation insurance market has always differed from most other insurance markets in that both the premium base and the customer base are very narrow, with just a small number of insureds; IATA only has some 270 airline members. At the same time, the potential exposure of each airline is huge.

Because of this very large exposure, no single insurer will underwrite the entire amount of an airline's overall risk. A number of insurers will each underwrite a percentage of the total risk, thus keeping the exposure for any one insurer within acceptable limits.

Claims arising from war, hostile detonation of nuclear weapons, civil commotion, terrorist acts, sabotage, political seizure, hijacking, and the like, are all excluded from aviation policies through an exclusion clause designated AVN48B – *War, Hijacking and Other Perils*.

War risks coverages relating to Hull can be insured in a separate War risk insurance market. Passenger and third party coverages can be “written back” to the principal liability policies by an extension clause known as AVN52 – *Extended Coverage Endorsement*. This cover (with limits as high as US\$2bn for each and every occurrence for each insured) was traditionally provided at nominal cost, given the historical absence of major loss.

It is important to note that nuclear detonation and the associated radioactive contamination cannot be written back since the potential magnitude, spread, and persistence of damage is such that the insurance industry will not cover it. It is deemed to be a weapon of mass destruction (WMD), giving rise to a major loss accumulation and therefore not insurable.

War risk coverages have also traditionally contained a seven-day notice clause which allowed insurers to review and reassess the risk and, if necessary, amend or cancel the cover in the event of a radical and adverse change in conditions or circumstances.

## 2. 9/11 and the immediate aftermath

Until 9/11 there had never been a case of airliners being used as weapons of mass destruction against civilian targets. The terrorist attacks were an unprecedented event with losses on a scale never before contemplated, either by governments, the insurance industry or the airline industry.

Accordingly, insurers invoked the seven-day cancellation provision for all War risk covers on 17<sup>th</sup> September 2001 in order to preserve their solvency and ensure the survival of the aviation insurance market in the event of further such attacks. Had it not been for governments providing insurance guarantees the air transport industry would have been effectively grounded.

Non-War hull, passenger and third party covers were unaffected. War risk cover was subsequently provided (again with a seven-day cancellation provision) at full policy limits for passenger liability arising out of War risks and cover for all third party bodily injury and property damage claims was limited to a maximum of US\$50m during any one 12-month policy period.

Additional capacity eventually did become available above the US\$50m third party limit. Since November 2002 some of the excess War risk policies have been non-cancelable (although of course subject to annual renewal), while others were part of the Allianz Scheme, subject to cancellation only after four major events. This Scheme is now in run off. The remainder of policies have a thirty-day cancellation provision.

In view of the restricted capacity and significant increase in premiums offered in the market, alternatives were sought. In the US Equitime was designed to cover passenger and third party War risk liability for US carriers, offering as much as US\$1.5bn in combined limits. The plan was for Equitime to retain US\$300m of the limit and re-insure the balance with the Federal government. The capitalization would be through the placement of airline stock – not something one could contemplate these days. However, the mutual never came to fruition since in December 2002 the US Government decided to provide superior cover at much lower cost.

The European airline industry also came up with its Eurotime proposal for third party liability in May 2002. It would provide a policy limit of US\$1bn for any one occurrence with industry retention above the excess point of US\$50m being US\$150m the first year, US\$250m the second year and US\$500m the third year. Based on a premium of US\$0.50 per passenger, the estimated gross annual premium was US\$329m, with the EU government's annual reinsurance premium estimated at US\$66m. However, after due consideration, the EU announced in October 2002 that it favored supporting the Globaltime Scheme proposed by the International Civil Aviation Organisation.

Globaltime was intended to provide non-cancelable third party War risk coverage from an excess point to be determined, up to US\$1.5bn per occurrence. However, the needed critical mass of contracting States representing 51% of the ICAO budget contribution rates was never achieved; as of February 2004 unconditional intentions totaled only 11.43%. Globaltime is therefore being held in contingency mode subject to the 51% participation threshold being reached and will only be activated when there is further failure of the commercial insurance market as determined by the ICAO Council. Market failure has widely been interpreted as further withdrawal of cover following another 9/11-type catastrophic event.

The limited capacity currently available in the excess third party War risk market is dominated by only a few insurers: AIG, Ge Frankona and AXIS together provide the majority of airline and service provider capacity under joint programmes. Berkshire Hathaway provides capacity, mainly on a co-insurance basis, but only for major airlines. Effectively, airlines and service providers have no real choice when purchasing this cover as the only competition to the foregoing was the Allianz Scheme, which ceased renewing policies from 1 November 2004 following the withdrawal by Berkshire Hathaway of their 55% co-insurance capacity.

Major air carriers can generally buy up to US\$1bn for any one occurrence, subject to a US\$2bn aggregate at a cost of approximately US\$0.70 per passenger. Passenger liability coverage can be included for an additional US\$2 per passenger.

The very low claims experience since the end of 2001 is leading to some reduction in airline rates generally and to offset these reductions the primary market is now willing to increase the US\$50m aggregate limit to US\$150m aggregate at additional premium.

A number of governments continue to provide insurance guarantees for excess third party cover free of charge or at subsidized cost. The EU States, however, decided to end government guarantees in October 2002 and not to back Eurotime, favouring instead the Globaltime concept. This has proven to be very costly to the European airline industry. Since 9/11, IATA's European members have paid governments and commercial markets over US\$1bn in excess third party war and terrorism liability premiums – enough to pay three years of premium for the original Eurotime.

A renewed push for New Eurotime has therefore been launched, in an attempt to establish a level playing field for War Risk insurance cover between EU carriers and competitors from other regions, namely the US.

US carriers enjoy superior cover under the FAA Program that provides US carriers with TWICE the pre-9/11 policy limits for Third Party Liability

to a maximum of US\$4 bn per any one occurrence. The Program was further extended to cover War Hull and Passenger Liabilities - total cost is about US\$0.20/passenger.

The FAA Re-Authorization Act (2003) provides for multi-year extensions of the Program to 31 March 2008, if agreed by Congress; it has so far been extended to end-2004 and is expected to be extended to end of 2005. US carriers pay US\$140 m annually as compared to US\$675 m by EU carriers for vastly inferior cover available in the commercial market.

### **3. Proposed new war risk exclusions**

To add to the War risk problem, the aviation underwriting community is now preparing to introduce a new standard war and terrorism exclusion clause to apply to all War Hull, Spares (e.g. engines), Passenger and Third Party Liability policies, that will exclude claims caused by the hostile use of a dirty bomb, electromagnetic pulse device, or bio-chemical materials (i.e. weapons of mass destruction - WMD).

Intelligence analyses post-9/11 have repeatedly identified threats of terrorists using chemical, biological, radioactive (“dirty bombs”), and electromagnetic weapons in pursuit of their aims. These are perceived as WMDs because of the magnitude, spread and persistence of their effects. In the view of most insurers and reinsurers WMDs fail to meet the insurability criteria, and could generate major loss accumulations. It should be noted that all other major insurance markets, for example property, marine, and energy, already operate under such exclusions.

The timing for when these new exclusions clauses – to be designated AVN48C - will be published for actual use is not yet clear as the underwriting community is waiting for acknowledgement from certain state regulatory authorities. However, current predictions are that the new exclusions clauses will be published by January 2005, thus missing the major renewal period of December, which will buy us a bit more time. However, it remains that all primary aviation War, Terrorism and Related Perils cover can be cancelled or restricted on 7-days notice at any time and it seems quite certain that a seven-notice would be immediately issued if terrorists used a WMD anywhere in the world.

### **4. This is an issue that can potentially ground air transport.**

Based on a survey conducted of our Member airlines, the prospect is that these exclusions will find an airline in breach of domestic and foreign regulatory requirements that require an air carrier to maintain adequate insurance.

The 1999 Montreal Convention governing the liability of air carriers in international carriage requires that carriers maintain adequate insurance to cover the liability in case of death and injury of passengers and damage to baggage. Under Montreal, no limits of cover are specified and an air carrier cannot exclude or limit its liability to less than 100,000 SDRs per passenger. Indeed, airlines should insure up to a reasonable level above this initial amount. For a fully-loaded B747, at current exchange rates, this would translate to no less than US\$60m. EU Regulation 785/2004 that comes into effect May 2005 will require minimum insurance limits of up to 250,000 SDRs per passenger and up to 700,000 SDRs for third party cover.

Likewise, aircraft leasing agreements require operators to maintain adequate hull insurance. It is doubtful that aircraft lessors will allow operators to operate their aircraft without adequate cover.

Further, from a risk management and corporate governance perspective, an airline may determine that it is not financially prudent and responsible to continue to operate - without the War risk cover currently available, airlines will face certain financial ruin in the event of a terrorist attack involving WMDs.

Ironically, while the FAA Program covers all of the foregoing exclusions, including nuclear perils, US carriers will also be affected through their code-share agreements. Code-share flights operated by non-US carriers will not have the necessary coverage, thus disrupting US airline operations. It is a global problem.

Unfortunately, governments have generally not been responsive to this latest twist in the problem of War risk insurance. In the absence of an occurrence that gives reason for cancellation on short notice, there is a general reluctance to give any indication of support for the airlines since such guarantees could be misinterpreted as an encouragement for underwriters. In the meantime, AVN48C has been undergoing regulatory review since July 2004 and it is as yet unclear how long this review will take and what the outcome will be.

In view of this uncertainty, IATA has launched an awareness campaign. During the last ICAO Assembly recently held end-September, IATA urged contracting States to prepare for the eventuality that the exclusions will be written, and that states grant government guarantees of cover - as an interim measure - for Hull, Spares, Passenger and Third Party losses arising from state-targeted acts of terrorism that employ WMD. IATA further urged that ICAO get underway the drafting of a limitation of liability regime for war and terrorism losses.

The Legal Commission to the ICAO Assembly concluded that ICAO should rapidly proceed with the work on the modernization of the Rome Convention, making a distinction between the new risks posed by war and terrorism and the other “classic” third-party risks. The Rome Convention of 1952 contains compulsory insurance requirements relating to damage caused by aircraft to third parties on the ground. However, there have been disagreements between states on the liability limits prescribed in the Convention resulting in it being ratified by only 47 states, most being LDCs (less developed countries), and these disagreements persist. This will not be a quick fix solution.

Our thinking has been that all acts of terrorism, especially those employing WMD, are first and foremost a national security issue rather than aviation security issue. If government intelligence services are unable to prevent a WMD attack with all the resources available to them, then it cannot be expected that the aviation industry should bear the burden of such acts. Clearly, a public/private partnership approach is required to deal with state-targeted acts of war and terrorism.

Due to the global nature of the airline business, solutions to the insurance problem must be found within a global context. A concerted, coordinated and global effort needs to get underway to ensure WMD risks are removed from commercial coverage and guaranteed by state-sponsored schemes. Reinsurance cover from the commercial aviation market that would be available on a limited basis can support LDC state guarantees.

In the longer term, any war and terrorism convention would need to make the aviation industry, in its entirety, not liable for any WMD losses.

In the meantime, the airline industry will continue to purchase, at considerable cost, the available third party war and terrorism liability insurance provided by the limited number of commercial insurers providing this cover. However, it is now unlikely that we will be able to purchase cover for WMD in the future.

It is important to emphasise that government needs to take on a much more proactive role in the insurability of large-scale disasters, particularly relating to war and terrorism. A partnership between States, the aviation industry and commercial insurers is required to deal with state-targeted acts of war and terrorism in a fair and balanced way. Unfortunately, the experience so far has not been encouraging.





## PART I

### *Chapter 7*

# **Terrorism Insurance : An Overview of the Private Market**

*by*

**Ben Garston**\*

**Map Underwriting at Lloyd's**

This chapter provides an overview of the scope and evolution of the market and capacity for terrorism risk insurance before and after 9/11 events. It also examines the coverage currently available for this risk, the practical and theoretical advantages of such a private cover and its prospects.

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\* Partner, MAP Underwriting, Chairman of the Lloyd's Terrorism Panel.

## **1. The Past**

### ***1.1. Small market mainly Lloyd's and AIG***

During the 1970's and 1980's, terrorism insurance was largely in the hands of a small number of political risk underwriters - predominantly Lloyd's and AIG - who also offered riot and terrorism cover.

It was fairly unusual to offer stand alone terrorism coverage and it was mostly given as an extension to asset confiscation policies.

### ***1.2. Limited regular demand: Colombia, Israel, Indonesia, Sri Lanka, South Africa, UK***

Policies were mostly sold in loss active countries such as Colombia, Israel, Indonesia, Sri Lanka, South Africa and post-1992 in the United Kingdom.

### ***1.3. Old fashioned insurance products***

Short, clumsy wordings were used for decades that were deficient in many ways and for example failed to define important terms such as terrorism or distinguish other political violence perils.

## **2. 9/11**

### ***2.1. Terrorism exclusions in every policy***

As a result of the fear and panic amongst ordinary property insurers, terrorism was excluded from virtually every possible policy, however genuinely exposed it was.

The insured loss from WTC was approximately \$35billion but it is worth pointing out that the recent storms in the USA and Caribbean may cost a similar amount.

However because the peril is more familiar, there is no call from governmental bodies for natural perils insurance to be further taken out of the hands of insurers, as is in some quarters true for terrorism.

### ***2.2. October 2001 : Lloyd's releases new T3 terrorism product***

As a result of the entrepreneurial freedom within Lloyd's and notwithstanding large losses to the market, a new product known as T3 was released in October 2001, one month after the attacks in New York.

### ***2.3. Private market capacity \$100m per risk/200m p/blast zone***

In the early months of 2002, capacity was a mere \$100million per risk/200million per blast zone.

With fairly low initial capacity, the product was priced in expectation of the next and imminent attack on the scale of WTC.

Critics of the private market incidentally often say that prices were “high” post-WTC whilst simultaneously saying that data was inconclusive and correct pricing hard to determine, which rather calls into question the certainty that the private market was charging “high” prices. Hindsight and the lack of large losses since WTC are wonderful things.

### ***2.4. Massive demand from USA, Europe, Australia, Japan and elsewhere***

As the popular perception was also that new attacks were only a matter of time, the product was in demand worldwide.

## **3. The Present**

### ***3.1. \$2billion per risk/4billion per blast zone***

Since the early days post WTC, the market has expanded enormously. There is now up to \$2billion per risk capacity and perhaps \$4billion per event.

### ***3.2. Competitive market: Lloyd’s, USA, Bermuda***

As the initial fear of daily or weekly attacks in Western countries has subsided, many previously nervous carriers have been drawn into the market. There is now very active competition-as well as co-insurance-between London, USA and Bermuda to the obvious benefit of the insurance buyer.

### ***3.3. \$120billion capital secures terrorism insurers***

The capital behind the main players in the private terrorism market amounts to approximately \$120 billion, easily sufficient to meet their obligations, even assuming a substantially increased frequency of loss.

### ***3.4. Average prices reduced by 60% compared to immediately post-WTC***

Average prices have reduced by up to 60% compared to the cost of insurance immediately after the attacks in New York. Net prices may often

be as little as 0.02% of the values insured and this represents a well-priced product from the buyer's perspective.

## **4. Practical Advantages of the private market**

### ***4.1. Underwriting flexibility***

One of the main advantages of the private market is underwriting flexibility.

Private market underwriters can distinguish between a mattress factory and a government office building, when trying to assess the likelihood and possible cost of a terrorist attack. They can consider security measures, such as controlled access, employee screening and building construction.

Through bespoke underwriting, insurers can look in detail at features such as commercial activity (is it military or defence related?) and exact location, including proximity to terrorist targets. In contrast, Pool Re in the United Kingdom, for example, simply divides the entire country into Zones A, B, C and D.

Underwriters have access to security reports and intelligence which allow risk assessment to be modified and updated on a daily basis. This cannot be said of state run schemes, which once created are inflexible and very difficult to change, generally requiring government intervention.

### ***4.2. Price flexibility***

Private market underwriters can also offer price flexibility. As each risk is considered individually, low risks are charged a low premium and higher risks pay an equally appropriate premium.

Unlike a one size fits all government scheme, there is no requirement that a peanut farmer, for example, subsidises a higher risk such as a city centre building.

Although data is not as comprehensive as for natural perils, there is a large body of information on terrorist attacks going back up to 100 years, indicating where they happen, who carries them out, what is their motivation, what methods are used and what they cost. There is no shortage of analysis of both the underlying trends and practical consequences and not a few competing models in this area. All of this means that pricing and risk assessment is increasingly well-informed.

### ***4.3. Established distribution and documentation***

As essentially just another insurance line-albeit a topical and sensitive one-there is a tried and tested distribution mechanism for these products, often using international insurance brokers. Equally, there is an established process for fast production of policy documents so that terrorism cover is provided and evidenced like any other physical damage peril.

There is no additional government mandated bureaucracy.

### ***4.4. Fast, efficient claims handling***

As is true of the documentation process, claims handling and the use of loss adjusters for catastrophe risks such as earthquake and windstorm is well established. Many insurers are very experienced in dealing with major, geographically widespread losses involving multiple insureds. These skills are extremely transferable.

There is no lengthy wait for a bureaucrat to make a decision over whether or not an attack amounts to “terrorism”. This is a decision for the insurer to make as soon as sufficient evidence is available.

Also, a victim of terrorism has only to pick up the telephone or e-mail to begin the process of recovery and indemnification for damaged assets, help in re-establishing his business or for that matter compensation for injured personnel.

The same is not necessarily true for government terrorism schemes, even if administered by insurers, because the insurers can only act to help their clients when they are certain that they are acting in accordance with the rules and decisions of the relevant scheme.

### ***4.5. Product innovation***

Some recent examples of new products offered by the private market are for terrorism public liability, contingent banking risks and cyber risks.

Unlike government terrorism compensation schemes in various forms, set out by statute, if a new demand arises, private market underwriters can begin to develop appropriate products immediately.

In response to such demand, we have developed terrorism public liability coverage, something only TRIA in the United States comes close to offering and then in a very limited form. We have also developed new terrorism related banking and cyber attack products.

Private market terrorism products are also routinely sold to fill in gaps and deficiencies in government terrorism schemes-such as the narrow

definitions of terrorism under TRIA and Pool Re-or because the buyers are not confident that the government schemes will provide an adequate service or even certainty of claims settlement.

## **5. Ideological Advantages of the Private market**

### ***5.1. No compulsory purchase by unwilling property owners***

Why should property owners be forced to insure their own assets-as distinct from say third party liabilities-where they feel they can take responsibility or otherwise protect their financial position through different measures including self-insurance?

### ***5.2. No compulsory sale by unwilling insurers***

Why should insurers who know little about terrorism risk and have no interest in selling it be forced to include a coverage that they have no idea how to price and particularly when specialist alternatives exist?

Why also should insurers be forced to deal with the cumbersome bureaucracy inherent in to the government systems and financial risk of government reinsurance failure if they fail to comply with the rules in some way?

### ***5.3. No taxpayer subsidy of private, commercial risk***

Why should our taxes go to subsidise private, commercial risk? This is what is happening where governments reinsure or mandate insurance at tariff rates far lower than free, commercial markets would charge or below actual loss cost.

## **6. The Future**

### ***6.1. Stable, effective world market for terrorism risks***

As more policies are sold, more loss data becomes available and trends become clearer, the private terrorism market will become even more stable and predictable in terms of pricing and coverage.

### ***6.2. Increased broker access to increased capacity***

As more brokers become familiar with the products, it will become even easier for supply to meet demand. As long as there is some margin to be made in selling terrorism insurance, capacity will continue to be drawn in.

### ***6.3. Competitive market subject to strong reserving***

The competitive market is set to remain, however pricing must not become complacent and the maintenance of strong balance sheets, so as to better deal with the inevitable losses is vital.

### ***6.4. Claims to prove the worth of the products and the service***

It is an old, dull but probably correct aphorism that the worth of an insurance policy only becomes evident when a claim is made. Whilst none of us wish to see terrorism claims, the truth is that more attacks in Western countries are highly probable. When this happens, the private terrorism market will have an opportunity to demonstrate just how good its claims service can be and just how valuable are the products.

### ***6.5. Private terrorism market accepted as a viable, long-term catastrophe market***

From the author's point of view, it is desirable to develop the private terrorism market in reach and financial strength and to accept it as a traditional catastrophe insurance market in which underwriters try to put a price on the vagaries of nature, manifested in hurricanes, earthquakes and volcanic eruptions.





## PART II

### **Financial Markets Solutions to Manage Catastrophic Risks**

- Chapter 8* **Current Challenges in the Securitization of Terrorism Risk**  
by G. Woo.
- Chapter 9* **Financing Disaster Risks in Developing and Emerging Economy Countries**  
by R. Mechler.
- Chapter 10* **The Potential for New Derivatives Instruments to Cover Terrorism Risks**  
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## PART II

### *Chapter 8*

# **Current Challenges in the Securitization of Terrorism Risk**

*by*

Gordon Woo\*

Risk Management Solutions Ltd

The successful securitization of terrorism risk, pioneered in October 2003 through Golden Goal Finance Ltd., suggests that the catastrophe bond market may yet be expanded through innovation, enterprise, and industry on the part of investment bankers, lawyers, and risk analysts. But, as with this initial transaction, the opportunity for securitization will depend on a confluence of circumstances. As with natural catastrophe bonds, the potential exists for a specialized niche market for terrorism securitization.

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\* Catastrophist.

## 1. Investor demand for risk-linked securities

At somewhat above a billion dollars per year, the issuance of catastrophe bonds remains a tiny proportion of the catastrophe insurance market. Nevertheless, those involved in structuring and analyzing the risk of these bonds continue to search for corners of the catastrophe insurance market, where risk might be alternatively transferred to the capital markets in an efficient manner. The high relative cost of securitization, compared with the cost of conventional insurance cover, has been the key factor in suppressing the volume of issuance. Although, theoretically, capital markets investors with little exposure to natural catastrophe risk might be expected to be prepared to take this risk more cheaply than insurers, this has not proven to be the case.

Not expert in the underlying disaster science, and wary of an exotic asset class, the select band of eligible capital markets investors in risk-linked securities have been cautious and choosy about their holdings, and insistent on attractive investment returns. For a 1% expected loss, an investor in the late 1990's would have demanded a coupon of around 6% above LIBOR. Following the sharp downturn in the global equity markets, and some notorious corporate bond defaults, the cat bond coupons payable to investors have declined in recent years to levels which are becoming more competitive with insurance. Currently, the market appetite for cat bonds far exceeds the volume of issuance, and there is little prospect of a significant growth in issuance, given the competitiveness of the reinsurance market.

Can this market appetite for natural catastrophe bonds be satiated with a supplementary diet of bonds carrying some exposure to man-made catastrophes? The idea of a terrorism catastrophe bond was proposed early on by Kunreuther<sup>1</sup>. But there has been market scepticism over whether there would be any actual issuance. Would anyone want, or be permitted, to invest in such bonds? Doubts over the viability of new types of catastrophe bond are themselves not new or surprising: similar sentiments were expressed a decade ago over the bizarre and apparently audacious concept of an earthquake catastrophe bond.

The over-subscription of Golden Goal Finance Ltd shows that, under the right circumstances, investors are prepared to buy bonds with a default potential explicitly tied to terrorism risk. Part of the challenge of terrorism risk securitization is to overcome investor reluctance to be seen overtly to be buying bonds with an explicit terrorism risk exposure. To some extent, this is a presentational problem, requiring terrorism risk to be wrapped cleverly within a more palatable financial product. In this way, the terrorism risk

exposure would appear as an auxiliary, or subsidiary, if not altogether implicit risk.

Many investments carry an implicit exposure to terrorism risk. It is an intentional feature of global terrorism that there should be an insidious continuous background threat of Islamist violence. Osama bin Laden himself reiterated, in a speech timed for broadcast shortly before the US presidential election, the continued Islamist policy to bleed America to the point of bankruptcy. A spectacular terrorist attack could not only cause significant numbers of casualties, but it could impact severely on a diverse range of businesses. The high loss leverage between the modest cost of an Al Qaeda operation and the very large cost to the US economy has been a source of boastful comments by Osama bin Laden.

Corporations may be able to recover reasonably over a period of time from loss of property or inventory, or even loss of key personnel, but reputational brand damage may be commercially disastrous – even terminal. Where there are alternative products for consumers to choose from, customer loyalty to specific brands might be rapidly eroded as a consequence of terrorist acts aimed against them. For example, the Lockerbie disaster of 1988 exacerbated the financial problems of PanAm, and forced the sale of aircraft and routes. The company collapsed in 1991. Similar financial misfortune may follow in the wake of terrorist attacks on cruise ships and other transport/tourist infrastructure. Other businesses vulnerable to terrorist attack are in the retail sector. The lethal poisoning of food or beverages with ricin has been rumored as an attack scenario. (The use of ricin is not fanciful: it was discovered in 2003 being ground from castor beans by Algerian refugees in London). This contamination might trigger the kind of commercial disaster that struck the bottled water firm Perrier in 1992 as a result of benzene pollution.

A number of mortgage-backed securities and corporate bonds have a non-trivial exposure to terrorism risk. For any particular corporate bond, the additional default risk associated with terrorism will typically be very low; sufficiently low for it not to figure in the bond rating, with its core focus on corporate susceptibility to adverse economic conditions. The ambiguity over the evolution of economic conditions would thus be considered to be a far more important factor than the ambiguity in terrorism risk evaluation.

But imagine, hypothetically, the task of explicitly extracting the terrorism risk from a corporate bond, e.g. for a food processing firm, and attempting to securitize it on its own. Rating agencies and investors would balk at dealing with a bare isolated terrorism risk, even if they would readily cope with it, if it were well diluted with a basket of other more conventional economic risks. The investment banking community is

renowned for creativity and ingenuity in structuring securitizations to meet the joint needs of the issuer and the investor. A plain vanilla securitization of the terrorism risk to a premier skyscraper office block in Manhattan will have minimal chance of success - but then the same can be said of an earthquake risk securitization for an office block astride the San Andreas Fault, or the hurricane risk for a hotel in Miami Beach.

## 2. Supply and demand for terrorism insurance

Prior to September 11<sup>th</sup>, 2001, terrorism was not a catastrophe insurance risk. With the threat since then of extreme loss to western interests resulting from actions of militant Islamists, terrorism has become world-wide a catastrophe risk. There are some specialist professional underwriters of terrorism risk, with long experience of handling political risks of all kinds. However, by and large, insurers are cautious over their exposure to terrorism risk, accepting such exposure if compulsory, as with US workers compensation, but being reluctant and hesitant to accept terrorism risk voluntarily. The shortage of willing insurers of terrorism risk engenders a chronic market imbalance between supply and demand. As a consequence, some terrorism premium rates may be unduly inflated.

Apparent inefficiencies in the market pricing of terrorism risk may catch the attention of terrorism risk analysts. Excessive, possibly exorbitant, prices for some risk classes, as might be charged by so-called insurers of last resort, may encourage the search for an alternative securitization route to transfer the terrorism risk. Practical opportunities for securitizing terrorism risk will depend on locating an ample spread between the market insurance premium for terrorism cover and the notional actuarial terrorism risk, as calculated by terrorism risk analysts. The existence in 2004 of a commercial global terrorism risk model, developed partly to assist in underwriting for the US Overseas Private Investment Corporation (OPIC), allows the opportunistic search for such spreads to be extended worldwide. At the same time, such underwriting aids should narrow the range of volatility in terrorism insurance pricing.

Some terrorism risks are perceived to be so high as to be currently commercially uninsurable. A classic post-9/11 example is aviation war risks coverage. Not just western airlines are affected, even the Singapore aviation industry is relying on government intervention for war risks coverage. Thought has been given to how the capital markets might relieve this government burden; so far, contingent finance has been the most promising suggestion.

### 3. Risk ambiguity

The risk analysis undertaken for a catastrophe bond transaction will routinely estimate the annual probability of attachment and exhaustion, as well as the annual expected principal loss. As part of the bond rating and marketing process, stress tests on the risk analysis may be requested. These stress tests examine a range of more conservative model assumptions on event frequency and severity, which explore the bounds of epistemic uncertainty, (otherwise referred to as parameter risk). Froot and Posner<sup>2</sup> have pointed out that, provided a risk analysis is unbiased, the fact that there may be epistemic uncertainty in the results does not merit special compensation for an investor, since the higher moments of the excess return distribution are unaffected. The premise of this statement holds true in that risk analysts aim to be unbiased; such bias as may be introduced by risk analysts tends to be in a conservative direction, and so in favor of the investor. But notwithstanding the theory, the degree of risk ambiguity is known in practice to affect the risk appetite of the comparatively small and select set of institutional investors who buy catastrophe bonds. Apart from a best estimate of risk, investors may be keen to have a high percentile confidence figure.

With a decade of satisfactory experience, investors in hurricane catastrophe bonds have become comfortable with hurricane risk analysis. This remains so, even after the stress of the turbulent 2004 hurricane season, which bondholders survived without loss. As Hurricane Jeanne made landfall in September 2004, the fourth hurricane to strike Florida in two months, one desperate homeowner fired his handgun in frustration at the incoming hurricane, and one irate teenager questioned Weather Channel meteorologists why hurricanes can't be 'killed' when they are young, to prevent them from causing Americans harm. Past vain meteorological attempts have been made to seed hurricanes; to try to steer them; and thought has even been given to bombing them, but the plain truth is that there was nothing that the President of the United States, nor his brother, the Governor of Florida, could do to stop one hurricane after another battering Florida during the 2004 hurricane season.

There is a misperception that major terrorist attacks may occur entirely at the whim of militants, and that therefore the frequency of attacks is beyond quantification. This might be the case where counter-terrorism forces are weak, but this is not the case in the leading western democracies. The powerlessness to stop landfalling hurricanes is in marked contrast with terrorism. After 9/11, lawyers worked around the clock to draft the Patriot Act, which provided urgent new legal powers to combat terrorism, even at a cost to the civil liberties of some Muslim Americans, who have felt



harassed. There is no Patriot Act respected by natural hazards. In contrast with windstorms, terrorism is a control process, to which the principles of cybernetics apply. After any future spectacular terrorist attack against a western democracy, the government would respond swiftly to heighten security, so as to prevent a recurrence. As demonstrated in 2004, it is possible to have four landfalling hurricanes in Florida, but if several separate major terrorist attacks occurred within the USA, senior politicians would be forced to step up security sharply or resign for poor risk management. For democratic states, counter-terrorism actions have to be commensurate with the threat. After a major attack, extended political license is granted to detain suspects, keep aliens under surveillance, tighten borders and put extra law enforcement officers on the street. The post 9/11 counter-terrorism response already has included the closure and indictment of several prominent Muslim charities, the detention and deportation of hundreds of Muslim immigrants, as well as interviews requisitioned by the FBI with Muslim individuals.

Rather as tropical storms form in the Atlantic Basin, so terrorist attacks may be planned by individual cells. But whereas it is a matter of meteorological fortune whether these tropical storms develop into landfalling hurricanes, planned attacks may be interdicted or otherwise foiled by concerted counter-terrorism action. Since 9/11, the capability of western counter-terrorism forces has been greatly augmented. In the USA, fewer than 20% of planned attacks should materialize as spectacular terrorist successes.

#### **4. Moral hazard and basis risk**

As tragically demonstrated on 9/11, terrorists attack at a time of their own choosing, and so have the opportunity to make money on their criminal actions by buying derivatives. It is surmised that Al Qaeda profited by shorting certain insurance and airline stocks, which inevitably slumped after 9/11. Any potential securitization of terrorism risk should avoid a situation arising whereby anyone, especially a terrorist, might gain financial advantage in perpetrating an act of terrorism. The ill-fated Policy Analysis Market conceived by DARPA with good intentions and persuasive theoretical backing, suffered acutely from this defect. Through the placing of odds on terrorist events such as political assassination, financial inducements might have been created for heinous crimes such as murder. More generally, Joseph Stiglitz noted that: *'The system creates a strong incentive for someone to buy futures in a violent act and then carry out the act—the insider information problem'*.

As with a purchaser of insurance, an issuer of a terrorism risk securitization should have an absolutely clear incentive to avoid falling victim to terrorism. There should be no element of moral hazard, whereby the issuer might have an inducement to alter behavior, such as to lower security standards, or to incite terrorism. Furthermore, the issuer should not stand to benefit in any way from a terrorist attack. In particular, the potential payout to the issuer from an attack should be less than its terrorism loss. Because of this moral imperative, payouts should relate directly to the loss suffered, with no prospect of undue excess gain to the issuer because of basis risk.

The absence of moral hazard is patently obvious in the case of Golden Goal Finance Ltd., which is described next. The World Cup is FIFA's flagship premier event, and the most important source of income, and any disruption would have been entirely detrimental to its future.

## 5. Golden Goal Finance Ltd

As with all new asset classes, the right opportunity would have to arise for initial implementation; one where the bond was price-competitive with insurance and where investors could be comfortable with the risk analysis, allowing for the risk ambiguity. A suitable opportunity arose in connection with the cancellation risk of the football World Cup, organized by FIFA, (the international federation of football associations). Ever since AXA withdrew its insurance coverage following 9/11, finding appropriate replacement coverage has been a challenge for FIFA. The 2002 World Cup in Korea/Japan was successfully covered, through the timely intervention of the Berkshire Hathaway Group subsidiary National Indemnity Co. However, the high cost of this coverage has been reason enough to seek the alternative solution of securitization for the next football World Cup, to be hosted by Germany. After a year of financial engineering planning by CSFB, this alternative has been achieved through the \$260 million transaction Golden Goal Finance Ltd. With this in place, FIFA have subsequently been able to securitize about \$260 million of future sponsorship revenue, which required that the event cancellation risk be mitigated as far as possible, either through insurance or a catastrophe bond. Both were considered, but the latter turned out to be less expensive.

The securitization of cancellation risk through Golden Goal Finance Ltd. is especially resilient since the 18<sup>th</sup> world cup can be relocated elsewhere, and postponed for a year, if needs be. This latter flexibility essentially makes this a second event transaction, because if any event were to occur in 2006 sufficient to prevent tournament completion during the scheduled year, then it might be re-scheduled for 2007. An apposite sporting precedent for such

re-scheduling was set by the postponement of the 2001 Ryder Cup until 2002, because of the understandable reluctance of US golfers to fly in the aftermath of 9/11. Both relocation and postponement are FIFA options with historical precedent: the FIFA women's world cup in 2003 was relocated from China to USA because of the SARS (Severe Acute Respiratory Syndrome) epidemic, and the FIFA youth world cup in 2003 was postponed from the Spring to the Autumn because of the proximity of the Iraq war to the host nation, the United Arab Emirates.

The resilience of the transaction is reflected in the risk analysis, which included a logic-tree framework to make explicit the sources of epistemic uncertainty. Given the presence of such uncertainty, no unique risk model exists; instead a range exists of alternative plausible models, and their parameterization. Rigor in the treatment of epistemic uncertainty is manifest computationally in the construction of a logic-tree, the branches of which reflect the diversity in model parameterization for key factors such as target attractiveness; weapon capability; level of security; interdiction by intelligence services; and curtailment after an attack. Information sources relevant to parameterization include the historical precedents of past World Cups, such as the 1998 tournament in France, against which an attack was planned by the Algerian Islamic terrorist organization (GIA), but interdicted by the French security service.

Although for several decades, a logic-tree has been customary within quantitative risk analyses for safety-critical industrial installations, the construction of a logic-tree is not yet standard in catastrophe bond risk analysis, because logic-trees are not incorporated within catastrophe models for insurance portfolio analysis. However, a logic-tree was constructed for the Tokyo earthquake bond Parametric Re, which was the first securitization of the parametric type: the trigger for loss of principal was a seismological determination of event epicenter and magnitude, which is not dependent on any portfolio analysis. For innovative securitizations, clarity in identifying sources of risk ambiguity is especially appreciated by rating agencies and investors.

For Golden Goal Finance Ltd., a conservative best estimate of about 5 basis points was obtained for the terrorism cancellation risk, and the range of logic-tree possibilities yielded terrorism risk results as high as 37 basis points. The risk ambiguity was made transparent in the Offering Circular, in that the calculational framework was explicitly described in sufficient detail as to permit the reader freedom to input his own parameters, and perform an alternative assessment.

An investment grade rating of A3 was given by Moody's Investor Service, following several meetings discussing the risk analysis. The

preparedness of Moody's to consider rating Golden Goal Finance Ltd. reflects a critical but open attitude towards terrorism risk assessment, and is consistent with their preparedness to down-rate some commercial mortgage-backed securities, heavily exposed to city center macro-terrorism. By contrast, S&P, being less open, a priori, to the technical agenda of terrorism risk assessment, did not alter its ratings on these CMBS deals, but ensured that investors knew what insurance provisions were in place on the buildings backing the transactions<sup>3</sup>. Consistent with this perspective, from the outset, S&P was not in a position to consider rating the FIFA cancellation bond, but did consider worthy of an A-rating FIFA's subsequent securitization of its World Cup sponsorship earnings, which now had the protection of this event cancellation bond.

A successful placement of the \$260 million issue of Golden Goal Finance Ltd. to the capital markets was made by CSFB. All the bonds were sold at a coupon of 150 basis points above LIBOR, which was very satisfactory for FIFA. Investor confidence in the German government to maintain tight security was a factor in the bond pricing, as was familiarity with FIFA, and the world of football: 80% of the bonds were sold in Europe. It should be stressed that, although the German government is responsible for national security, the decision on cancellation rests entirely with FIFA, and not the German government. If there were popular sentiment from within the global footballing community for the World Cup to be cancelled, FIFA would do so, notwithstanding government representations.

In the year since the bonds were issued, both the European Football (UEFA) Cup competition and the Athens Olympic Games have been completed without terrorist incident, which is a vindication of the game theoretic principles underlying the risk analysis. Both of these major sports events in 2004 had rigorous, extensive, and exemplary military-style security, which served as a strong deterrent against a terrorism attack. NATO provided strategic support to Portugal for the European Football Cup, and nearly \$1.5 billion was spent on security at the Olympic Games. Given the hardness of these two international sports targets, terrorists have not diverted attention to these, but instead concentrated on attacking softer western targets, most notably in Iraq, where the likelihood of attack success has been so much higher.

## **6. Securitization of mortality risk**

Since 9/11, awareness amongst life reinsurers has been heightened of mortality as a catastrophe risk, for which securitization might be an attractive possibility if coverage is unduly expensive or difficult to obtain. The 2002/2003 winter outbreak of SARS has further concentrated the minds

of life actuaries on the potential for catastrophic loss, to the extent that a securitization of catastrophe mortality risk has been undertaken by Swiss Re. Vita Capital is the first transaction to transfer this kind of risk to the capital markets.

Excess mortality is measured with respect to a mortality risk index, weighted according to Swiss Re's exposure, which is segmented according to gender (35% female; 65% male), age; and country (70% US; 15% UK; 7.5% France; 5% Switzerland; 2.5% Italy). The age weighting is geared towards individuals in middle age (e.g. 40% aged 35 - 44), which precludes efficient hedging of the mortality risk of life insurance policies with the longevity risk of annuity policies. The trigger threshold for excess mortality rate is 30% higher than expected, based on 2002 mortality in these countries.

This huge excess mortality might be attributable to a global pandemic alone, (Nature's own weapon of mass destruction), but this is very unlikely, given the choice of index weightings. The country weighting is loaded in favor of parts of the world with advanced medical care facilities for disease control, and the age weighting of the mortality index is loaded in favor of people less prone to dying from disease than the young and elderly. The US death rate from pneumonia and influenza among those aged 25 to 44 is about 20% of those aged 45 to 64, and only 4% of those aged 65 or more.

Mortality catastrophes which would score a high index value are those striking middle-aged men in the USA. More so than pandemics, terrorist attacks on down-town urban centers might target such a population group. Fear of such catastrophic attacks is a driver of foreign policy in Washington and London, aimed at denying terrorists access to weapons of mass destruction. Currently, the WMD capability of Islamist militants is low. As shown in Iraq, such capability is not easy to acquire and retain. However, the intent of Al Qaeda to develop or acquire such a capability is evident. Literature on nuclear weapons has been discovered in Al Qaeda training camps in Afghanistan, and information on anthrax was found on the computer of Khalid Sheikh Mohammed, chief of military operations until his arrest in March 2003.

The operational WMD capability of Al Qaeda may well increase over the next three years. But even with enhanced capability, it is extremely unlikely that a single WMD attack could trigger loss to Vita Capital investors. In principle, it might be possible to kill hundreds of thousands of people with a fine anthrax aerosol sprayed over a city on a cool, calm night, but this would require perfect weather and security conditions, and a level of technical sophistication in weaponry well beyond the means of any terrorist group. The urban detonation of a nuclear bomb would not have such a

lethality rate either. As a benchmark, about 100,000 died from the atomic bomb dropped on Hiroshima.

With the assigned weights of the mortality index, the trigger threshold of excess mortality is most likely to arise, within the three years of the transaction, from the occurrence of not one but several different disasters: perhaps a recurrence of the 1918 influenza pandemic and a WMD atrocity. The risk posed by such multiple disaster contingencies should be of the order of a few basis points. Accordingly, as with Golden Goal Finance Ltd, this bond was rated A3 by Moody's. Notwithstanding the exposure to terrorism risk, this bond was rated A+ by S&P.

With the precedent of this transfer of mortality risk to the capital markets, the prospect exists of other financial instruments being developed which transfer casualty risk from insurers. Workers compensation coverage is an example.

## 7. Multiple event risk

A promising corner of opportunity for securitization is the coverage of multiple event risk, whereby an investor would not lose any principal if, within a designated time period, only one event occurred, but the investor might lose principal if two or more events occurred. As with the World Cup, a number of other high profile sports tournaments fall into the category of being postponable and replayable at a later date, if necessary. Some major high profile public entertainment extravaganzas are also postponable.

There are several clear reasons why multiple event risk might be an attractive prospect for securitization. First, from the perspective of both an investor and a bond rating agency, the prior occurrence of one event before principal is at risk affords a distinct warning for the bond to be put on sale, or put on watch. A topical example is Zenkyoren's Phoenix securitization of second-event Japanese earthquake risk. The 6.8 magnitude earthquake which struck northwest Japan on 23rd October 2004 had the immediate effect of reducing the value of the bonds in secondary trading, but no principal was yet lost.

Secondly, a sequence of two or more catastrophe events in a short period of time could well expose an insurer to financial stress and jeopardize its credit rating. Protection against such a contingency should be a priority for insurance risk management, but adequate protection may be costly or hard to obtain.

Of course, whether an investment manager prefers one tranche over another depends on many considerations - investment grade being one.

Multiple event catastrophe bonds are typically of investment grade, and hence are attractive to those institutional investors restricted only to purchasing investment grade bonds. To date, the more highly rated multiple event tranches have been particularly popular among investors. Allocation of an over-subscribed senior tranche to investors may even be made conditional on their purchase of some of the junior tranche, if they are able to do so.

Multi-event catastrophe bonds thus fill a narrow but significant insurance market niche. They are successfully marketable because their comparatively low risk enables them often to achieve investment grade ratings, so appealing to a wider range of institutional investors than the typical first event securitization. Furthermore, given the high loss threshold, the cost of issuance may be more price-competitive against standard insurance than first event bonds.

## **8. Opportunities for securitizing terrorism risk**

With a shortage of natural catastrophe bond issuance, investors are willing to consider the purchase of catastrophe bonds exposed to other perils. The probing of investor appetite for novel forms of alternative risk transfer is allowing the boundaries of catastrophe bond issuance to be extended. Terrorism risk, as embodied within event cancellation risk, workers compensation risk, or mortality risk, is potentially securitizable.

Packaging of this man-made catastrophe risk as a multi-event transaction helps to gain the confidence of both rating agencies and investors. At least when packaged in this way, capital markets investors have shown preparedness to take on terrorism risk. Other ART opportunities exploiting this market niche are being explored. Now that this seemingly formidable securitization frontier has been breached, perhaps further probing of investor appetite will allow terrorism risk to be securitized in other ways, perhaps bundled up with more familiar and well established catastrophe risks, such as earthquake and windstorm, which would serve to dilute the overall terrorism component.

An ideal terrorism risk portfolio would comprise properties which were either extremely well protected, or were not mainstream government or commercial iconic targets. To the extent that market pricing may give insufficient credit for excellent security, or may unduly penalize properties lacking the prime qualities attractive to terrorists, risk arbitrage opportunities for terrorism securitization may possibly arise.

## Notes

- 1 Kunreuther H. The role of insurance in managing extreme events: terrorism, Risques (2002).
- 2 Froot K.A., Posner S.E. The pricing of event risks with parameter uncertainty, Geneva papers on Risk and Insurance Theory, Vol.27, No.2, (2001).
- 3 Reactions Magazine, Fifa's Golden Goal, (November 2003).





## PART II

### *Chapter 9*

# **Financing Disaster Risks in Developing and Emerging Economy Countries**

*by*  
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This chapter examines the experience, opportunities and drawbacks of risk financing, particularly through financial market instruments, for reducing the vulnerability of developing and emerging-economy countries to sudden-onset, natural disasters. Financial markets comprise a wide institutional spectrum from rural credit banks, international financial markets to multilateral finance institutions. This chapter shows that market-based financing instruments have potential for assisting households, businesses and governments in their recovery from catastrophes and for providing incentives for loss reduction. However, the cost of market instruments can substantially exceed that of traditional family-, state- and internationally-supported, non-market financing mechanisms. The chapter concludes that there is a case for national and international support to make these options affordable in developing and emerging-economy countries.

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## 1. Introduction

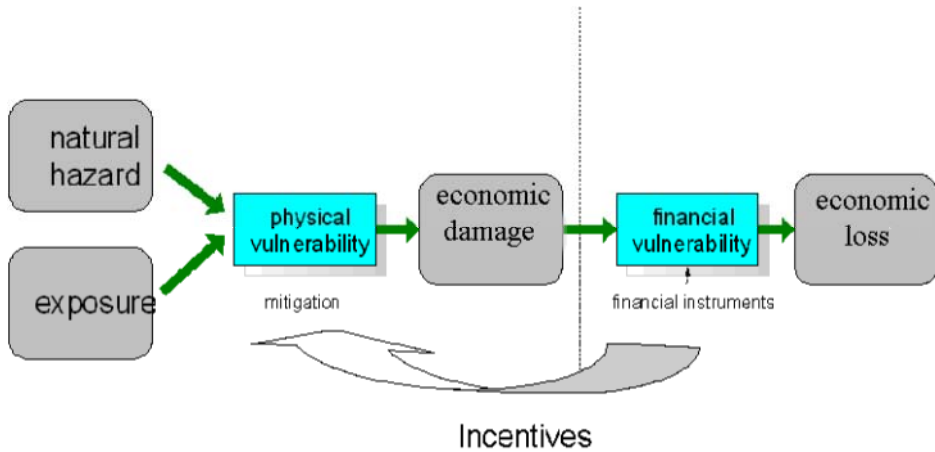
This chapter examines the experience, opportunities and drawbacks of relying on financial markets to finance risks arising from sudden-onset, natural disasters. Financial markets are defined to comprise a wide institutional spectrum from rural credit banks, international financial markets to multilateral finance institutions. The focus is on the application of these tools to developing and emerging-economy countries. We conclude that natural disaster risk financing instruments have a great deal of potential for assisting countries to adapt to their growing catastrophe risk exposures and for providing incentives for reducing risks; however, we point out that the cost of market instruments can substantially exceed that of traditional family- and state-supported, loss-sharing financing mechanisms. Traditional post-disaster financing, however, may not be sufficient for households and governments in developing and emerging-economy countries that face high catastrophe risks, in which case market risk-financing instruments that are put into place before the disaster, can be an important, but costly addition to the portfolio of measures available to households and government authorities.

The need to develop improved institutions, procedures and mechanisms for spreading and sharing disaster losses is motivated by their alarming increase. Economic losses from all natural disasters including earthquakes, windstorms, floods, droughts, landslides and tsunamis, to mention the most serious, have increased almost nine-fold from the decade of the 1960's to the 1990's, and insured losses more than 15-fold (Munich Re, 2003). The dominant factors behind rising losses are changes in land use and increasing concentration of people and capital in vulnerable areas, for example, in coastal regions exposed to windstorms, in fertile river basins exposed to floods, and in urban areas exposed to earthquakes (Mileti, 1999). Climate change may also be playing a role. The Intergovernmental Panel on Climate Change (IPCC) has concluded that at least part of the increase in economic losses is due to changes in climatic conditions (IPCC, 2001, Chapter 8). Most economic losses occur in wealthy countries, yet most of the human suffering (death toll, injuries, loss of income) occurs in developing countries (Müller, 2003). Not only developing countries, but the poor in those countries are the most vulnerable to disasters (POVCC 2003, UNDP 2001).

There are two options to reduce the net economic losses from disasters: mitigation and risk financing. The first, and usually highest priority in risk management, is to invest in preventing and mitigating economic damages from disasters. The residual risk can then be managed with risk financing strategies. What remains, is the actual or net loss. Mitigation, therefore, reduces physical vulnerability; risk financing reduces financial vulnerability.

As illustrated in figure 9.1, these options are interlinked, since the choice of financial instruments can have effects on physical vulnerability because of positive or adverse incentives.

**Figure 9.1 Reducing physical and financing vulnerability**



Financial arrangements that spread disaster losses among those most at risk, and including solidarity from those not at risk, can make a difference in the lives of vulnerable people in developing and emerging-economy countries. For example, many Mexican farmers face double exposure to fluctuations in crop prices and natural catastrophes that in a very bad year or consecutive years can force them to migrate to the slums of Mexico City, where they face even higher risks. Pre-disaster or ex ante financial arrangements that spread crop losses, temporally and spatially, have the potential to secure their livelihoods. Likewise, financial arrangements that transfer and spread catastrophe risks facing governments can make a huge difference in the economic development of vulnerable countries. If governments do not have the necessary infusion of capital after a disaster to rebuild critical infrastructure and assist households and businesses with their recovery, the indirect costs can greatly exceed the direct losses from the disaster. Such delays can also lead to secondary economic and social effects, such as deterioration in trade, budget imbalances and increased incidence of poverty (Benson, 1997; Freeman et al., 2002). For these reasons, international financial institutions and disaster management communities are placing great emphasis on pre-disaster, pro-active disaster planning to prevent losses and enable households and governments to recover in a timely manner (Gurenko, 2004, Kreimer and Arnold, 2000, World Bank, 2000).

While market instruments for financing risks have great potential for developing and emerging-economy countries, there are also associated costs. Keeping in mind that up to 95 percent of recent disaster deaths have occurred in poor countries (Mitchell and Ericksen, 1997), the return on preventive mitigation investments may outweigh the return on investing in market-based financial instruments. It is important thus to weigh the benefits and costs of financial instruments, particularly in comparison to the benefits and costs of preventing human and economic losses. This point cannot be overemphasized. In low-income countries, the opportunity costs of market based risk-financing instruments can be prohibitively high in terms of meeting other human needs. Moreover, it is important to examine the incentive effects that any financing approach has on preventing disaster losses. Gurenko (2004) and others argue that highly concessional post-disaster funding from large international donors and international development banks has reduced incentives of governments to engage in proactive risk management. Finally, market instruments often transfer liability from the state to individuals, which can mean increased burdens on already poor and vulnerable communities.

In addition to the well-known risk financing instruments of insurance and reinsurance, other types of market instruments have recently emerged making use of the rural, domestic and international financial markets. There are important examples of securitizing disaster risk in the financial markets by issuing catastrophe bonds, issuing weather derivatives for flood and drought exposure and using contingent credit arrangements for financing a government's post-disaster liabilities. This paper examines the benefits and costs, pros and cons, of market risk-transfer and other financial instruments in the social and economic context of developing and emerging-economy countries. We separately discuss financial risk management for households and businesses (private-sector risks) and governments (public-sector risks).

We begin by describing market and non-market financial instruments, both traditional and novel. In Section 3 we examine the range of private sector risk-financing instruments available for developing and emerging-economy countries, including traditional kinship arrangements and state-funded post-disaster assistance, weather derivatives and other hedging instruments. We emphasize the importance of national and international solidarity to assure the viability and social acceptance of these systems. In Section 4 we turn to financial risk management in the public sector. The underlying question is the amount of risk a government should retain and still avoid long-term negative implications on its citizens, growth and fiscal performance. This section presents a methodology and software for assessing the benefits and costs of pre-disaster instruments for the public sector, and suggests a role for the international community in providing

assistance to put these instruments into place. We conclude in Section 5 with a case for national and international support for financial risk management for developing and emerging-economy countries.

## 2. Risk Financing Background

Risk financing instruments can be categorized into risk transfer and intertemporal risk spreading. Risk transfer spreads and pools risks among victims and non-victims (individuals, households, businesses and governments) before a catastrophe occurs. An agent can choose to *retain* the risk to which it is exposed, or the agent can *transfer* the risk to another agent, which then *absorbs* the risk. There are both market and non-market instruments and institutional arrangements for transferring risks. Market risk-transfer instruments (for example, insurance) are pre-disaster arrangements in which the purchaser incurs a cost in return for the right to receive a much larger amount of money after a disaster occurs. Risks can be transferred to the government without the use of markets by legal or informal arrangement that obligate the government to fund the recovery of households or business after a disaster occurs. There are other pre-disaster arrangements that may not involve a transfer of risk from one agent to another, but spread risks over time. For example, persons or governments can spread risks inter-temporally through savings or catastrophe reserve funds, respectively (these instruments may transfer risk from one generation to the next).

The instruments for financing disaster risks are summarized in Table 9.1 and discussed in more detail below:

**Table 9.1 - Risk management approaches and instruments**

Approaches	Examples of Instruments
Non-market risk transfer* ( <i>collective loss sharing, ex post</i> )	Government assistance (taxes) for private and public sector relief and reconstruction funding, Kinship arrangements, Some mutual insurance arrangements, Donor assistance
Market Risk transfer ( <i>ex ante risk financing</i> )	Insurance and reinsurance, Microinsurance Financial market instruments: Catastrophe bond, Weather derivatives
Intertemporal risk spreading ( <i>ex ante risk financing</i> )	Contingent credit (financial market instrument), Reserve fund, Microcredit and -savings (coupled with microinsurance)

\*Mostly, these approaches have an ex post, ad hoc character. However, they can be considered *ex ante risk financing measures* if they are put into place, formally or informally, before the disaster.

Financial market instruments listed in table 9.1 and discussed in the following comprise catastrophe bonds, weather derivatives and contingent credit arrangements.

The ways in which catastrophe risks are transferred or losses shared are not value neutral, but they differentially transfer the risk and loss burden to family members, contributors to an insurance pool (e.g., property owners), taxpayers, future generations, and citizens/investors in other countries. Importantly, they also have differential incentives and implications for loss reduction.

### ***2.1. Non-market risk transfer (collective loss sharing)***

One of the most important non-market arrangements for transferring risks is post-disaster government assistance, which can be formally arranged before a disaster (e.g., the Italian government is statutorily required to assist earthquake victims) or arranged after a disaster in an *ad hoc* way. At the same time, acting as “insurers of last resort”, governments pool their own risks due to exposed infrastructure and other public assets across a wide geographical area. In case of an event, the reconstruction of these assets can be paid with taxpayer-money. Since governments often finance disaster losses with taxpayer funds, these collective loss-sharing practices are based on solidarity from persons not at risk. Alternatively, households or businesses facing similar risks can form a pool among themselves. Non-profit mutual insurance arrangements have a long tradition for providing crop, fire and other types of insurance. Informal kinship arrangements are another traditional coping mechanism characterized by financial or in-kind support of relatives (and neighbors) after a disaster. A family might collectively finance the migration of a child or relative to another region or country, and this relative is expected to support the family in times of crisis. Similarly, the family may diversify its livelihood, for example, by financing the education of one of its members.

While kinship is an important risk-transfer institution, governments play a key role throughout developing and emerging-economy countries, and even in high-income countries. For example, Colombia spent USD 800 million to rebuild Armenia and Perei after the 1999 earthquakes, and much of this funding went to private households and businesses. This was more than 50 percent of the direct damages (Freeman, et al., 2003). After the Sudanese floods in 1998, the state government transferred about 15 percent of the total direct costs to assisting households, businesses and local governments (Mantaye, 2000).

The picture changes little in middle- and high-income countries. Historically, the transition countries of Central and Eastern Europe have

provided substantial compensation and assistance to disaster victims. For example, after the 2001 flood on the Upper Tisza river in Hungary, the government fully financed the rebuilding of over 1000 homes that had been washed away. Moving to high-income countries, after the 1995 Great Hanshin earthquake, the Japanese government absorbed close to 50 percent of the direct losses, whereas private insurers absorbed only 2.5 percent. In the US, the average annual expenditure by the federal government for disaster assistance from 1977 to 1993 was significantly greater than the average annual loss borne by reinsurers on U.S. catastrophe coverage (Froot and O'Connell, 1999). The US federal government covered 30 percent of the losses from the 1993 Midwest floods, whereas insurance only absorbed 12 percent of these losses. In Europe, Italy stands out since the government is statutorily obligated to compensate earthquake victims 100 percent of their losses (Linnerooth-Bayer et al., 1999).

A major concern with any risk-financing system that depends on solidarity is "moral hazard", or the lack of incentives for reducing risk. It is feared that financial assistance to disaster victims, in whatever form, will encourage people to take less precaution against losses and to move into high-risk areas. Moreover, it will discourage people from purchasing insurance. If uninsured disaster victims are guaranteed post-disaster support that enables them to continue to locate their property in hazard-prone areas, and more people build in those areas, taxpayers will be subject to increasingly larger expenditures for bailing out victims of future disasters. For this reason, leading disaster experts in the United States argue for making private responsibility the guiding principle of catastrophic risk management (Kunreuther and Roth, 1998).

How relevant is moral hazard to emerging economy and developing countries? Two factors suggest that there may be a stronger case for avoiding moral hazard, which is inherent in government assistance or subsidized risk transfer, in wealthy countries than in developing countries. Rather than capital moving into high-risk areas, the main concern in poor countries or regions may be population migration out of rural disaster-prone areas to even riskier conditions, for example, rural farmers in Mexico resettling in the slums of Mexico City. Second, there are fewer risk-mitigation measures that poor households and businesses can afford, even with incentives. Alternatively, there are strong humanitarian arguments for providing pre- and post-disaster assistance to poor communities.

## **2.2. Market risk transfer (*ex ante* risk financing)**

Risk can be bought and sold like merchandise. Instruments that make these trades possible must be put into place before a disaster occurs, and thus in this paper they are often referred to as *ex ante* risk-financing



instruments. Household, businesses and government authorities, who choose not to retain their catastrophe risk, can transfer or exchange risk for a fixed price or premium. The most common of these instruments is commercial insurance, but there is a great deal of recent interest in other alternative risk-transfer instruments, such as catastrophe bonds and risk swaps. Because of emerging interest in transferring risks with market instruments in developing and emerging-economy countries, we will describe the rationale, costs and benefits of insurance and other instruments in some detail.

According to Kunreuther (1998), a risk is insurable if it meets two conditions: (1) insurers must be able to identify and quantify the risk, that is, to estimate the chances of the event occurring and the extent of losses likely to be incurred, and (2) insurers must be unrestricted (unregulated) in setting premiums. Insurers do not offer coverage for all insurable risks, since it may not be possible to specify a rate for which there is sufficient demand and incoming revenue to cover the development, marketing, and claims costs of the insurance and still yield a net positive profit. This is especially the case in poor regions or countries, but even in developed countries full insurance cover is not available for many types of disasters.

Actuarial methods were long the preferred technique for estimating risks and setting premiums (Walker, 1997). In many areas of insurance coverage, such as car accidents, insurance policies are typically underwritten on the basis of historical loss data. In these areas, financial losses are inherently predictable due to a statistical concept known as the *Law of Large Numbers*<sup>1</sup>, also known as the *insurance principle*. This means that the variance of insurance claims decreases as the number of policies increases (see Mechler, 2004). Because of the insurance principle, larger insurance companies have a comparative advantage over smaller ones; thus, in the insurance business there are economies of scale. Independence or low dependence of the risks plays a crucial role in risk transfer. If the independence condition is violated, it is important for the risk purchaser or insurance company to diversify its portfolio across regions or countries, and/or purchase reinsurance. Because of the expenses involved in diversification and reinsurance, and other difficulties, many insurers are reluctant to provide catastrophe cover.

In many respects, catastrophic risks are becoming more insurable as computer technologies provide improved methods for estimating risks and as better knowledge reduces the problem of adverse selection. Catastrophe models and other methodologies for estimating risks, however, can never yield unambiguous measures. Historical data on rare events is by definition sparse, and changing conditions require scenarios about an uncertain future world. As a case point, the IPCC concludes with a high degree of confidence that the risk of extreme weather events will increase as the climate changes.

Yet, the problem of uncertainty remains: climate scientists are currently unable to quantify the extent to which this risk is increasing, let alone provide more specific guidance as to when and how a disaster will strike. What seems clear though is that adaptation measures as envisaged in the UNFCCC and Kyoto Protocol might not be able to prevent substantial damage in developing countries (Verheyen, 2002).

Partly because of these ambiguities in the risk estimates, insurers have pulled out of some catastrophic risk markets. In the US, Hurricane Andrew in 1992, followed by the Mississippi floods in 1993 and the Northridge earthquake in 1994, and finally the events of Sept. 11, 2001, were unprecedented in the extent of insured losses. These mega-loss events threatened the solvency of a number of insurers and raised alarms that insurers may be over exposed in many regions and states. This has led to an increase in premiums on catastrophe insurance with a corresponding reduction in demand. This is not only a problem in the US, but insurance is unavailable for many types of disasters throughout emerging-economy and developing countries. In those countries, particularly low-income countries, NGOs and alternative financial institutions are exploring how to couple concepts of microfinance and microinsurance for independent risks, like illness and death, to provide microinsurance for dependent, disaster losses. Microinsurance schemes, as well as other mutual insurance arrangements, are ill suited, however, for co-variant risks that require a large capital reserve, reinsurance or wide geographical diversification. Thus, some backup scheme is necessary to guarantee the solvency of such schemes.

### ***2.3. Alternative risk transfer (ex ante risk financing)***

Recently, so-called alternative risk-transfer instrument utilizing the financial markets have become an important addition to the portfolio of financial risk management instruments as an alternative to traditional reinsurance (while households insure through primary insurers backed by reinsurance, governments generally insure through reinsurers). Prime examples are catastrophe bonds (cat bonds); these are instruments whereby the investor receives an above-market return when a specific catastrophe does not occur (e.g. an earthquake of magnitude 7.0 or greater in the vicinity of Tokyo, Japan), but shares the insurer's or government's losses by sacrificing interest or principal following the event. Cat bonds make use of different formulas to trigger compensation based on losses or on a physical phenomenon such as wind speed or precipitation. These bonds are purchased by investors and thus transfer the risk to the global capital markets.

Catastrophe bonds emerged as instruments primarily for insurers. In the early 1990s large losses from U.S. catastrophes strained the capacity of the

reinsurance markets and raised the price of reinsurance. This insurance crisis led to the development of new financial instruments to transfer catastrophe risk exposures, including cat bonds, but also to other types of index-based securities that are traded on the equity markets. For instance, the risk transfer characteristics of cat bonds can be replicated through a mechanism called catastrophe risk swaps, where the cedant (e.g., the government) makes fixed payments equal to the premiums paid in a cat bond structure against receipt of claims compensation in case losses occur. However, index-based bonds and securities have an associated “basis” risk since they may be poorly correlated with losses.

Furthermore, another interesting alternative to traditional insurance are so-called weather derivatives, which have been used by businesses and farmers to protect against harmful variations in temperature or rainfall. Contracts are written against physical indicators such as excess or shortage of rainfall measured at a certain location— a kind of lottery against the weather. As payments are triggered by these indicators, the complicated process of settling indemnity payments by insurance companies can be avoided and thus transaction costs are kept low. The downside of derivatives is usually the basis risk that is associated with linking indemnity payments to physical indicators, not to individually experienced losses.

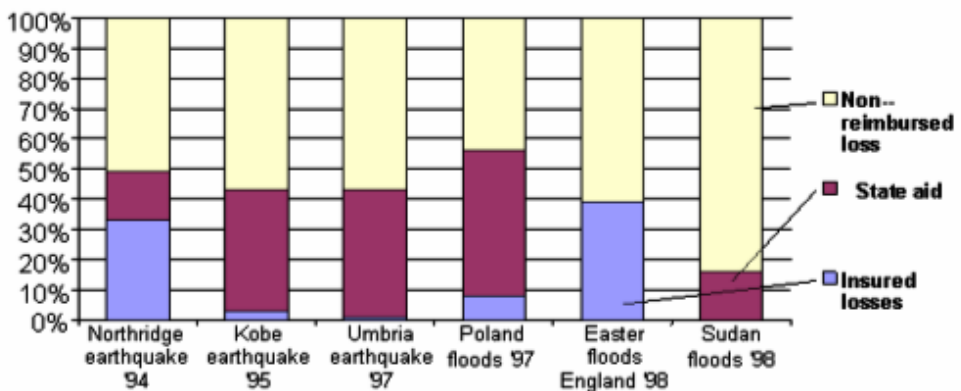
#### **2.4. Inter-temporal risk spreading (*ex ante* risk financing)**

Risk financing options can also be arranged inter-temporally to secure sufficient funding in case of need. Because these arrangements also must be put into place before a disaster occurs, they also belong to what we often refer to in this paper as *ex ante risk-financing* instruments. At the household level, inter-temporal risk spreading can be in the form of savings, and many microinsurance schemes are based on saving accounts that will be paid out if the event occurs (for example in the case of death) combined with pooling among those holding the saving accounts. Governments can also spread their risks temporally. Some regional and national governments (for example, Mexico) have catastrophe reserve funds financed by taxes, which will be used for disaster assistance and recovery. If these funds accumulate over time, this is a form of inter-temporal spreading combined with pooling among tax-payers. Borrowing after a disaster is also a form of inter-temporal spreading of the losses, since payments will be made in the future. In other words, arrangements for spreading losses over time can be made before a disaster occurs (saving) or after a disaster occurs (borrowing). The two can be combined, for example, contingent credit arrangements require a pre-event fee and a smaller post-event annuity in comparison to a regular credit.

### 2.5. Government assistance versus market-based arrangements

Most societies depend on both state and individual responsibility - on non-market and market arrangements - for distributing the losses from rare, unanticipated events, but the balance between the two varies considerably. Figure 9.2 shows six major disasters in the 1990's, which affected five OECD countries and one non-OECD. This figure illustrates the amount to which the victims retained the risks (or absorbed the losses) and the extent to which they were transferred to insurance companies and the state. In Poland, the government reimbursed around 48 percent of the estimated direct losses from the 1997 floods, which was mainly central government compensation to private victims. Notably, the US government also plays a large role in assisting victims; the losses from the 1994 Northridge earthquake were absorbed by insurance companies (about 30 percent) and governments (about 20 percent). In stark contrast, in the UK local and national governments gave practically no assistance to the victims of the 1998 Easter floods (nor did the central government give significant aid to repair local government infrastructure). The lack of government assistance resulted in only about 39 percent of the estimated losses being reimbursed, and almost fully by private insurers who claim close to 75 percent flood insurance penetration. As another contrast, and typical of low-income countries, the government of Sudan was only able to assist victims by about 15 percent of the direct losses from the 1998 floods, and there is no private flood insurance in this country.

**Figure 9.2 Losses reimbursed from insurance and government assistance as a percentage of direct losses**



Sources: Linnerooth-Bayer et al., 1999; Mantaye, 2000.

## ***2.6. Potential, benefits and costs of market-based instruments***

Only about 20 percent of global disaster losses are insured (Munich Re, 2000); the major share of catastrophe risk to households and businesses is retained or transferred to the government. Yet, the potential of insurance and alternative insurance instruments for transferring the risks of disasters to investors across the globe is high. The size of the US capital market alone is in the order of US\$ 26 trillion (Insurance Services Office, 1999), which could easily absorb the annual bill of global weather disaster losses averaging about US\$ 40 billion. In other words, the worldwide losses from extreme disasters are only a small percentage of the global capital markets, which deviate everyday by several billion dollars. This highlights the scope and potential of market risk transfer, especially for governments of poor countries that cannot form a viable insurance pool of taxpayers within their borders.

Market risk financing instruments can be extremely valuable to individuals and governments alike. In the case of severe disasters in poor countries, traditional coping strategies and government assistance for households and businesses may break down. This can have long-term consequences leading to a cycle of poverty. Likewise, if a government experiences a post-disaster financing gap, and additional funds are not available through pro-active financing strategies, its inability to continue social and economic programs, rebuild assets and assist the poor in the wake of the disaster can have severe effects to the public and the economy. These circumstances describe the case of risk aversion where purchasing market-based ex-ante risk financing instruments can be very beneficial in helping to avoid such eventualities and the longer-term adverse consequences they may cause.

The desirability of risk transfer instruments to developing and emerging-economy countries, however, cannot be determined solely by considering the benefits – it is essential to consider the costs. Most commercial risk financing arrangements incur an expected net financial loss to the purchaser (the annual costs over a longer time period are higher than retaining the risk and paying with own resources) since insurance and financial market companies are profit seeking and averse to risks that threaten their solvency. Several years ago Froot and O’Connell (1999) contended that the premium for catastrophe protection was considerably above its actuarially fair price or pure premium, mainly because insurers and reinsurers must have sufficient capital on hand to pay the bill if the rare disaster occurs. A capital reserve is costly. Additional factors that add to the costs of catastrophe cover include ambiguity or uncertainty aversion, adverse selection and moral hazard.

To conclude this section, there are many market and non-market mechanisms for transferring or spreading risks facing households, businesses and governments. First and foremost, risks can be pooled with those at risk and those who show solidarity, or they can be spread over time. These arrangements can be made by government, by communities pooling together, or through the market. Some of these financial strategies require planning before the disaster, and there has been a great deal of recent interest in pro-active *ex ante* financial tools for the private and public sectors.

In the following, we will discuss some recent experience with and comparative benefits of market mechanisms with a focus on financial market tools.

### 3. Financial Risk Management in the Private Sector

This section examines the experience and potential of risk-financing instruments, particularly those offered by financial markets, for spreading disaster risks and sharing losses accruing to the private sector in emerging-economy and developing countries. These instruments include market and non-market mechanisms for transferring risks across agents and spreading risks over time.

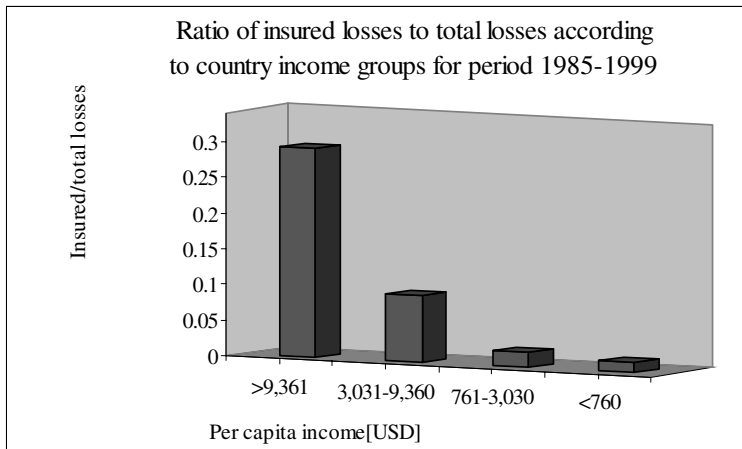
For this discussion, it is important to make a distinction between two different contexts of financial vulnerability. The first includes households or groups that can cope financially with the disaster risks to which they are exposed. This group can pay the costs of joining a pool, where each pays their expected annual losses plus administrative costs.

A second class of financial vulnerability includes persons or households who cannot pay the annual expected losses from disasters. In other words, they cannot afford the risks to which they are exposed, and they will require financial support to become members of a pool or to recover financially if a disaster occurs. The challenge for a risk-financing strategy for vulnerable countries is to combine social solidarity with affordable pooling arrangements, and at the same time promote loss prevention.

#### 3.1. Risk transfer in emerging and developing countries

Insurance density for disaster risk is highly correlated with the state of economic development measured in terms of per capita GDP. Figure 9.3 shows the differences in insurance density for four main country income groups: high, upper middle, lower middle, and lower income.<sup>2</sup>

**Figure 9.3 Catastrophe insurance density according to country income groups (per capita GDP in 2000)**



Source: Munich Re 2000: 24-25.

As we see in Figure 9.3, most disaster insurance is held by citizens or residents of high-income countries, although even in the wealthy countries insurance density is far from its potential. Less than a third of disaster losses are insured. Not surprisingly, the picture is quite different for countries outside of the high-income bracket, where insurance density drops from around a third to less than a tenth in the emerging economy income countries, and it is almost negligible (1-2 percent) in developing lower middle income and lower income countries. Furthermore, the global reinsurance market covers mainly assets in developed countries and almost none in developing. As a consequence, the financing of recovery in developing countries has often to be done after a disaster by relying on family, government, multilateral donations and emergency loans (Andersen 2001: 1).

Low uptake of commercial catastrophe insurance in the developing world is neither surprising nor disturbing. There is great scope for and appeal of pooling and transferring risks; however, commercial insurance is for the most part unaffordable for low-income households. Even if insurance is affordable and available, there are high opportunity costs in terms of providing shelter, food and other basic needs in low- and medium-income households. Affordability is not the only limiting factor to insurance uptake. The literature on insurance in developing countries (see, e.g., Andersen 2001: 39; Kreimer et al. 1999: 26; and Litan 2000: 191) points to many factors limiting uptake, including:

- high premia including high transaction costs,

- lack of formal requirements and economic incentives to purchase insurance,
- lack of formal titles to property of many individuals and firms, without which no formal proof of holdings can be established,
- insufficient risk assessment and mitigation,
- lack of awareness and understanding of the concept of insurance,
- reliance on government or international donor relief spending.

Many low-income countries are highly exposed to disaster risk, which also holds true for many low-income communities in middle-income countries. Nicaragua and Haiti in the Caribbean are exposed to hurricane, flood and landslide risks; Bangladesh faces extreme risks from sea surge and floods; Nepal is at high risk to riverine and flash flooding along with landslides; India faces significant flood and earthquake risk; and Sudan and Mozambique face severe risks from flood and drought. For the most part, residents of these countries cannot pay the price of a fair pooling arrangement, and they will inevitably require support from the non-risk communities in their own countries or internationally.

Traditionally, low-income households have protected themselves from the economic impacts of natural disasters by diversification of crops and livelihoods and through kinship risk-transfer arrangements. For example, farmers may have a variety of crops that are differentially resistant to droughts, floods, hail storms and pests. In addition, many farmers in low-income countries have two and sometimes more different sources of income, and often they encourage their children to take on different jobs in and out of the region so as to hedge against family disasters. These family arrangements can be formalized, as in Nepal, where there are clear responsibilities among members of the extended family (Gyawali, 2004). At the extreme, families deliberately place their children or other kin in distant regions or countries that will not be affected by the disaster. Woo (2001) suggests that insurers consider offering disaster policies to family members living in wealthy countries to insure them against claims by relatives struck by disasters in their home countries.

Remittances from family members living abroad to low-income relatives, even in times of no disasters, are significant and growing. Orozco (2002) estimates that remittances to Mexico and selected Central American countries increased 20-fold from 1980 to 2000. Remittances can be a significant percentage of gross national income. For example, in 2000 remittances were estimated to be as much as 25 percent of the reported GNP of Honduras, which makes remittances in this country more important than



export income. Remittances to Honduras increased by approximately 15 percent after Hurricane Mitch devastated the country in 1998.

Informal kinship practices to hedge disaster risks are far more prevalent in low-income countries than insurance. Recently, however, there has been a great deal of interest in extending microinsurance and -financing arrangements to provide financing to low-income individuals and households. The idea is to provide very low cost financing to poor households by minimizing transaction costs, overhead and profits. Microinsurance has mainly covered funeral expenses, health and more recently, death. Most participants in the microfinance movement of recent decades see themselves as improving the availability and quality of financial services to poor and near-poor clients. It is generally thought that the main providers of microfinance, usually called Microfinance Institutions (MFIs), are NGOs and a few commercial companies. Recent evidence suggests that Alternative Financial Institutions (AFIs), which include state-owned banks and postal services, member-owned savings and loan institutions and low-capital local or rural banks, may be more important than NGOs in providing microfinance services.

The following examples from India and Bangladesh illustrate the types of risk financing provided by AFIs coupling microfinance and insurance schemes. Furthermore, the case of weather derivatives is discussed.

### ***3.2. Coupling microfinance and insurance schemes***

The not-for-profit Gono Bima and Grameen Bima insurance programs for South-East Asia are operated by the Delta Life Insurance Company, which is fully licensed and regulated. The programs offer life insurance combined with microcredit, including protection against emergencies and disasters. Because they serve many clients with ensuing high transaction costs, premiums are actually higher than commercially-available insurance (which, however, is not available for poor persons). The sources of income are premium and service charges of micro-credit activities, which are invested to provide additional revenue. There are no profits or dividends accruing to Delta.

The Grameen Bank started as an experiment in Jobra village in Bangladesh with 42 of the poorest villagers. It has expanded to an institution covering 40,000 villages (out of 68,000 villages) and 2.4 million active micro entrepreneurs. Today, 494,044 groups comprise 67,691 centers under 1149 branches in 60 districts (out of 64 districts). The initial disbursement of Taka 856 (US\$26) has expanded to a cumulative disbursement of Taka 124,035 million (US\$3 billion). Among other types of insurance, the Grameen Bank offers two saving funds: the Group Fund and Emergency Fund. The

Emergency Fund covers the death of the member and has developed into a solid insurance plan for the poor. There is no explicit premium to be a member of the fund. Rather, payments to the fund are bundled with the interest paid on loans. As of November 1995, the fund is self supporting, and the Grameen Bank has discontinued collecting contributions from members for the Emergency Fund (Barual, 2004). Table 9.2 compares institutional arrangements of Grameen Bima and Gono Bima with those of commercial insurance companies and NGOs.

These programs, however, have not met the social-welfare objectives set out by their founders. Most current policyholders are middle class; only 5 percent of policyholders come from the poorest or have-nots. The reason is that without any subsidization, the poor are unable to afford the premium.

GHASHFUL, a small NGO MFI based in Chittagong City, Bangladesh, created a life insurance product for the people in slum dwellings. According to the NGO, their product is the least expensive form of life insurance protection available in the area. Coverage is limited to female members, who are clients of the GHASHFUL savings and credit program. The program operates with a small initial charge (5 Taka) and a monthly premium (10 Taka). The NGO reserves the right to increase or modify the premium rates, especially in exceptional cases, such as a large number of deaths due to disaster or epidemics. The organization maintains a cash reserve equivalent to 8 percent of the total loan outstanding for cash liquidity needs, including the payment of death claims, which range USD 100-200. The advantage of the program is its accessibility to low-income slum dwellers. In 2000, GHASHFUL had 1,955 policy holders. The program has been criticized for its lack of reinsurance exemplifying the considerable danger of small grassroots programs operating insurance schemes, which can be overwhelmed with claims in the case of a major disaster (Mamun, 2000).

### ***3.3. Weather derivatives***

Another interesting alternative to traditional insurance are so-called weather derivatives, which can protect farmers against droughts, storms and other extremes.<sup>3</sup> Contracts are written against, say, severe rainfall shortages measured at a regional weather station. The contract is sold in standard units by banks, farm cooperatives or microfinance organizations, and the “premium” varies from crop to crop. The claim is a pre-fixed amount per unit of protection— a kind of lottery against the weather. By keeping it simple, the transaction costs are reduced.

**Table 9.2 Comparing institutional arrangements for microcredit and microinsurance for Grameen Bima and Gono Bima with commercial insurance companies and NGOs.**

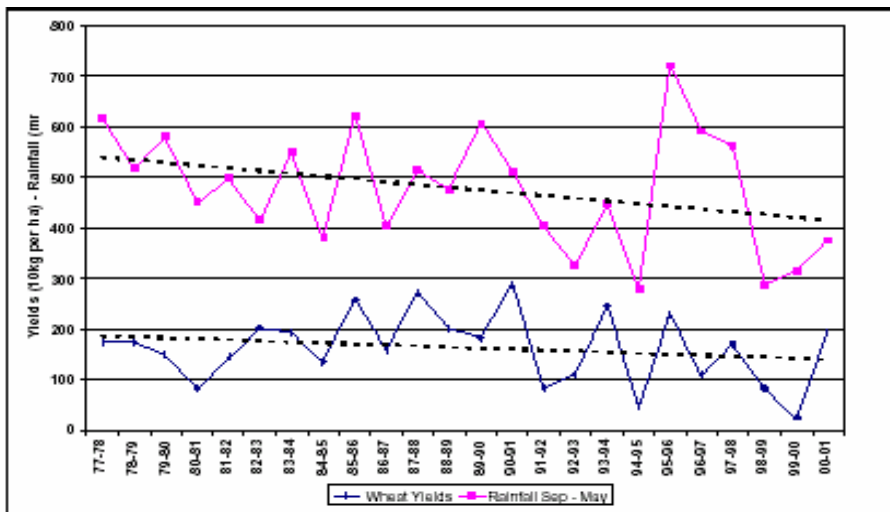
Commercial Insurance Companies	Not-for-profit Grameen Bima and Gono Bima
<p>The goal is profit Private owners take dividends Mainly dependent on commission based agent for collection of premiums Unspecified working area for agents. They are allowed to insure people and collect premium from any part of the country There is no limit to the sum assured. Clients are comparatively wealthier Policies are sold mainly to individuals and the relationship between policy holder and institution is purely commercial.</p>	<p>Profit is the means. The goal is socio-economic security for the have-nots and low income people Owners do not take dividends. All profits are invested in the improvement of the program and partially distributed among policy holders as a bonus Recruit officers and organizers who have a fixed salary Sum assured is limited (Taka 5000 to Taka 50,000). Clients must be low-income group or have-nots. Trying to organize the target group with an aim to build up self reliance and a welfare program</p>
NGO	Not-for-profit Grameen Bima/Gono Bima
<p>Well established institutions with reputations Mainly dependent on grants Employees are not local Insufficient levels of decentralization Lack of adequate transparency Have provisions for limited death security Avoid local leadership</p>	<p>Comparatively new and experimental products No international or domestic grant support Almost all workers are local Move towards a decentralized system that is simple with high levels of transparency Operated with participation of policy holders Insurance activities play a dominating role in the program Local leaders are welcome to participate in motivating anti-corruption measures</p>

Source: Adapted from Ahmed and Mosleuddin (2000)

In India, such a scheme has been recently implemented on a pilot basis by the government-owned Agriculture Insurance Company of India in collaboration with the rural credit banks (Agriculture Insurance Company of India, 2004). The main reason for initiating this program was that the existing public crop insurance program supplied by the National Agricultural Insurance Corporation of India for drought and flooding had been highly deficitary in recent years. Premium income had been only a sixth of total payouts, mainly due to the high costs associated with settling indemnity payments on a case-by-case basis. Another concern was the time lag associated with indemnity payments. Farmers place great emphasis on timely payouts. For example, if seedlings are lost at the beginning of the growing season, and capital is not available for replacement investment, the whole crop will be lost.

For these reasons, index-based weather derivatives with low transaction costs were introduced. Transaction costs are kept low by involving existing rural credit channels. Payouts are triggered by excess or lack of rainfall defined by a rainfall index, which eliminates the need to assess claims after the disaster. Generally, farmers are aware of the associated basis risk. On average, the costs of the derivatives amount to around 15 percent of the “insured property”. However, farmers value the proposed quick payout of claims, which is planned to take a maximum of two weeks after the triggering event. Furthermore, such a scheme provides incentives for prevention. As the payouts are not coupled with the individual loss experience, it will be beneficial to engage in loss-reduction measures (eg switching to a more robust crop variant). As the scheme has been only recently introduced, the number of contracts written is still low, and there is little experience to assess its viability. However, it is planned to expand the system to a large number of provinces in India affected by drought and flooding.

**Figure 9.4 Correlation between physical and economic variables in Morocco**



Source: Rainfall DMN, Yields DPAE

Source: Stoppa and Hess, 2003.

Similar schemes have been proposed or are currently being examined for Morocco and Ethiopia (see Stoppa and Hess 2003). The research experience in Morocco suggests the possibility of avoiding basis risk by constructing a hazard-index that is highly correlated with the agricultural

product. In the case of Morocco, the following time series for cumulated rainfall and wheat yields through September to May for the years 1978 to 2001 measured at one station were reported. As shown on figure 9.4, from 1977 to 2001, there clearly is correlation between wheat yield and rainfall during the growing season of November to May. However, when measured it amounted to 67 percent, a value for which basis risk would still be substantial. When focusing and establishing weights on certain growth phases, as well as limiting the measurement of precipitation to only water that can be stored and used, an improvement in the index correlation to 95 percent with wheat yields was achieved (Stoppa and Hess, 2003).

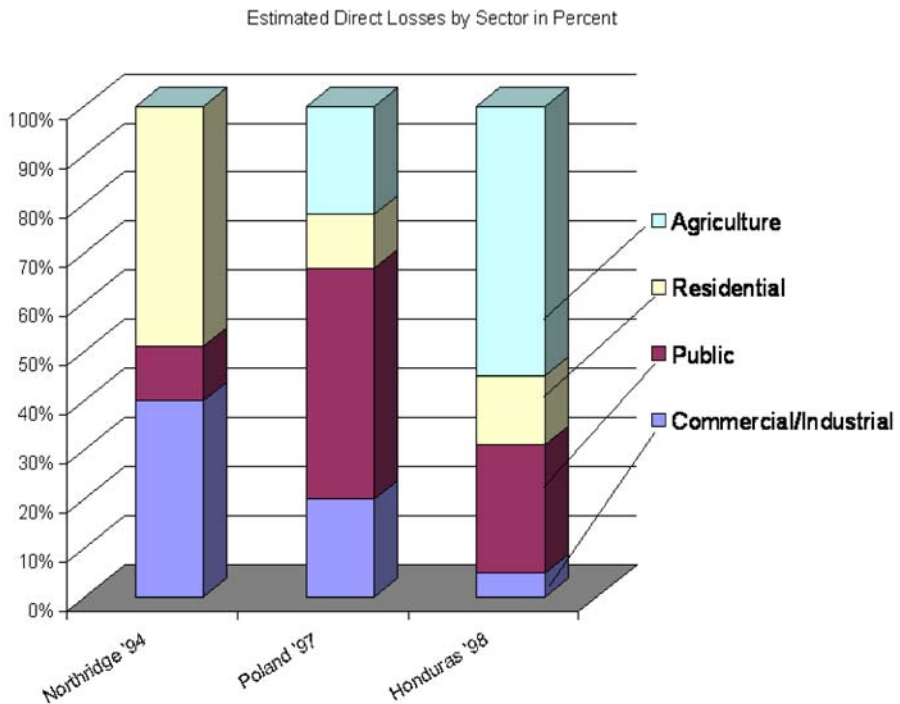
However, as discussed already, a major constraint to this and any micro scheme for providing disaster finance is the dependent nature of the insured risks within a single region. When an event occurs, the provider may not have the capital to cover the dependent claims. For this problem, micro scheme providers could make use of reinsurance, or of catastrophe bonds that spread the risks internationally. Many consider the use of alternative instruments an exciting new opportunity to pool large volumes of dependent risks at the global level, and they point out that these instruments have already been successful to spread insurers' risks. However, as pointed out above, there is a substantial cost associated with these instruments that may make these schemes unaffordable without assistance from international donors. In many vulnerable countries, there is increasing recognition that national programs must be developed that will effectively and fairly link private and public responsibility, insurance and loss mitigation (Kunreuther and Roth, 1998). The uneven distribution of income in these countries raises the issue of risk financing as a distributive mechanism, invoking social solidarity with low-income groups. At the same time, it raises the possibility of imposing greater personal responsibility on the wealthier members of society, encouraging more personal and local risk-reducing measures.

#### **4. Financing Disaster Risk in the Public Sector**

Throughout the world, the public sector retains a large proportion of catastrophe risk from naturally occurring disasters resulting from two main roles of government: the allocation of goods and services not provided by the market and the distribution of income (Peffekoven 1992: 487 ff.). Public economic infrastructure is a typical example of the allocative function of governments, and many governments carry a large portfolio of capital exposed to risk. Figure 9.5 compares infrastructure, agricultural, residential and commercial losses from three recent disasters. As shown in this figure, the share of public-sector losses was about 10, 45 and 20 percent in a developed country (1994 Northridge earthquake, U.S.), a transition country (1997 Polish floods) and a developing country (1998 Hurricane

Mitch, Honduras), respectively. In the case of Poland, losses to public infrastructure were significant, around 2 percent of GDP of that year. Since earthquakes generally cause more destruction to roads, schools, electric lines and other public infrastructure than floods and windstorms, these differences might be even more pronounced were we comparing over the same type of disaster. The important message is that, especially in developing and transition countries, the public sector can bear a large proportion of the direct economic losses from natural disasters, thus resulting in significant post-disaster government liabilities.

**Figure 9.5 Direct losses borne by economic sectors for three natural disasters**



Source: Adapted from Linnerooth-Bayer, et al, 1999

As discussed, governments also have a role in distributing burdens in society. Government's liabilities for redistributing losses, or assisting households and businesses, can be considerable. Around 29 percent of the USD 6.2 billion direct losses from the 1993 mid-west floods in the US were reimbursed by federal and state government assistance. In comparison, the

National Flood Insurance Program (NFIP) only paid out about half, or around USD 1.3 billion in claims, which amounted to about 14 percent of the direct losses to households, businesses and farms. As another case, after the catastrophic flooding on Hungary's Upper Tisza river in 2001, the government fully rebuilt nearly 1000 houses that had been washed away. This kind of taxpayer solidarity with flood victims is typical of all the formerly socialist countries of Central Europe. It is also typical of Latin American countries, many of which provide a great deal of state support to households and businesses following a disaster (Freeman et al, 2003).

Governments thus absorb and spread losses by acting as "insurers of last resort". Because of their ability to spread and diversify risks over a large population, Priest refers to governments as "the most effective insurance instrument of society" (Priest 1996: 225). This function allows governments to redistribute income to those members of society that are in need of post-disaster assistance. Government subsidies in the form of post-disaster assistance are criticized as promoting more development in high-risk areas, but in developing countries this assistance may be essential to the survival of poor households and businesses that cannot afford commercial insurance.

Many governments in developing and emerging-economy countries have difficulties raising the capital necessary for reconstruction of public assets and for their role as insurer of last resort. In this section we examine the arguments for and against *ex ante* market financing instruments to finance risks to the public-sector, or sovereign risk financing. We discuss the theory and practice, and conclude with the costs and benefits of *ex ante* financing instruments.

#### ***4.1. Reducing public sector catastrophe risk***

A government has again two options for financing its post-disaster obligations. The first, and most common, is to rely on *ex post* disaster financing sources. For highly exposed countries, the strategy of raising necessary capital after the disaster has the risk that a disaster might overwhelm the government's available resources for financing recovery. The second option, sometimes referred to as sovereign risk transfer, is to arrange *ex ante* risk financing before an event occurs, usually through market risk-transfer instruments and inter-temporal risk spreading. Some combination of *ex ante* and *ex post* financing instruments is essential for aiding recovery. *Ex ante* instruments will help in guaranteeing a sufficient and timely financing of government's post disaster obligations, but they entail additional costs to reward investors for absorbing the risks. The question we turn to below is how to balance the portfolio of financing options. We begin by describing *ex post* and *ex ante* financing instruments in more detail.

#### 4.1.1 *Ex post financing instruments*

*Ex post* financial instruments are arrangements whereby the government taps its funding sources after the event occurs. In the aftermath of a disaster, the government can divert funds from current budgets or internationally financed projects, borrow by issuing bonds or other debt instruments, raise taxes, or accept international bank loans. We discuss each in turn:

- *Diversions from other items in the public budget,*

Governments throughout the world resort to diverting funds from budgeted items to cover their post-disaster liabilities. This is a rational alternative if the return on the diverted funds is less than the interest on the debt, and some governments have even legislated this response as priority. For example, after the 2001 floods on the Tisza river, the Hungarian government discontinued construction on an extension of the Budapest subway system in order to divert funds to disaster relief and reconstruction (Linnerooth, et al., forthcoming);

- *Diversions from internationally financed project*

In the developing countries, these diversions are often from international loans for infrastructure projects. Whereas this response may be the least costly one for the government, it can be disruptive both economically and politically. The World Bank and other lending organizations are therefore interested in reducing the post-disaster liabilities of poor governments by encouraging sovereign risk transfer.

- *Internal borrowing*

Debt instruments, which partly pass the burden on to future generations, are a common post-disaster financing option, particularly for countries with a high credit standing or bond rating. The government can borrow either domestically or on the foreign market. For instance, after the 1997 floods Poland raised all its needed capital domestically; alternatively, Honduras relies on foreign borrowing. A government can also raise funds through a credit from the national bank if it has sufficient reserves, or, alternatively, it may use its foreign reserves, print money, or borrow by issuing bonds. International financial institutions warn indebted countries of the dangers of relying on debt instruments and especially foreign reserves and printed currency.

- *External borrowing*



Governments in developing countries often rely on loans from the World Bank and other multilateral finance institutions (MFIs). The World Bank estimates that it has provided grants and loans of more than US\$ 38 billion to developing countries over the last two decades for disaster relief and recovery (Gurenko, 2004; Gilbert and Kreimer, 1999), and the Asian Development Bank also reports large loans for this purpose (Arriens and Benson, 1999).

- *Taxes*

Governments can collect special catastrophe taxes or increase taxes. For example in Germany the tax reduction planned prior to the Elbe flooding in 2002 was postponed and the extra revenue was used for private sector compensation and public sector reconstruction. Alternatively, if a new tax year is approaching, government officials can raise the tax rate as was the case in Austria after the 2002 floods. A new tax has the disadvantage of large transaction costs for its implementation, and the funds will not be immediately available.

- *International assistance*

International donations, especially for highly publicized disasters, are an important source for bolstering the government's relief and reconstruction budget, yet donor aid is relatively small and declining (Linnerooth-Bayer and Amendola, 2000). Still, the donor community is concerned that international donations and loans for post-disaster reconstruction are taking an increasing portion of declining official development assistance (Mechler, 2004).

Most governments rely on *ex post* non-market instruments to finance their obligations from disasters. This reliance is not a problem in large, wealthy countries. For example, the US federal government with its vast base of well-to-do taxpayers absorb up to 90 percent of state and local government infrastructure losses from major disasters (Linnerooth-Bayer and Amendola, 2000). A problem in developing countries, and a major limitation of the current *ex post* approach to disaster funding, is the growing discrepancy between the extent of reconstruction funds available from taxes, the international community and other internal sources and the growing funding needs of disaster-prone countries. Government fiscal constraints often limit the capacity to raise capital from the budget or printing money. As a consequence, governments may resort to diverting funds from development projects or from other government programs, or to increased borrowing and national debt.

### 4.1.2 *Ex ante market-based financing instruments*

If the government chooses not to bear the full risks from disasters, it can spread its risk temporally by setting up a reserve fund or transfer its risk by paying a third party to absorb it. There are many forms of temporal spreading and risk transfer, some of the more common are listed below:

- A catastrophe reserve fund usually financed by tax revenues.

To reduce their dependency on debt financing, many countries have put into place a catastrophe or calamity fund. For example, the Mexican catastrophe reserve fund, FONDEN, was set up to smooth the volatility of economic activity after natural disasters (World Bank, 2000). Costa Rica, Nicaragua and Honduras also have or intend to create national funds (Charveriat, 2000). This financing option differs importantly from a post-disaster tax, which has the added disadvantage of high administrative costs. A catastrophe fund has a cost equal to the foregone return from maintaining liquid capital and an additional benefit in having the resources immediately available with less transaction costs. A major problem with a fund, however, is that it may not be able to supply sufficient capital, especially if the disaster occurs shortly after its creation. A second problem with a catastrophe fund is the political risk that it is diverted for other purposes in years with no disasters.

- Commercial insurance

As discussed, the most common forms of risk transfer are insurance or reinsurance, which provide indemnification against losses in exchange for a premium payment. For example, after the 1997 floods in Central Europe, the Czech Republic insured its infrastructure losses through a commercial reinsurer. Pricing of catastrophe insurance is very volatile, and this option may be significantly more costly than *ex post* financing instruments.

- Catastrophe bonds and other alternative insurance instruments

Catastrophe bonds pay high yields, but interest and/or principal may default if a specified catastrophe event happens during the lifetime of the bond. Funds from placing these bonds in the capital markets are usually invested in risk-free financial instruments. Catastrophe bonds are the most popular the group of alternative risk transfer instruments; this group also includes exchange traded catastrophe options, weather derivatives, catastrophe equity puts and catastrophe swaps. Catastrophe bonds are rather new and have until recently been issued only by insurance companies. Recently, the

Taiwan Residential Earthquake Insurance Pool, a publicly backed insurance scheme for private property, has placed a catastrophe bond on the market. Also Mexico is currently investigating whether to issue a cat bond for FONDEN liabilities.

- **Contingent credit**

In exchange for an annual fee, a contingent credit arrangement grants the purchaser the right to take out a specific loan amount post-event that has to be repaid at contractually fixed conditions. As mentioned in section 2, contingent credit options spread risk temporally.

Table 9.3 summarizes the most important *ex ante* and *ex post* financial instruments available to governments to assure sufficient funds for their post-disaster needs.

**Table 9.3 Ex ante and Ex post financing sources for assistance and reconstruction**

Ex ante	Ex post
Reserve fund	Diversion from budget and international loans
Commercial Insurance	Taxation
Catastrophe bonds and other alternative Risk transfer instruments	Central Bank credit
	Foreign reserves
	Domestic bonds and credit
Contingent Credit arrangements	Multilateral borrowing
	International borrowing
	Aid

Sources: Benson 1997, 1999; Fisher and Easterley 1990.

#### ***4.2. Should governments undertake risk financing for catastrophe risks?***

The case for insurance instruments and other means of transferring or spreading public-sector risks is not a clear one. In fact, economic theory argues against public-sector risk transfer. However, we conclude that the theory may not hold for highly exposed developing and emerging-economy countries if the government faces constraints in raising sufficient capital after a disaster to meet its post-disaster obligations. In this case, it will be important to examine the costs and benefits of public-sector insurance and alternative insurance instruments.

#### 4.2.1 *The theory and its implications*

The insurance premium or costs of risk-transfer instruments will generally be greater than the purchaser's statistical expected losses. This is due to transaction costs, cost of capital reserved by insurance companies for potential losses, as well as the financial return required for absorbing the risks. Still, people buy insurance, and justifiably so, because of their aversion to large losses, ie, their concern about the volatility of the possible outcomes. Insurance and other risk-transfer instruments are thus justified by the concept of risk aversion. It is because of aversion to large losses that people are willing to pay for insurance.

In contrast to many individuals, governments are not, in theory, risk averse, and, therefore, in most circumstances should not purchase insurance or other market risk-transfer instruments. This is the result of a well-know theorem by Arrow and Lind (1970), who give two reasons for the risk neutrality of governments: risk spreading and risk pooling through diversification.

*Risk spreading:* Arrow and Lind (1970) show that if the government spreads its risk over its citizens (most notably by means of taxation), the expected and actual losses to each individual taxpayer are minimal due to the sheer size of the population. They state, that

*[...] when risks associated with a public investment are publicly borne, the total cost of risk-bearing is insignificant and, therefore, the government should ignore uncertainty in evaluating public investments" (Arrow and Lind 1970: 366).*

A government can be compared to a wealthy individual engaging in small bets, who is not averse to the largest conceivable loss (Reutlinger 1970: 51). The Arrow-Lind theorem is largely accepted as the theoretical underpinning for governments dealing efficiently with risk (see Little and Mirrlees (1974: 316), and leads to the conclusion that governments should not purchase catastrophe insurance or other risk-transfer instruments.

*Risk pooling through diversification:* The government's relative losses from disasters in comparison with its assets may be small if the government possesses a large and diversified portfolio of independent assets. Depending on the size and diversification of its portfolio, public sector disaster losses may be independently distributed. This means losses will not deviate substantially from expectations, or statistically speaking, they will converge to the mean with little variance. The *Law of Large Numbers* states that for a series of independent and identically distributed variables the sample mean over the variables converges to the theoretical population mean of the probability distribution and thus the variance around the mean decreases for

large numbers (Kunreuther 1998: 24). It follows that by pooling independent or uncorrelated risks to government assets, a government is able to reduce the variance around the probability mean. If the government's portfolio of independent assets is very large, this is then another justification for risk neutrality.

Because of these conditions for risk neutrality, Arrow and Lind (1970:366) argue that "[...] the government should behave as an expected-value decision maker" and thus not purchase insurance or otherwise engage in risk transfer. Avoiding the extra costs involved in risk transfer, governments can be considered the entity best suited to deal with disaster risk (Arrow and Lind 1970: 364). In practice, most governments assume catastrophic risks themselves (Guy Carpenter 2001: 39-40), thus implicitly or explicitly they behave as risk-neutral agents.

Stated simply, local, state or national governments are not advised to incur the extra costs of transferring their disaster risks if they carry a large portfolio of independent assets and/or they can spread the losses of the disaster over a large population. We argue below that these conditions, and thus the Arrow-Lind theorem, are not fully relevant for many highly exposed developing countries. In the following section, we argue further that developing and emerging-economy governments should under very special circumstances consider pro-active risks transfer strategies. Because there are costs to these strategies, and because they violate the Arrow-Lind theorem, we will examine the two conditions underlying this theorem in more detail below.

#### *4.2.2 Relevance of the theory to developing and emerging-economy countries*

The conditions leading to government risk neutrality may not hold for highly exposed developing and emerging-economy countries, in which case government officials might consider pro-active risk-transfer strategies. We examine each of the two conditions in turn:

*Risk spreading:* in smaller developing countries the tax base is often too narrow to spread risk sufficiently. In other words, a small and poor population may not be able to collectively absorb the losses from a catastrophic disaster through additional tax payments. Of course, raising taxes is not the only way governments pay for disasters. As discussed in Section 3.3, the government can also rely on diverting funds, on domestic and international borrowing, and international assistance. What distinguishes a developing country from a developed country is that developing country officials may be severely constrained in raising capital in the aftermath of a disaster.

*Risk pooling through diversification:* This second condition will also not apply in a small, developing country, where the national or state government has a far smaller and less diversified portfolio of assets (Brent, 1998). Moreover, in a small country or region these assets will be in close proximity, and thus the risk is correlated (not independent, sometimes referred to as covariant risk).

In sum, developing and emerging-economy countries that meet these conditions may be justifiably risk averse to catastrophic events. This is the conclusion of the Organization of American States, which has many members from the developing world that are highly exposed to natural disasters. In the OAS primer on natural disasters, it is stated:

*In view of the responsibility vested in the public sector for the administration of scarce resources, and considering issues such as fiscal debt, trade balances, income distribution, and a wide range of other economic and social, and political concerns, governments should not act risk-neutral (OAS 1991: 40).*

The conditions that might lead countries to consider transferring their public sector risk through insurance and other instruments are (see Mechler 2004a):

- high natural hazard exposure;
- low tax revenue, low domestic savings and shallow financial markets, high indebtedness with little access to external finance;
- few large infrastructural assets and high geographical correlation between those assets; and
- concentrated economic activity (e.g. large urban agglomerations) exposed to natural hazards.

This does not necessarily mean that under these conditions state or national governments should purchase risk-transfer instruments. It is important to consider the government's ability to retain risks of different severity, as well as the opportunity costs of investing in pre-disaster mitigation and risk transfer. In other word, in developing a risk-financing strategy it is important to examine the government's financial vulnerability and the costs/benefits of reducing this vulnerability.

### **4.3. Developing a pro-active risk financing strategy**

In the words of a leading World Bank expert, any *ex ante* risk financing strategy should be based on “an in-depth understanding of a country's risk exposure, a thorough analysis of the potential benefits of mitigation efforts,

and cost trade-offs between different types of risk-financing instruments, and last but not least, on assessing the country's internal financial capacity to retain the risk" (Gurenko, 2004:xxii). This advice for developing a proactive, country level risk-financing strategy underlies the approach described in this section, and which is embedded in IIASA software to assist policy makers in financial planning. Importantly, in our interpretation of this advice, the risk-financing instruments include traditional post-disaster measures for raising capital. We begin by assessing a country's internal financial capacity to retain risk, or its financial vulnerability. We then illustrate the IIASA software with reference to Honduras.

#### *4.3.1 Financial vulnerability and the financing gap*

Financial vulnerability can be defined as the risk that a local, state or national government will not have sufficient funds, either from domestic or foreign sources, to meet its post-disaster obligations for financing reconstruction investment and relief. We refer to this lack of sufficient funds as a financing gap.

A Financing gap is the difference between a government's loss potential and the amount of internal financing resources available to finance the recovery

Post-disaster financing gaps are frequently encountered in developing countries. For example, after the devastating earthquake of 2001 in Gujarat, India, there was a significant shortfall between the state government's planned expenditure, planned funding sources and the actual funding made available.

The Gujarat government estimated its post-disaster liabilities, or expenditure for reconstructing infrastructure and housing, at 2.4 billion USD, and planned funding from the state, from central reserve funds, and multilateral and bilateral financial sources was estimated at 3.6 billion USD. However, actual funding received by end 2002 amounted to only 0.7 billion USD. The state government faced a financing gap of 1.7 USD (World Bank 2003).

### 4.3.2 *Estimating financial vulnerability*

What is the risk that Honduras, or any exposed country or region, will experience a financing gap in the near future? This question has recently received a great deal of attention at the World Bank (see Pollner, et al, 2001), the InterAmerican Development Bank (see Keipi and Tyson, 2002) and other international financial institutions. The risk will depend on two factors: (1) the probability of public-sector disaster losses of different magnitudes (risk exposure), and (2) the ability of the government to meet its post-disaster liabilities. IIASA has developed a computer tool (CATSIM) to estimate these two factors, and, thus, to estimate a government's financial vulnerability (Hochrainer et al., 2004).

#### **Assessing Honduras' Financial Vulnerability: The CATSIM Tool**

Combining Honduras' loss probability with the government's ability to absorb the losses yields a picture of the government's financial vulnerability. IIASA's CATSIM model has illustrated the financial vulnerability of Honduras as shown in Figure 9.A.3 in the Annex following this chapter.

Governments of OECD countries can also experience financing gaps. In Poland, as a case in point, the infrastructure losses from the 1997 floods amounted to over 2 percent of GDP, and it was estimated that due to lack of funds it would be several years before all the roads and bridges were repaired (Kunreuther and Linnerooth, 2000).

### 4.3.3 *Importance of reducing financial vulnerability*

If a government experiences a financing gap after a disaster, its inability to continue social and economic programs, rebuild assets and assist the poor in the wake of the disaster can have severe effects on the public and the economy. The failure to repair public infrastructure, including roads, railways, electricity lines and water supplies, in a timely way can be economically devastating. First, there is a direct link between infrastructure and poverty since disasters can reduce access to sanitation, electricity and clean water, all indicators of poverty (Freeman, et al, 2002a). At the macroeconomic level, infrastructure is critical for economic growth and development. Moreover, if foreign investors anticipate long-term business disruptions from damaged infrastructure, they may not locate in disaster-



prone countries. All these factors underline the criticality of a timely repair of public infrastructure following a disaster.

International financial institutions are greatly concerned about the dependence of highly exposed, developing countries on post-disaster capital grants from large international donors and international development banks. This prevents them from seeking alternative market sources of risk financing because of their considerably higher cost. A major limitation of this *ex post* dependency, according to Gurenko (2004:xxiii) is the growing discrepancy between the amount of reconstruction funds available from the international community and the growing funding needs of disaster-prone countries:

*As a consequence, governments tend to resort to diverted development loans, which often have onerous procurement rules, or additional external borrowing to fund reconstruction.... To reduce the funding/capability gap, the government fiscal exposures and the vulnerability of national economies to exogenous risks, the existing international system of post-disaster financing should be redesigned to provide stronger fiscal incentives for governments to adopt more proactive approaches to risk management and resort to market funding mechanisms.*

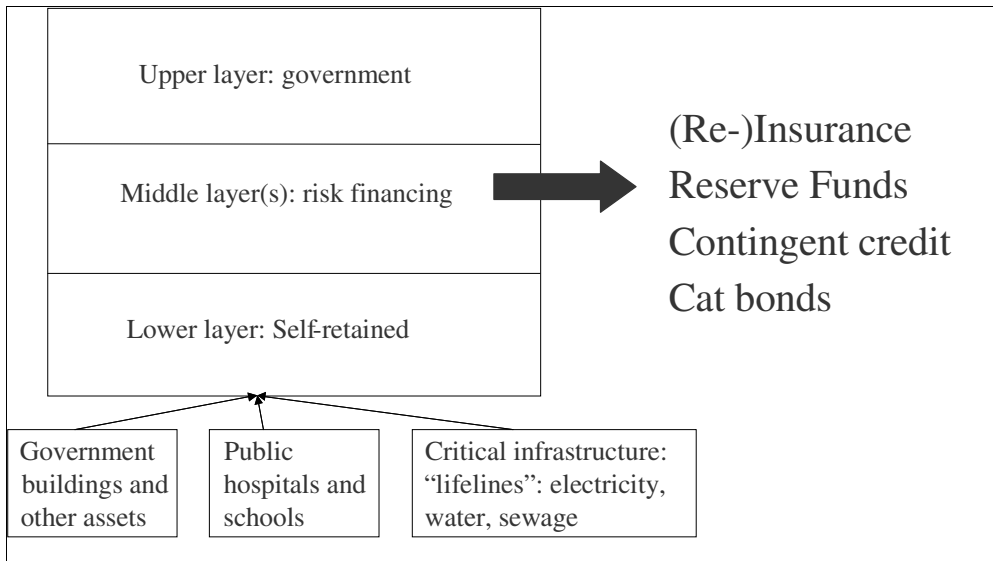
It is important to add that not only can poor governments not afford post-disaster reconstruction costs, but they also cannot afford the costs of market funding mechanisms. This may call for shifting disaster assistance from the current post-disaster approach to supporting pre-disaster mitigation and financing strategies.

#### ***4.4 Reducing financial vulnerability with ex ante risk financing instruments***

The risk of a financial gap, or financial vulnerability, can be reduced by the purchase of *ex ante* risk financing instruments. Typically these instruments are put into place to finance a layer of the government's risk. Schematically, such arrangements could look as proposed for the Caribbean as shown in Figure 9.6. The proposed regional structure shown in this figure is a government risk pool for infrastructure and other public assets. A unique feature of this system is that public assets of neighbouring governments are included, increasing the size of the pool (increase in bargaining power) and rendering it more diversified. Under this arrangement, the lowest risk layer (with events occurring more frequently - up to 10 years) would be self-

retained by the government(s), whereas risk financing would cover the middle layer. Since it is generally very expensive or difficult to purchase risk financing for the very extreme losses, the uppermost layer often remains uncovered. Whatever form the risk-transfer contract takes, it is important to examine its pros and cons – costs and benefits - to the government.

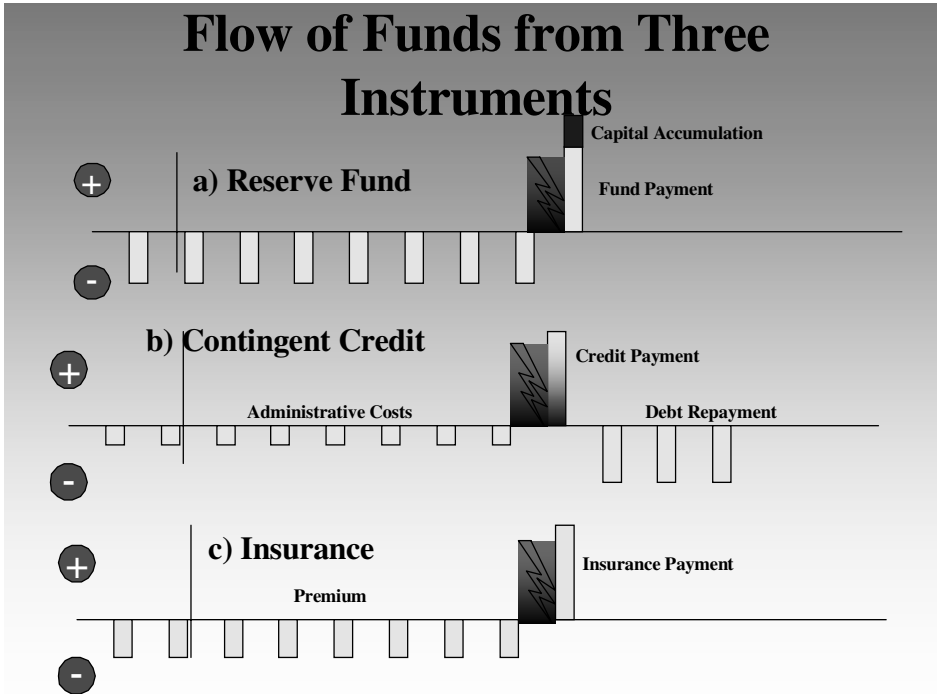
**Figure 9.6 Proposed risk transfer structure for public assets**



Source: Based on Pollner, 2000.

#### 4.4.1 Pros and cons of ex ante financial instruments

*Ex ante*, risk-financing instruments - reserve funds, contingent credit arrangements, commercial insurance and catastrophe bonds - can be compared on several criteria, including their costs, their respective benefits after a disaster occurs, and the types of incentives they create for loss mitigation. These comparisons are summarized in Table 9.4.

**Figure 9.7 Financial streams of three ex-ante financing options**

*Costs of instruments:* The costs of these instruments are distributed over time in different ways. Figure 9.7 illustrates the different flows of capital before and after disasters with each of three *ex ante* instruments (the figure does not show cat bonds, which has the same profile as insurance). As we see from this figure, a reserve fund requires moderate public outlays before the disaster, which is used to meet the government's obligations after a disaster occurs. There is a misnomer that reserve funds have no cost. Indeed, the opportunity costs of keeping large amounts of capital liquid can be significant. Contingent credit arrangements require smaller expenses on the part of the government before an event; however, large debt service payments will be necessary in the case of a disaster (in this example for an assumed maturity of 20 years, after the grace period 56 million USD (in constant terms) will have to be paid annually in debt service installments). Insurance has the highest annual costs, but provides guaranteed loss indemnification for the risks insured and has no consecutive costs in terms of debt service payments. However, unlike the reserve fund, if no disaster occurs, the government will have no claim on the residual capital. If there is no disaster, the opportunity cost of reserve funds is only the interest

foregone on the resources invested in the fund, whereas for insurance and contingent credit these costs comprise the full premium or fee payment.

*Post-disaster benefits:* A reserve fund has the advantage that it is not automatically depleted after a disaster, but any residual capital accumulation remains in the fund. It relies on domestic financing and, therefore, does not transfer the losses into the international capital markets (of course, the latter comes with a cost). Insurance has the advantage of predictable loss indemnification, but in comparison with the other instruments insurance claims may be delayed due to the time needed for assessment.

*Incentives for mitigation:* A disadvantage of all *ex ante* instruments is moral hazard since governments may be less disposed to invest in mitigation if funds are available after a disaster. This is most serious with respect to insurance, but can be mitigated with the inclusion of a deductible. Catastrophe bonds may have several advantages: First, they avoid the “load” of insurers (which can be over and above the transaction costs and return on risk absorption), and, second, if there is a physical trigger (for example, payment on the bond is triggered by the intensity of the earthquake and not the losses), there is an incentive for the government to reduce the losses.

*Political and other risks:* Reserve funds are frequently diverted for other uses if a disaster has not occurred over many years. The risk of depleting the reserves can be high, particularly in capital-scarce economies where the accumulated capital in the fund stands in competition with other social projects. In addition, after many years without major disasters politicians become reluctant to continue contributions to the fund. (Freeman et al. 2003). A similar risk faces purchasers of insurance and contingent credit arrangements, which are subject to re-insurer or financial agent insolvency. Finally, the payments from catastrophe bonds with a physical trigger, if a disaster occurs, may be uncorrelated with the losses. If, for example, precipitation is the trigger, this may or may not lead to flooding in the designated area.

The IIASA CATSIM tool has the capability of calculating the cost efficiency of *ex ante* instruments for reducing the risk of a financial gap. Of course, these calculations depend critically on the current prices of the instruments, including insurance premium and interest rates, as well as the assumptions underlying calculation of the risks. For this reason, the CATSIM tool is interactive, allowing the user to change parameters and assumptions. Based on one set of parameters and assumptions, Figure 9.8 illustrates the efficacy of three measures – insurance, a reserve fund and mitigation – for reducing Honduras’ risk of a financing gap (Mechler and Pflug 2002)<sup>4</sup>.

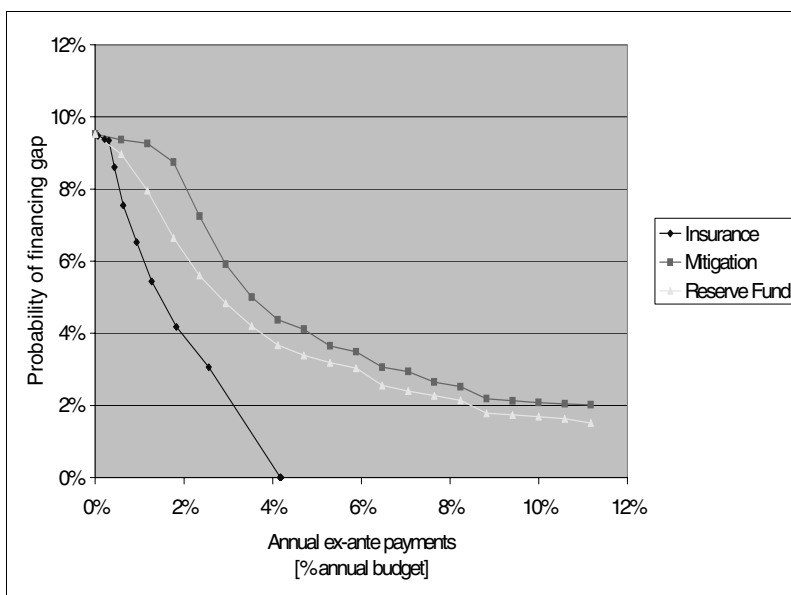
**Table 9.4 Pros and Cons of Ex-Ante Financing Tools**

	<b>Reserve fund</b>	<b>Insurance</b>	<b>Contingent credit</b>	<b>Catastrophe bond</b>
<b>Cost before and after event</b>	Usually annual payment into fund; Opportunity cost of liquid capital.	Annual premium includes transaction costs plus return to investors for absorbing risk; Volatile international reinsurance prices	Holding fee includes transaction costs and return to investors; Post-event, additional debt service	Interest payments to investors
<b>Benefit after event</b>	Capital immediately available; Funds will not be lost in case of no event	Loss indemnification for elements insured; Increased capital inflows from abroad to affected economy	Capital immediately available; Increased capital inflows from abroad to affected economy	Capital immediately available; Increased capital inflows from abroad to affected economy
<b>Incentive for mitigation?</b>	More incentive than insurance w/o deductible since government retains unspent funds	Only if insurer rewards loss-reducing behavior or high deductible; otherwise moral hazard	No Also risk of moral hazard	Yes, if physical trigger.
<b>Political and other risks</b>	Reserve funds can be raided for other purposes; Risk of insufficient funds	Risk of (re)insurer insolvency;	Risk of insufficient funds Risk of financial entity insolvency	Basis risk (losses uncorrelated with bond)

Source: Mechler 2004a, extended on basis of Freeman et al. 2000b

Note that Figure 9.8 includes mitigation in the portfolio of *ex ante* tools available to the government. Indeed, a question on the minds of policy makers facing constrained budgets is: Should the government invest in risk-transfer instruments, or should it rather invest in reducing risk? CATSIM includes mitigation as an option, and the policy maker has a choice of the effectiveness of mitigation measures for reducing the financing gap. In this illustrative example, mitigation is less effective in reducing the gap than insurance. However, it must be kept in mind that risk-reductions measures have benefits to the society far greater than reducing financial vulnerability. The mitigation-financing tradeoff, thus, requires an integrated analysis of the full costs and benefits.

**Figure 9.8 Comparison of different risk financing instruments and mitigation for Honduras**

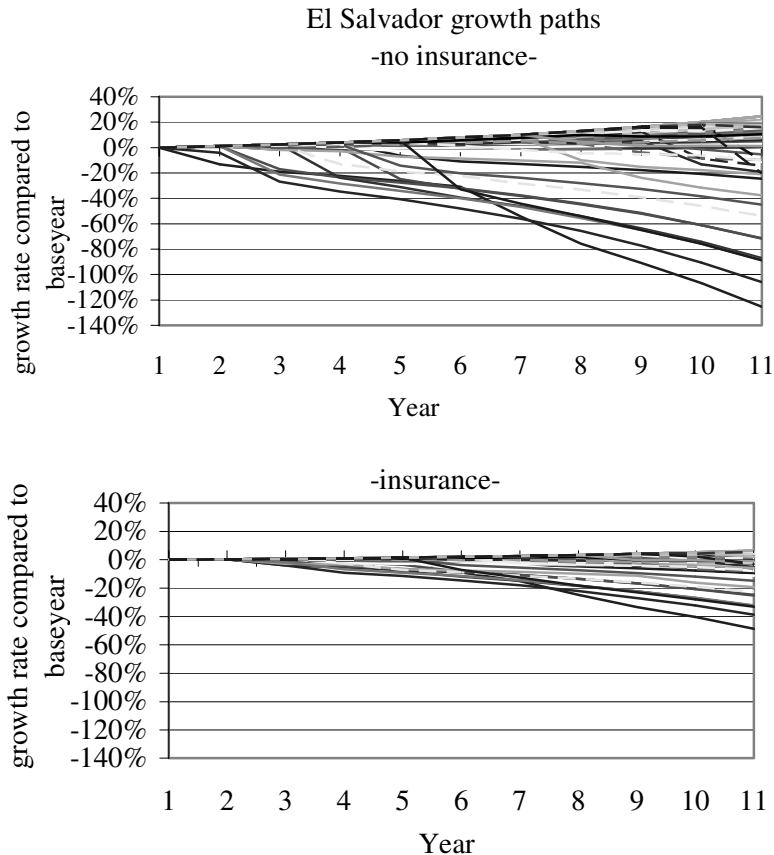


Source: Mechler and Pflug 2002: 24.

#### 4.4.2 The tradeoff between growth and stability

Ex-ante mitigation and financing can be analyzed in terms of a trade-off between economic growth and economic stability. If a government purchases a risk-financing instrument, there are fewer public resources for investments in capital and socioeconomic development. Alternatively, without this purchase, there is no indemnity for infrastructure losses, which will delay economic and social recovery and thus add to economic instability.

*Example El Salvador* IASA has modeled this tradeoff for El Salvador and insurance (Freeman, et al. 2003). However, the same relationship holds true for other ex ante risk financing instruments. Figure 9.9 illustrates model simulations of El Salvador's growth path for public assets without risk-financing and with risk-financing. The upper figure illustrates simulated growth paths without risk-financing, which shows high average growth but with large volatility. The lower figure illustrates simulated growth paths with risk financing (insurance), which shows lower average growth but a more stable economy.

**Figure 9.9 Growth-stability trade-off in El Salvador as modeled by IIASA**

Ideally, El Salvador would have both high growth and economic stability. This suggests a role for the international community in providing pre-disaster assistance for governments investing in risk-transfer instruments and mitigation to complement post-disaster humanitarian assistance. International assistance could have high payoffs, especially if this assistance is tied to requirements for mitigation (for example, in the same way as the US flood insurance program). The advantages of international pre-disaster assistance might be considerable, including a more secure economy for internal planning purposes and for attracting outside investment.

There are also compelling reasons for the international community of wealthy nations to assist developing and transition countries in preparing their economies for disasters. Besides contributing to reaching the UN's

millennium goals, wealthy countries may have an increasing responsibility for weather-related disasters in the developing world because of their historical emissions of greenhouse gases. In a background paper to a UNFCCC (United Nations Framework Convention on Climate Change), the authors (Linnerooth-Bayer, et al, 2003) identified several specific ways in which the international community can assist developing countries to transfer their disaster risks, including the following (by no means exhaustive) possibilities:

- *Supporting public private partnerships:* The international community could absorb (or arrange for the transfer of) a layer of the risks of national or regional public-private insurance systems.
- *Supporting relief and reconstruction:* The international community could assist governments in transferring their risks of public infrastructure damage either through private insurers or directly to the capital markets through alternative risk-transfer instruments.
- *Supporting microinsurers:* The international community could also play a role in supporting and transferring the risks of microinsurers, for example those offering weather hedges, possibly by acting as reinsurer or assuming the interest payments of catastrophe bonds.
- *Supporting data collection and analytical capacity building:* Since any insurance or insurance-related system requires knowledge of the risks, the international community could provide support to developing countries in collecting the requisite data and in building analytical capacity.
- *Supporting alternative instruments:* There may also be options to create national-level market incentives, for example tax reductions to individuals or institutions for purchasing developing country catastrophe bonds at lower interest. There might be possibilities for enhancing the participation of voluntary contributions and NGOs in these schemes. One imaginative idea could be to link investments in developing country disaster hedges to emerging sustainable-development investment portfolios.

#### ***4.5. Recent developments in Latin America***

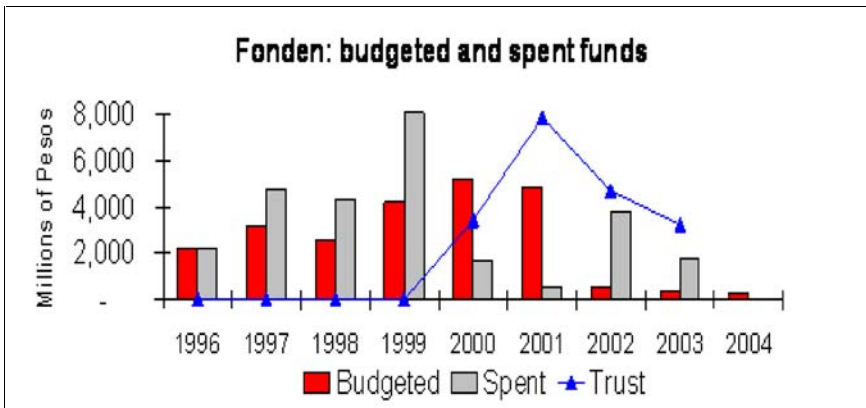
A number of governments in developing and emerging economy countries are currently considering ex ante risk financing instruments for public-sector liabilities.



## Mexico

In 1996, Mexico, an upper-middle income OECD country, installed a government-sponsored fund (FONDEN) for financing reconstruction of federally or state-owned infrastructure as well as relief to the public. This fund is financed by annual contributions from the central government's budget.<sup>5</sup> Fig. 11 demonstrates, that as long as requests for assistance under FONDEN and funds spent had been high, funds budgeted were of similar magnitude. However, after years with relatively little disaster funding needs, resources proposed for funding have tended to be stripped by Congress. FONDEN resources have been reducing since 2001 and spending for natural disasters has become highly unpredictable. Furthermore, the trust fund, fed by residual FONDEN amounts in respective years has been decreasing strongly.

**Figure 9.10 Budgeted and spend funds of FONDEN**



Sources: Hurtado, 2004.

Within this context, in order to improve financial security, Mexican authorities are considering whether to engage in risk financing to cover a layer of losses accruing to the government in case of a major earthquake event. Specifically, a cat bond is being examined. A benefit of a cat bond is the avoidance of reinsurance cycles arising from reinsurers' practice of intertemporal premium adjustment between peak years and years with reduced catastrophe activity. A related benefit is the avoidance of global cross-subsidization of reinsurance premium. As reinsurers are only active in a very limited number of markets in the Western Hemisphere, severe losses in one region will have a bearing on unaffected areas and may increase premia there.

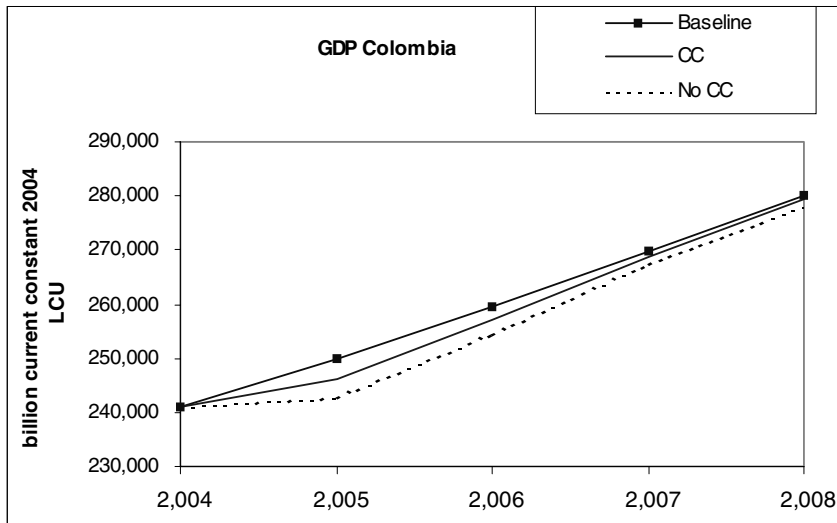
## *Colombia*

A second Latin American country, Colombia, faces a difficult situation regarding the financing of public infrastructure losses. Natural disaster risks in this country are high - on average Colombians face more than one severe flood every year and a strong earthquake every two years. Past disasters, such as in the 1999 Armenia earthquake, have caused losses up to 3 billion USD. At the same time, fiscal operations are heavily constrained by high external debt and debt service payments, which severely limits the ability of the central government to respond to disasters. One option currently under discussion in Colombia is a contingent credit facility of a total amount of 150 million USD through a multilateral financial institution. Generally, such a contingent credit scheme has the following costs and benefits associated:

- **Cost:** there is a cost associated with paying for the commitment fees of the contingent credit in terms of government funds spent on it on a regular basis; this results in less financing available for government spending and investment, which adversely affects overall economic output. As with debt instruments, the debt has to be paid back ultimately.
- **Benefit:** necessary financing after a disaster is available quickly in case of need for reconstruction and relief, whereas regular lending and increasing taxation have a time lag of at least one year. This means that relief and reconstruction activities can be funded more fully and more quickly. The economy can rebound more quickly.

In a model-based analysis including deterministic and probabilistic scenarios, the benefits of such an arrangement were analyzed (see Mechler 2004b). In the deterministic case, it was assumed an event with a recurrence period of 100 years would occur in 2005 and destroy 6.2 percent of capital stock causing total damages of ca. 45,500 billion Pesos of which a substantial part would have to be financed by the government. As Figure 9.11 shows, a contingent credit arrangement, according to this analysis, would be effective in rebuilding capital stock in a timely manner. More productive capital results in more GDP produced with the contingent credit. As a consequence, the GDP recovery process is quicker given the contingent credit arrangement.

**Figure 9.11 Baseline GDP and effects of deterministic 100 year earthquake shock on GDP with and without contingent credit for government liabilities in Colombia**



Source: Mechler 2004b.

In this analysis, and for the case of Colombia, the credit was provided by a MFI at rates substantially below market interest. When arranging such a credit in the financial markets at higher interest, the viability and economic implications for Colombia may change considerably.

### *Honduras*

Honduras is another country that is currently examining whether to engage in a sovereign risk financing scheme, traditional or alternative. In Honduras, some quasi-private public infrastructure is already insured, for example, airports, telecommunications and energy facilities. Yet, Honduras lacks a risk financing scheme for roads, other transport and water infrastructure. With assistance from a multilateral finance agency, workshops and deliberations are ongoing with government officials from the Finance Ministry and the Central Bank. To date, however, no decision has been taken on a specific public risk-financing strategy.

## **5. Outlook: Financing Catastrophe Risk in Developing and Emerging-Economy Countries**

Risk-financing instruments can potentially assist individuals and countries cope with the economic hardships of disasters. Financial planning

can make a difference in the lives of vulnerable people in developing and emerging-economy countries, and can mean the difference between post-disaster economic stagnation and recovery. However, the cost of these instruments can substantially exceed that of traditional post-disaster financing mechanisms.

We have emphasized in this paper that market risk-financing instruments, because of their high costs, are not appropriate for poor households or governments unless they are highly financially vulnerable to disaster losses, meaning that they cannot muster sufficient capital to finance their recovery from traditional post-disaster sources. Even with high financial vulnerability, households and governments must carefully consider the costs and benefits of pre-disaster financing instruments.

This paper specifically focused on the experience, opportunities and drawbacks of risk financing mechanisms offered by the financial markets for sudden-onset, natural disasters in developing and emerging-economy countries such as weather derivatives, catastrophe bonds and contingent credit arrangements. The paper distinguishes between market and non-market risk-transfer and intertemporal risk-spreading instruments for both the private and public sectors. For both the private and the public sector there are important initiatives and precedents for using the financial markets for financing risk. In the private sector, initiatives are underway to render these instruments affordable to households and farms in developing and emerging-economy countries. Schemes in the form of coupled microcredit and microinsurance arrangements are offered by alternative financial institutions including state-owned banks, member-owned savings and loan institutions and low-capital local or rural banks. Weather hedges, which combine low transaction costs with public subsidies, already exist or are on the horizon in Asia and Latin America. There are also important initiatives and exciting prospects for transferring sovereign risks, especially the risks of vulnerable countries. Government policy makers in Colombia and Honduras are considering risk financing arrangements with assistance from multilateral finance institutions. In Mexico, the government is designing a catastrophe bond in order to secure financing for its catastrophe reserve fund in case of a severe earthquake.

Market-based financial mechanisms can have important benefits compared to traditional insurance and reinsurance: These generally consist of a reduction of transaction costs, increased speed of payouts and increased incentives for mitigation. Another benefit is that existing financial market channels can be utilized, as is the case for weather derivatives and rural credit banks. On the other hand, the main drawback with financial market instruments is the problem of basis risk, i.e. correlating the individual loss experience with indemnity payments triggered by pre-defined indexes such

as rainfall. As shown, improvements in the specification of the index may mitigate this problem.

As experience shows, the success of these instruments depends on the affordability for developing and emerging-economy countries, and may necessitate subsidies from national or international bodies. Since micro schemes for disaster cover can only operate with a costly capital backup, they inevitably require outside support to assure their affordability to the poor. Recent schemes developed or devised in Honduras and Colombia will likely rely on support from international financial institutions in transferring their high public-sector risks.

The advantage of these financial market instruments is that they share responsibility between individuals, the state and international bodies, and by providing needed capital after the destruction of a disaster, they will avoid reliance on debt financing and international donations. The international community – especially as wealthy countries recognize their contribution to climate warming and weather-related disasters affecting the developing world - can assist developing and emerging-economy countries finance their risks in many ways, including: supporting microinsurers by absorbing a layer of risk; absorbing risks of national or regional public-private insurance systems in the capacity of re-insurer and subsidizing the costs of alternative insurance instruments; creating national-level market incentives, for example tax reductions to individuals or institutions for purchasing developing country catastrophe bonds; or linking investments in developing country disaster hedges to emerging sustainable-development investment portfolios. These measures could be important additions to international post-disaster donor assistance, especially if they are contingent on households and governments adhering to a pro-active plan for preventing losses. In an assessment of disaster insurance options for the Caribbean region, a World Bank study came to the following conclusion:

*[...] based on the evidence, market arrangements (both domestic and international) can better channel and fund these (disaster) risks, with governments and multilateral institutions supporting the development of self-sustaining structures (Pollner 2000:5).*

The focus on supporting *ex ante* risk financing can be seen as a third phase of assistance by the donor community: The first phase was (and remains) characterized by *ex post* disaster assistance and relief by the international donor community. The second phase, at least rhetorically, has emphasized pro-active disaster risk prevention. The third phase of disaster risk management complements prevention with a focus on financial planning to spread disaster burdens so that developing and emerging-economy communities and countries can recover from disasters in a timely, efficient and fair way.

## Notes

- 1 The *law of large numbers* states that for a series of independent and identically distributed variables the sample mean over the variables converges to the theoretical population mean of the probability distribution and thus the variance around the mean decreases for large numbers.
- 2 This discussion is based on the World Bank classification of economies according to GNI per capita in 2000, calculated using the World Bank Atlas method. High income countries had incomes greater than USD 9,385, upper middle income USD 3,036-9,385, lower middle income USD 765-3,035, and lower income less than USD 765.
- 3 Weather contracts can be issued as weather derivatives or weather insurance, the main differences being in regulatory and legal issues. For this discussion, the main point was the involvement of the (rural) financial market in such a scheme.
- 4 In this study, insurance was modeled as XL-insurance with a fixed attachment point at 5 percent capital stock lost (equal to the 50-year storm and flood event in Honduras). The exhaustion point was the decision variable in this stochastic simulation exercise and determined by the amounts spent on insurance (Mechler and Plug 2002).
- 5 In case of an event, states have to contribute own matching funds in order to qualify for reconstruction and relief funding by FONDEN.



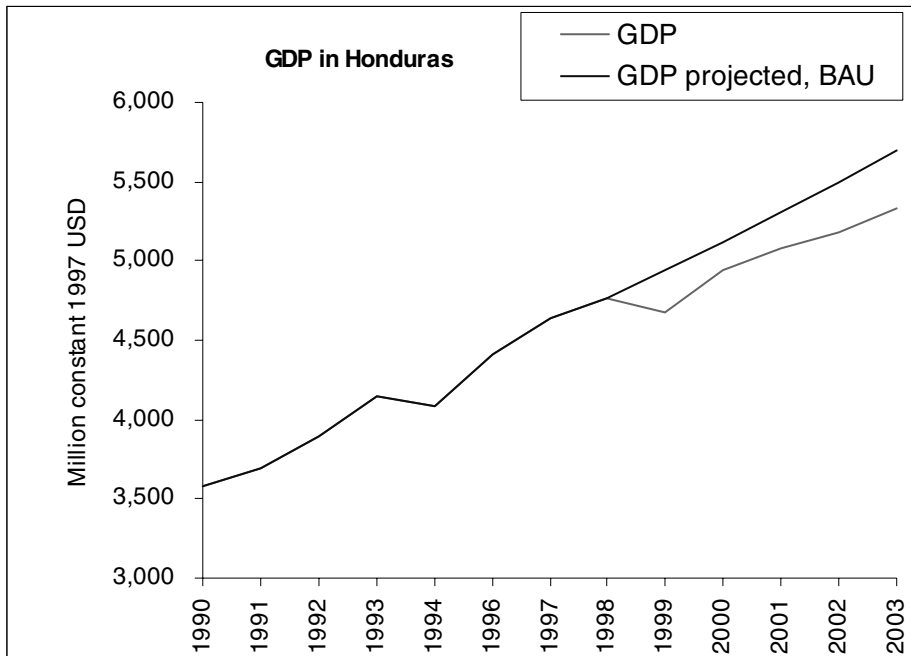
## *Annex 9.A*

### **Estimating Financial Vulnerability: Case Study Honduras**

The economic consequences of a government ill prepared to respond to a major disaster can be illustrated by considering the case of Honduras, in which following the devastation of Hurricane Mitch in October 1998, development was set back significantly. With over half of its 6.5 million people living in poverty, Honduras is socially and economically vulnerable to extremes in weather. Since the 1980s, the economy has been subject to a combination of adverse internal and external influences causing stagnation, inflation and a large increase of external debt. In addition to killing 5,700 people, and affecting another 620,000, Hurricane Mitch, an event with an expected return period of less than one in 100 years, destroyed or damaged about a third of the country's public infrastructure. Total direct losses amounted to approximately 2 billion USD. Indirect damages were calculated at 1.8 billion USD (ECLAC and IDB 2000: A 1-4-8; CRED 2004). Total losses approximated 80 percent of the country's GDP and overwhelmed the government's capacity to provide relief and repair critical infrastructure. In other words, Honduras experienced a serious financing gap.

Before Mitch, the economy had performed well, and GDP was projected to increase substantially in future years, as shown on the upper line in Figure 9.A.1 Post-Mitch, GDP continued to grow in the remainder of 1998, mainly because of the reconstruction efforts. In 1999, there was a recession with a decline in GDP by 1.9 percent, followed by a recovery. Comparing growth projections (in a business-as-usual scenario) with actual development of GDP, it can be seen that the development path in Honduras after Mitch fell short of pre-Mitch expectations.



**Figure 9.A.1 GDP over the last 20 years (1980-2002) and as projected**

Data source: World Bank 2004, own projection.

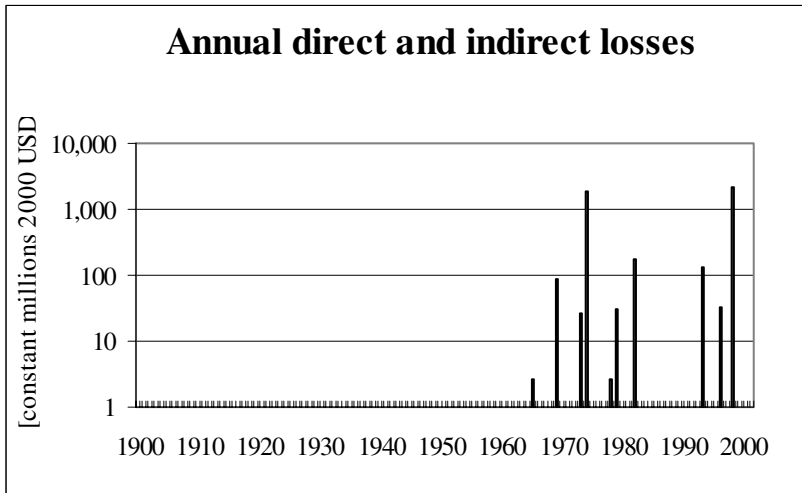
What is the risk that Honduras, or any exposed country or region, will experience a financing gap in the near future? This question has recently received a great deal of attention at the World Bank (see Pollner, et al, 2001), the InterAmerican Development Bank (see Keipi and Tyson, 2002) and other international financial institutions. The risk will depend on two factors: (1) the probability of public-sector disaster losses of different magnitudes (risk exposure), and (2) the ability of the government to meet its post-disaster liabilities. IIASA has developed a computer tool (CATSIM) to estimate these two factors, and, thus, to estimate a government's financial vulnerability (Hochrainer et al. 2004). In what follows, we illustrate the estimation of financial vulnerability for Honduras.

### 1. Honduras' probability of losses and associated government liabilities

Given Honduras' exposure to weather extremes, the IIASA CATSIM model has illustrated the conditions under which the government can expect to experience a financing gap. Figure 9.A.2 shows the historical losses from all types of natural disasters in Honduras 1900-2001. The destruction from

natural disasters has worsened since 1960, from which time there have been losses nearly every second year. In some years, there have been multiple catastrophes. Very significant economic damages have been rarer, but in three recent years losses have reached or exceeded 1 billion USD in constant 2000 prices.

**Figure 9.A.2 Total direct and indirect disaster losses in Honduras: 1900-2001**



(Source: CRED 2004)

The IIASA model assessed the direct loss potential for Honduras based on historical losses and hazard simulation modeling. Based on loss exposure information provided by Swiss Re in Freeman et al. (2002b) the expected annual losses due to storm/flood and hurricane risk are 0.43 percent and 0.06 percent of Honduras' total capital stock, respectively, which results in a combined expected loss (due to independence of these events) of 0.49 percent of capital stock. Thus, IIASA estimated Honduras' expected losses for the coming year as 62.3 million USD total capital stock and 12.7 million USD infrastructure losses.

Financial vulnerability cannot, however, be based on expected loss since disasters may be considerably more or less costly than the average. Therefore, we must look at probabilistic occurrence of disasters of different magnitudes, which we will turn to in a later section.

## 2. Honduras' financial options

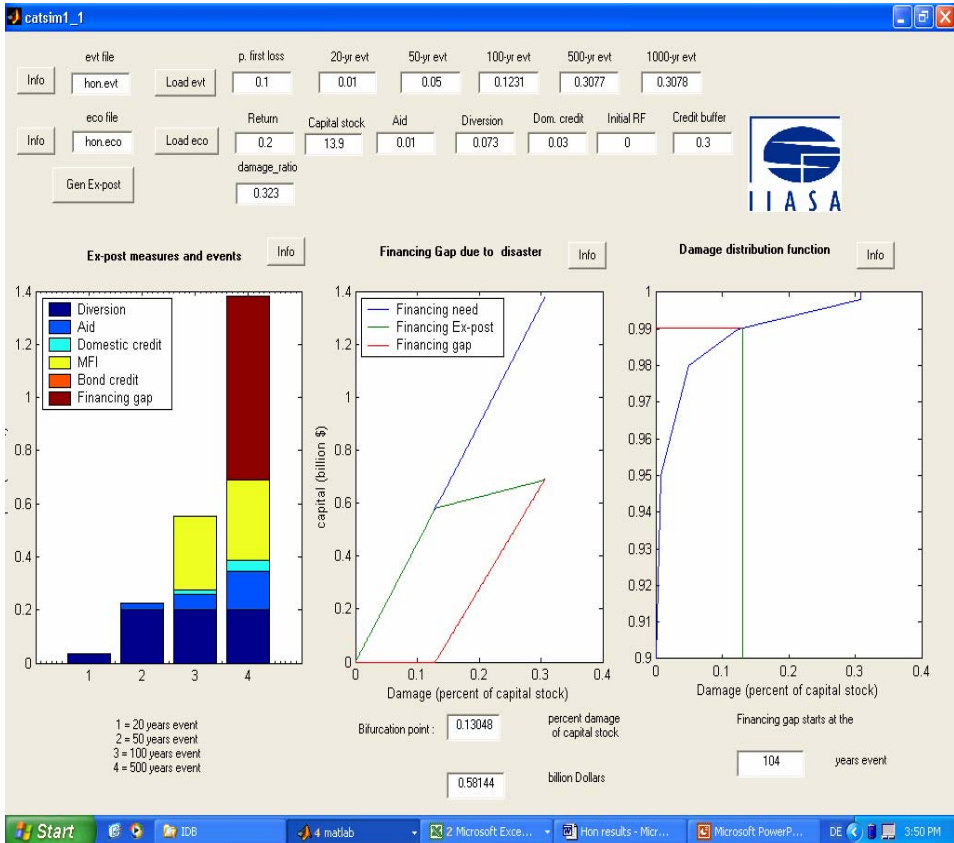
If a disaster of a particular magnitude occurs in Honduras in the current year, can the central government finance its obligations for reconstruction and assistance? To answer this question it is necessary to examine the capacity of the government to raise funds. Honduras, like most developing countries, has neither a catastrophe reserve fund nor other *ex ante* financing instruments in place. Therefore, it relies fully on *ex post* financing, including particularly external aid and assistance. Concerning the latter, because of its low per-capita income, Honduras is eligible for most favorable borrowing or very low percent interest loans from World Bank through the International Development Association (IDA). After disasters, such as Hurricane Mitch, Honduras is heavily dependent on outside assistance. Already before Hurricane Mitch, foreign aid amounted to 6.3 percent of GDP in 1997 (6.1 percent in 1998), and rose to 15.2 percent in 1999, when disaster aid flows materialized. This reliance reflects the high cost of disasters in Honduras in relation to GDP and the inability to spread risk internally.

## 3. Honduras' financial vulnerability

Combining Honduras' loss probability with the government's ability to absorb the losses yields a picture of the government's financial vulnerability. IIASA's CATSIM model has illustrated the financial vulnerability of Honduras as shown in Figure 9.A.3.

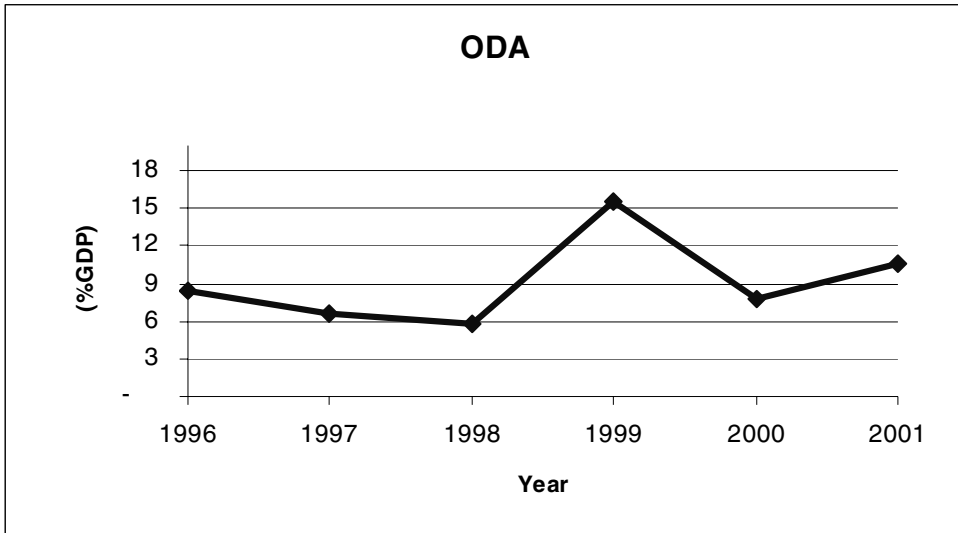
The left chart in Figure 9.A.3 illustrates the government's projected financial needs and available funds to recover from disasters occurring at four different frequencies: the 20-, 50-, 100- and 500-year events. A financing gap occurs only between the 100- and 500-year events, in this figure shown as the 500 year event (precisely, as shown in the lower right window, Honduras experiences a financing gap at ant below the 104-year event). The middle chart shows financing needs and financing availability given the destruction to the country's capital stock. The right chart illustrates the cumulative loss-frequency distribution and outlines the threshold event (104) that would trigger a financing gap. The period of recurrence of this threshold event, the associated damage to capital stock and absolute losses are also calculated in the lower area of the screen.

Figure 9.A.3 The Financing Gap for Honduras



The IIASA model shows that if the event occurred in 2004, the government could “withstand” the losses from moderate flood and storm disasters up to approximately the 100-year event. For rarer catastrophes, according to this analysis there would be a financing gap. The model calculated the gap to commence with the 104-year event estimated to destroy 13.1 percent of Honduras’ capital stock and cause economic losses of approximately 581 million current USD to the public sector. Of course, these estimates rely on the different parameters and assumptions, all of which can be changed by the user of this software (the parameters are shown on top of the screen).

Historical data corroborate this assessment of financial vulnerability. As shown in Figure 9.A.4 Honduras has had a limited ability to finance losses by its own means and has traditionally relied on external assistance to help with economic development in the event of natural disasters.

**Figure 9.A.4 Actual financial vulnerability in Honduras after 1998 Hurricane Mitch**

As illustrated in Figure 9.A.4, official development assistance (ODA), comprising of grants or loans with a grant element of at least 25 percent given to developing countries, comprised about 6 percent of GDP in 1998. With this amount of international aid, it is not surprising that Honduras was in need of outside help after Hurricane Mitch. Post-disaster, ODA rose sharply to about 16 percent of GDP in 1999, or in absolute terms from 303 to 842 million USD. This large inflow of free or concessional financing contributed considerably to the recovery process. However, even with this international flow, it was estimated that Honduras would take many years to fully replace its public infrastructure. This reliance on outside assistance reflects the high cost of disasters in Honduras in relation to GDP and the inability of the government to spread risk internally.

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## PART II

### *Chapter 10*

# **The Potential for New Derivatives Instruments to Cover Terrorism Risks**

*by*

Michele David\*

The Bond Market Association

This chapter begins by a brief overview of the credit derivatives market and the structures of credit default swaps (which are highly relevant to our discussion of catastrophe-linked derivatives). It then looks at catastrophe-linked derivatives and two ideas for new instruments to cover terrorism risk—catastrophe risk swaps and swaptions—and some of the challenges and advantages to the development of these products. It, finally, discusses the Association’s members’ perspective on catastrophe-linked derivatives as a viable source of capacity for terrorism coverage.

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\* Vice President and Assistant General Counsel of The Bond Market Association, Principal Staff Advisor to the Association’s Corporate Credit markets.

## 1. Introduction

The Bond Market Association, through its offices in New York, Washington DC and London, represents securities firms and banks that underwrite, trade and sell debt securities and other financial products on a global basis. Members of the Association account for the overwhelming majority of fixed-income securities underwritten and dealt in the United States, and also include the 23 primary dealers of U.S. Treasury Securities as recognized by the Federal Reserve Bank of New York and the 20 leading primary dealers in Euro government securities through one of the affiliates of the Association, the European Primary Dealers Association.

As the voice of the global fixed-income markets, the fundamental mission of The Bond Market Association is to advocate public policies before legislative and regulatory bodies that will enhance market efficiency, integrity and safety. The Association also plays an important role in establishing standard market practices and documentation for common transactions, as well as promoting guidelines for the business conduct of market participants. In addition, the Association is committed to the goal of investor education, both through the Association itself and through The Bond Market Foundation, our educational partner.

The Association operates and interacts with its members through a committee structure, which includes a Risk-Linked Securities Committee established in 2000, whose members include all of the major underwriters and dealers in the primary and secondary risk-linked securities markets. This Committee serves as a forum for member firms to exchange ideas and build consensus on legislative, regulatory and market practice issues affecting the risk-linked securities market, issues such as the Terrorism Risk Insurance Act, and the U.S. General Accounting Office's Report on Insuring Terrorism Risk. Our Committee also hosts an annual Risk-Linked Securities Conference, held most recently in New York last month, to promote the development and growth of the market to potential issuers and investors.

The Association's member firms have a substantial interest in dealing with the issue of managing terrorism risk, since they play significant roles in critical financial markets whose disruption or failure could present systemic risk. The Association also works on a broad range of initiatives related to terrorism risk, including business continuity planning, the tracking of terrorist financing, and support of recovery and redevelopment efforts, and is a member of the Coalition to Insure Against Terrorism, which represents a broad coalition of insurance consumers.

This note begins by a brief overview of the credit derivatives market and the structures of credit default swaps (which are highly relevant to our discussion of catastrophe-linked derivatives), it then looks at catastrophe-linked derivatives and two ideas for new instruments to cover terrorism risk—catastrophe risk swaps and swaptions—and some of the challenges and advantages to the development of these products, and, finally, discusses the Association’s members’ perspective generally on catastrophe-linked derivatives as a viable source of capacity for terrorism coverage

## 2. Credit Derivatives and Credit Default Swaps

The undeniable trend in the financial markets over the past decade has been the development of risk management tools and strategies which allow market participants to price, hedge and manage different types of risk separately. Credit derivatives, and credit default swaps in particular, have been one of the most popular and effective products of this kind and have meant huge advancements in the segregation and management of risk. In the past year alone the global market in credit derivatives more than doubled in notational amount outstanding, from \$2.6 trillion in the first half of 2003 to \$5.44 trillion in the first half of 2004,<sup>1</sup> and it is expected to rise to \$8.2 trillion by the end of 2006.<sup>2</sup>

The International Swaps and Derivatives Association (ISDA) has established and defined standard credit events (bankruptcy, failure to pay, restructuring, etc.) and standardized terms of credit default swap contracts through its Master Agreement and related definitions.

Major players in the credit default swaps market include commercial and investment banks, securities firms, insurance companies and, in increasing numbers, hedge funds.

Credit default swaps, which make up the majority of credit derivatives market, are privately negotiated bilateral contracts under which one party, usually known as the “protection buyer,” pays a fee or premium to another, generally referred to as the “protection seller,” to protect itself against the loss that may be incurred on its exposure to an individual loan or bond as a result of a defined credit event. The premium, or default swap spread, reflects the credit risk of the reference credit, and is usually quoted as a spread over a reference rate such as LIBOR, to be paid upfront, quarterly or semi-annually. If no credit event occurs before the end of the contract, the contract is terminated, with the protection seller having received the premium payments. If a credit event occurs during the contract period, it triggers a contingent payment to the protection buyer, made by either physical or cash settlement.

The Securities Industry Association (SIA)<sup>3</sup> and others have recently suggested that the credit derivatives market could potentially be a source of significant new capacity for insuring catastrophic risk, and that catastrophe risk swaps could be developed under the type of structure and standardized documentation used in credit default swaps, with a terrorism event, rather than a credit event, defined as the triggering event. Despite various regulatory and other obstacles and challenges to developing this type of a product and market, given the size, depth, and dramatic growth of the credit default swaps market in the last ten years it is certainly an idea worth exploring.

### **3. Catastrophe-Linked Derivatives**

#### ***3.1. Exchange Traded Derivatives***

There have been several unsuccessful attempts in the last fifteen years to establish markets in exchange traded derivatives contracts. The Bermuda Commodity Exchange traded catastrophe options based on the Guy Carpenter Catastrophe Index (GCCCI) for catastrophe property losses beginning in 1997, but suspended trading in 1999 due to sluggish trading volume over the preceding two years. The Chicago Board of Trade (CBOT) traded catastrophic futures contracts based on quarterly losses reported by the Insurance Services Office (ISO), futures and options contracts based on the catastrophe risk index established by Property Claims Service (PCS). These products were introduced in 1992, expanded in 1995, and finally delisted in 2000 due to lower than expected demand. The Catastrophe Risk Exchange International, Inc. (CATEX), begun in 1994, is a global electronic notice board that was originally designed as the world's first Internet based, business to business reinsurance exchange for standardized reinsurance contracts. However, trading in the standardized exchange contracts ended due to low interest and trading volumes, and CATEX is now used by companies to execute specific catastrophic risk transactions and reinsurance placements.

A number of possible reasons for the limited interest and liquidity in these derivatives contracts have been cited by the industry, including the substantial basis risk of index-based contracts, issues related to the frequency of settlement and index calculation, the inflexibility of standardized contracts, and the need for investors in exchange traded derivatives to have significant knowledge of and insight into the catastrophe reinsurance market<sup>4</sup>.

### ***3.2. Catastrophe Risk Swaps***

Catastrophe risk swaps are used today by insurance and reinsurance companies seeking to manage and diversify their natural catastrophic risk exposures. A relatively small number of risk swaps are executed between insurance companies to exchange one type of catastrophic risk exposure for another, usually in the form of two privately negotiated reinsurance agreements.<sup>5</sup> Insurance companies also enter into catastrophe risk swaps with various counterparties—including other insurers and institutional investors—using standardized ISDA documentation. Similar to the type of swap proposed by the SIA, these instruments involve premium payments by a ceding party to a counterparty in exchange for protection against future claims and losses.

## **4. Developing Risk Swaps Covering Terrorism Risk**

Aside from the challenge of being able to successfully model for terrorism events, which will be discussed at greater length below, the development of risk swaps covering terrorism risk poses several significant challenges. First, tapping the credit markets for new capacity for terrorism risk would mean having non-insurance company counterparties, and formal regulatory restrictions mandate that only chartered insurance and reinsurance companies can enter into an instrument deemed to be an insurance contract (i.e., a contract that provides coverage on an indemnity basis). However, there could be ways to design and structure catastrophe risk swaps so that they are not deemed insurance contracts and could be executed with non-insurance company counterparties. For example, designing parametric or other objective triggers, or transferring the risk on an index basis, might be possibilities.

Developing triggers for terrorism risk would present an additional challenge, but, as the SIA has suggested, could be accomplished perhaps through the use of objective measures resulting from a terrorist event, such as business or revenue stream interruption for a particular entity or asset destruction or impairment measured by predetermined criteria<sup>6</sup>.

Factors which may increase the premiums for these products should be considered as well. For example, protection sellers (investors) may charge a higher premium to buyers (insurance companies) if they believe those buyers have an informational advantage over them with respect to terrorism risk—for example if they do not believe they have sufficient information about the extent to which an insurance company covers high risk terrorism targets, or have a lack of information about insurer underwriting and practices. These informational issues could increase the premiums and



potential legal costs for doing a transaction as well as the potential for securities litigation in the event of a triggering event. Investors may also have concerns about strategic behavior by terrorists with respect to targets they know are covered. Such fears, even though unsubstantiated, could also increase premiums.

Derivatives with these types of structures would have significant basis risk and counterparty risk, but the development of such a market could have numerous advantages. The potential new capacity from the credit derivatives market (at \$5.44 trillion), could be much larger than traditional reinsurance capacity, and utilizing ISDA standard documentation would also provide advantages in terms of flexibility and speed in entering into these swaps.

A second idea recently proposed by the SIA is that municipal and other public financing issuers could issue bonds to finance stadiums and other public spaces with an embedded option on a terrorism risk swap (a “swaption”)<sup>7</sup>. At the issuer’s option, it could enter into a terrorism risk swap with the bondholder. We believe there are a number of significant obstacles to developing this type of an instrument. First, because interest payments on most municipal bonds are tax-exempt in the U.S., many municipal bonds are held by individual, retail investors. These types of investors are not likely counterparties for a risk swap, since they lack the sophistication, market knowledge, and access to information of most institutional investors. This type of instrument would also put municipal issuers—with limited or no experience in such matters—in the position of measuring and pricing the cost of the terrorism risk, since it removes reinsurance and insurance companies from the equation entirely.

## **5. TBMA Members’ Perspective: The Need to First Develop Reliable Models To Assess Terrorism Risk**

The Association’s members believe that, while one could develop any number of derivative instruments to transfer terrorism risk, the primary challenge in the short term to derivatives instruments as a source of terrorism capacity—and to the capital markets in general as a source of terrorism capacity—is that accepted models do not yet exist to assess terrorism risk. Until there is acceptance of credible and reliable models by rating agencies and investors, the issuance of catastrophe bonds or catastrophe-linked derivatives covering terrorism in the United States will be unlikely and probably unrealistic.

The members of the Association believe that the current unavailability of affordable terrorism insurance is not due to a lack of capacity as much as to a mismatch in the perception of risk between protection buyers and

sellers. Until there is a way to accurately measure and price terrorism risk, it is not likely that derivatives and other capital markets instruments will provide a viable solution.

## 6. Conclusion

While the development of new derivatives instruments and markets to cover terrorism risk is possible, the use of derivatives to transfer terrorism risk is probably not feasible until we have a way to accurately measure and price terrorism risk. Market participants would like to find a new form of capacity, but without a way to price the risks involved the premiums for these types of derivatives would likely be cost prohibitive. The mismatch in the perceived level of risk needs to be resolved through the use of reliable and widely accepted models before derivatives can provide a viable source of capacity for terrorism risk.

## Notes

- 1 International Swaps and Derivatives Association's 2004 Mid-Year Market Survey.
- 2 British Bankers Association Credit Derivatives Report, published September 22, 2004.
- 3 See Terrorist Risk: Insurance Market Failures and Capital Market Solutions, Research Reports Vol. 5, No. 1, January 31, 2004 ("SIA Research Report").
- 4 See SIA Research Report at page 9; International Financing Solutions to Terrorism Risk Exposures, Toben Juul Andersen, at pages 21-22.
- 5 See e.g., the August 2003 USD 100 million catastrophe risk swap between Swiss Re and Mitsui Sumitomo (Swiss Re News Release dated August 4, 2003).
- 6 See SIA Research Report at page 10.
- 7 Id.



## PART II

### *Chapter 11*

# **Catastrophic Risk Securitization: Moody's Perspective**

*by*  
**Rodrigo Araya\***  
Moody's

Catastrophe bonds (“cat bonds”) are structured finance instruments devised to transfer catastrophe risk to the capital markets. The bonds appeal both to sponsors and investors, and provide a general economic benefit as well, in that they help to distribute some of the financial risk associated with insurance payouts on major disasters.

The cat bond market has changed in the six years since Moody's issued its first cat bond rating, with the addition of new transaction structures, new perils and greater precision in the modeling techniques used to gauge disaster frequency and likely loss severity.

This chapter presents Moody's perspective on the rating of catastrophe bonds including transactions that include new perils and examines the different types of structures in terms of their characteristics, the types of perils covered, their duration and their loss-triggering mechanisms.

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## 1. Introduction

Catastrophe bonds or cat bonds were conceived as alternative risk transfer instruments for insurance and reinsurance companies to help them pass portions of their catastrophic risk exposure to the capital markets. The first cat bond rated by Moody's Investors Service was Residential Re Limited, issued in June 1997. Since then, Moody's has rated a little over 40 such transactions covering a large number of natural hazards in different regions of the world for a total of about \$6.2 billion in rated securities.

Until 2002, issuance of cat bonds was somewhat stable at around \$1 billion per year but this trend changed in 2003 with a 50% increase of rated notes for a total of about 1.8 billion spread over 13 transactions. As some cat bonds mature and new ones are issued, the distribution of covered perils changes from year to year, but U.S. hurricane and earthquake perils account for a significant share--over 50%--of the outstanding cat bond exposure at any time. In 2003, Swiss Re issued the first cat bond covering a peril not related to a natural hazard, Vita Capital Ltd., transferring the risk of catastrophic mortality. The potential impact of terrorist attacks was examined but was not significant.

It is interesting to note that, since its first cat bond rating, Moody's has not downgraded any of these securities nor has any Moody's-rated cat bond triggered losses to investors.

## 2. The Role of Cat Bonds in the Marketplace

Insurance and reinsurance companies are typical sponsors of cat bonds, using them to transfer catastrophic risks to the capital markets. Occasionally, large corporations issue cat bonds as an alternative source of risk financing and as part of their risk management strategies. However, even though there have been discussions about the possibility of issuing cat bonds sponsored by governments of earthquake-prone countries to provide coverage against extreme losses due to these events, this has not yet materialized.

In the marketplace, cat bonds appeal both to sponsors and investors and provide a general economic benefit as well. Sponsors benefit from the creation of alternative sources of risk financing that brings increased coverage capacity and more predictable prices since the capital markets have considerably larger capacity and greater scope for economic diversification than insurers and reinsurance companies. Investors benefit from the added portfolio diversity and attractive spreads. Society in general benefits in that

catastrophe-linked securities dilute the economic impact of the risk associated with large natural catastrophes.

### 3. Types of Cat Bonds

In general, cat bonds can be classified according to the number of perils they cover (*single-peril* and *multi-peril*), the risk period covered (single-year or multi-year), the type of losses they cover (*per event* or *aggregate*), and the mechanism that triggers losses to the investors (*first-event* or *second/third event* and *parametric, index-based, modeled-losses* and *indemnity* triggers). Most cat bonds are of the first-event type, i.e., the securities are exposed to losses from the first qualifying event that occurs during the covered risk period. In contrast, for cat bonds of the second-event type, the securities become exposed to losses after the occurrence of a qualifying *triggering event* that activates the protection provided by the securities.

As for all structured finance securities rated by Moody's, the rating addresses the expected loss posed to investors relative to the promise of receiving the present value of all promised interest and principal payments. Potential losses to investors are tied to the occurrence of the natural perils covered during the specified risk period and according to defined triggering mechanisms as well as other secondary risks such as counterparty and sponsor credit risk.

The perils usually covered by cat bonds rated by Moody's include earthquakes and wind-related storms (hurricanes, typhoons and European windstorms). However, in 2003, Swiss Re issued Vita Capital Ltd., a cat bond rated by Moody's that covered a non-standard peril: catastrophic mortality in a pool of five countries, U.S., U.K., France, Switzerland and Italy.

### 4. Type of Loss Triggers

As indicated before, there are four types of triggers used to determine losses to the holders of cat bonds: parametric, loss index, modeled-losses and indemnity triggers. Over time there has been a shift in the type of transactions brought to market. The early stages of the cat bond market were dominated by indemnity transactions whereas parametric transactions tend to be more prevalent nowadays.

Each of these trigger carries varying degrees of basis risk and moral hazard. *Basis risk* is defined as the potential difference between actual losses in the sponsor's portfolio of assets in the event of a covered natural hazard and the losses predicted by the catastrophe modeling analysis. *Moral*

*hazard* is the chance that some insureds or other parties will intentionally cause a loss or increase loss severity in order to collect payments that otherwise they would not be entitled to receive.

#### ***4.1. Parametric Losses***

In parametric transactions, losses to the cat bond holders are triggered when a parameter that defines the peril covered exceeds a certain threshold. Losses to the securities are a function of the value of the parameter selected. For example, in an earthquake-linked transaction, the triggering parameter is normally its magnitude. However, there has been an evolution in the definition of the parametric triggers, with recent transactions using more elaborate definitions in an attempt to correlate better with actual losses in the covered portfolio of assets.

#### ***4.2. Modeled Portfolio Losses***

In the case of modeled portfolio loss transactions, losses are based on a model analysis of a representative portfolio of assets exposed to the peril covered that acts as a proxy to the sponsor's exposure in their book of business. Typically, the version of the catastrophe model and the input data representing the portfolio used in the original analysis are kept in escrow to be used in case of an event. After the occurrence of a covered event (such as hurricane or earthquake), the modeling firm will use the event parameters as inputs to their model and evaluate the losses to this pre-defined portfolio.

The losses resulting from this analysis are not actual losses attributable to the event, but only an estimated value as calculated by their model. Principal reductions to the securities are directly proportional to the output losses of the model between the specified lower to upper bound thresholds.

#### ***4.3. Index Losses***

In index-based loss transactions, losses to investors in the securities are tied to industry-wide losses caused by qualified events. The value of the total insurance losses resulting from a natural catastrophe is generally assessed by using the PCS Index or other similar indexes. The selected index is used as a proxy to determine the actual losses sustained by the sponsor and the pay-out structure is defined in terms of the values of the index. The objective is for the bond reimbursements to the sponsor (losses to the principal amount) to be highly correlated with the actual sponsor losses.

This type of transaction is the preferred choice when the sponsor's book of business does not contain very detailed data, but is representative of the total industry exposure, as is the case for many reinsurers' portfolios.

#### ***4.4. Indemnity Losses***

In certain cases, the cat bond is structured such that losses to the principal amount of the notes are tied directly to the actual insurance payments made by the sponsor as a result of insurance claims filed by those insureds that have experience losses due to the occurrence of a natural peril covered by the bond. Usually, such indemnity deals include provisions to extend the maturity of the securities to allow for the development of the claim process and a better assessment of the final losses.

In this type of transactions, the sponsor is completely indemnified for its losses and is not exposed to any basis risk. Indemnity loss transactions were popular in the early stages of the development of this asset class but have apparently fallen out of favor.

### **5. Moody's Rating Approach**

Moody's ratings of cat bonds address the ultimate cash receipt of all required interest and principal payments as provided by the governing documents of a transaction. The ratings are based on the expected loss posed to the holders of the securities relative to the promise of receiving the present value of such payments. The ratings are derived primarily from our analyses of the likelihood of occurrence of the perils relevant to the transaction during the risk period defined, and the severity of losses to investors resulting from such events. In addition, our review considers the credit strength of the parties involved (swap counterparty, sponsor and others, if applicable) and the effectiveness of the documentation in conveying the risks that are intended to be transferred.

The methodology followed by Moody's to assess the risk to investors has been discussed in some detail in two Special Reports published by Moody's<sup>1</sup>. Our rating approach entails the following steps: (i) assessing the promise to investors; (ii) examining potential loss scenarios and their associated probabilities; (iii) calculating expected losses; (iv) comparing the expected losses for the cat bond to those of a set of benchmark notes.

#### ***5.1. Assessing the Promise***

Each transaction's promise to the investors generally involves the return of principal at a certain specified date (assuming that no losses have occurred) and interest payments through the tenor of the notes. To assess the promise Moody's reviews the terms of the transactions as specified in the indenture and other transaction documents. The definition of the promise to which we rate includes the amounts that are due to the investors, i.e. the return of principal and the amount of the interest payments, as well



as the definition of when those payments will be received, i.e. the final maturity of the notes and the conditions under which this date can be extended by the issuer and the frequency of the interest payments.

Investors in these securities are exposed to potential losses to both their principal and the promised interest payments. However, the promise of receiving their interest payments may contain additional elements of risk that Moody's incorporates in the analysis. For instance, it is usual for these types of transactions to split the interest payments in two parts: (i) a coupon that is guaranteed for a given period (usually a year) and equal to LIBOR times the outstanding balance of the notes at the end of the previous period; and (ii) a coupon that is variable and equal to the promised spread times the balance of the notes at the time of payment. If an event that results in losses to the principal amount takes place between two payment dates, the investor will receive the guaranteed portion of the coupon (the LIBOR portion) but will receive the spread portion corresponding only to the remaining principal after losses are paid to the sponsor. Moody's normally includes the interest payments along with the principal payments in the definition of the promise. This becomes more relevant for multi-year deals since in case of a loss at the beginning of the transaction, the investors will not only lose a portion of their principal, but also the corresponding interest payments for the remaining life of the deal.

## ***5.2. Examining the Loss Scenarios***

The evaluation of loss scenarios is tied to the results obtained from risk models developed by established catastrophe modeling consulting companies. For cat bonds covering perils associated with natural hazards (earthquake, hurricane), the risk analyses have been exclusively based on the cat models from three modeling firms: Applied Insurance Research (AIR) based in Boston, MA; EQE International, Inc. (EQECAT), and Risk Management Solutions, Inc. (RMS), the last two based in California. The risk analysis for the cat bond covering the catastrophic mortality peril was done by Milliman USA, an actuarial consulting firm based in Chicago.

Moody's will independently evaluate the models used by the catastrophe-modeling firms and to lend comfort to our understanding of the consultant's work, Moody's usually develops simplified models to verify the adequacy of the models employed to support the analysis of the transaction. Earthquake hazard in California and U.S. hurricane hazard are two models that have been extensively reviewed for all three of the modeling firms.

The results of the modeling analysis conducted by these consulting firms are normally expressed as the annual probability of loss exceedance corresponding to the particular peril considered. Generally, the models used

to obtain these results are based on a probabilistic description of the natural phenomena (the hazard analysis), the performance of the assets in the book of business (the portfolio modeling and the vulnerability analysis), and the financial losses resulting from the convolution of both (the loss analysis). In the case of parametric transactions, the modeling is circumscribed only to the hazard analysis. The analysis is based on the simulation of specified scenarios and the results weighted by their corresponding probability of occurrence.

In addition to the analysis performed by the catastrophe-modeling firm, Moody's will routinely require the analysis of modeling scenarios that stress relevant assumptions in the corresponding model. To define the stress scenarios Moody's examines the validity of the modeling assumptions made and the uncertainty associated with the parameter estimates. The results of those analyses are usually incorporated in the prospectus distributed by the sponsor to investors and, expressed as *stressed probability of exceedance curves*, also used by Moody's in its own modeling of the transaction to estimate expected losses. The purpose of stressing some of the assumptions and/or parameters of the catastrophe model is to examine the robustness of the modeling results (and hence of the ratings) relative to the modeling assumptions.

### ***5.3. Calculating Expected Losses***

The expected loss, EL, is defined as the weighted average of the losses, adjusted for the relevant stresses, across all possible scenarios considered in the analysis and is expressed as a percentage of the promised amount due to investors. To calculate the average we assign a probability to the occurrence of each scenario considered so that the EL will be the sum of the losses to investors for each scenario weighted by the probability of that scenario occurring.

The promise to investors is generally the repayment of principal at the maturity of the notes and interest payments at each payment date. The present value of the promised cash flows assumes that no losses have occurred and discounting them by the risk-free interest rate considered (usually LIBOR). If losses occur during the life of the cat bond, then the investors will receive an amount that is smaller than the promise. Thus, the present value of the actual cash flows considers the likelihood of occurrence of principal payments and the corresponding reduced interest payments discounted by the risk-free interest rate. The loss to the noteholders is calculated as the ratio between the present value of the amounts that the investor actually receives and the present value of the amount promised.

As indicated above, this computation is performed for all possible scenarios defined by Moody's, each characterized by its probability of occurrence. The EL is calculated as the weighted-average of all such scenarios and the average duration of the cat bond is calculated directly from the actual cash flows. The EL and the average duration of the cat bond are then used to estimate the rating.

#### ***5.4. Comparing the Expected Losses to the Benchmarks***

Once the EL for the cat bond has been established, the final step is to associate a letter rating with this quantity. This is accomplished by way of a benchmarking procedure, where the cat bond's expected loss is compared to those corresponding to conventional bullet bonds of the same duration, assigning the rating of the bond that matches it most closely.

### **6. Type of Perils and Geographic Regions Covered**

Since 1977 and until 2003, all cat bonds rated by Moody's have covered essentially two types of natural hazards: earthquakes and windstorms (hurricanes, typhoons and European windstorms). In terms of geographical distribution, they have covered earthquakes in the U.S. and Japan with a single transaction covering earthquake risk in a European country (Mediterranean Re), windstorms in several European countries, hurricanes in the continental U.S. and Hawaii, and Japanese typhoons.

It is interesting to compare the distribution by peril of the coverage provided by cat bonds with actual losses sustained by the insurance industry in the last 20 years. This comparison indicates a significant correlation between actual loss experience and disintermediation of catastrophe risk through the cat bond market, especially for the hurricane peril in the U.S. Using data not adjusted for inflation, the distribution of catastrophe losses is dominated by losses attributable to U.S. hurricanes including Hawaii (about 37% of the total), followed by European windstorms (about 29%), U.S. earthquakes (18.5%), typhoons in Japan (12%) and earthquakes in Japan (about 3.5%).

In the last few years there has been a shift in the distribution of cat bonds according to the types of triggers used to determine losses to the notes. Indemnity-type transactions were dominant until five years ago. In recent years, we have seen an increase in parametric type transactions. As indicated earlier, the use of parametric triggers results in simpler transactions that include no basis risk to investors, as well as the elimination of moral hazard. The increased popularity of parametric-trigger transactions is likely attributable to these factors and also to the fact that they provide greater transparency to investors in the capital markets.

In 2003, a U.S. \$400 million cat bond<sup>2</sup> was issued to cover the risk of excess population mortality in five countries, covering a risk period of 4 years. This transaction was structured as a parametric transaction, i.e., principal payments to the sponsor are triggered when a defined parameter, the *combined mortality index value*, exceeds some pre-established triggers. The risk analysis was performed by Milliman U.S.A., and following Moody's general approach, their model was reviewed and its results compared with Moody's in-house model. To account for uncertainties in the modeling, Moody's requested that the modeling firm rerun their analysis considering alternative scenarios including an epidemic/pandemic outbreak and terrorist acts involving nuclear and biological weapon attacks.

A second transaction covering non-traditional perils was also issued in 2003, a risk-transfer transaction covering losses to FIFA for the cancellation or postponement of the 2006 World Cup in Germany<sup>3</sup>. Among the potential scenarios that could result in cancellation or postponement of the matches include natural or manmade disasters such as civil unrest or terrorist attack.

A logic tree approach was used in both cases to assess the risk of terrorist attacks and their effect on each of these transactions. In both cases, the likelihood of occurrence combined with the impact of potential attacks was not significant in the assessment of the expected losses to potential cat bond investors. In the Golden Goal transaction, it was clear to Moody's (as well as to anyone familiar with a World Cup event) that it is reasonable to expect that in almost all instances the desire to continue the event will be strong and the event will be completed. As a matter of fact, both the host nation and FIFA have huge political and financial incentives to push forward with the event under almost any circumstance. On the other hand, the Vita Capital transaction was not structured specifically to transfer the risk of extreme mortality due to terrorist attacks and consistently, the analysis showed that even in the most conservative scenarios, such events did not have a large impact on the expected losses to noteholders.

Although there has not been a proposal to issue a cat bond covering exclusively the peril of terrorist attacks and the losses associated with them, it seems difficult at this stage to consider rating such a transaction due to the uncertainties involved in assessing the likelihood of occurrence of such attacks.

## 7. Monitoring Cat Bonds Ratings

As part of its rating process, Moody's continues to monitor the cat bonds' outstanding ratings until their legal maturity or until the notes are withdrawn by the issuer. This monitoring is performed to maintain the accuracy of the current ratings of the notes and it involves updating the

expected losses to investors. This updating is done at least once a year to assess either the effect of seasoning of the transaction (the effect of the passage of time), the effect of a reset of the attachment and exhaustion points (modeled-losses cat bonds), the occurrence of a triggering event (second-event cat bonds) or the accumulation of covered losses that are eroding the first-loss layer (aggregate loss cat bonds). The expected loss analysis is also updated when new notes are issued within a cat bond program.

### ***7.1. What Would it Take to Downgrade a Cat Bond?***

Moody's would consider downgrading a cat bond only under certain circumstances. Certain perils occur without previous warnings, like earthquakes and, thus, losses to holders of cat bonds could be triggered instantaneously. Parametric cat bonds that cover earthquakes are in this category; a potential downgrade would happen only after investors had already incurred in losses.

On the other hand, cat bonds that cover perils that occur with some level of warning, like hurricanes, may be more likely to be put on watch for downgrade. Naturally, a downgrade could only happen after the hurricane has made landfall and the severity of losses has been established. Consider the recent Hurricane Frances that threatened the east coast of Florida; it was originally classified as a category 4 storm but eventually made landfall as a category 2 storm. A rating action to the affected cat bonds in anticipation of large losses would have been premature, as history confirmed.

A different situation could be faced in the case of a second-event or third-event cat bonds because, after the occurrence of a triggering event, the likelihood that investors would experience losses increases and, therefore, its current rating may not reflect this increased risk to investors. Under such circumstances, a downgrade of the securities could be warranted. In fact, Moody's has recently put on watch for downgrade a cat bond that covers earthquake and typhoon perils in Japan due to the occurrence of an earthquake that may turn out to be a triggering first-event for the transaction.

### ***7.2. The Hurricane Swarm of 2004***

The official hurricane season in the North Atlantic runs from June 1 to November 15, with the most intense activity occurring between August and September (a little more than 60% of all hurricanes that make landfall do so during this period of time).

The intensity of the 2004 hurricane season was expected to be above average, according to the August 1<sup>st</sup> prediction from the National Oceanic and Atmospheric Administration (NOAA), and the actual results confirmed

this prediction. Four hurricanes of significant intensity hit Florida during August and September, causing as much as \$25 billion in insured losses: Charley, a category 3 hurricane when it made its first landfall near Cayo Costa, Fla.; Ivan, a category 3 storm that made its first landfall near Gulf Shores, Ala.; Frances, a category 2 hurricane when it made landfall near Sewall's Point, Fla.; and Jeanne, a category 3 hurricane that made landfall near Stuart, Fla., which was very close to the spot Frances hit. Not since 1851 have four hurricanes hit Florida in a single season.

The current estimates of losses to the insurance industry ranges between \$18 billion and \$25 billion, distributed among Charley (\$6 billion to \$8 billion), Ivan (\$4 billion to \$6 billion), Frances (\$4 billion to \$5 billion) and Jeanne (\$4 billion to \$6 billion).

However extreme the outcome of the current hurricane season, the insurance industry appeared better prepared to withstand the losses resulting from all these events. The experience of Hurricane Andrew in 1992 resulted in the imposition of higher deductibles for homeowners by insurance companies. In addition, insurers became more selective of the risks they were willing to underwrite and they also transferred a larger portion of their potential losses to the Florida Hurricane Catastrophe Fund, thus reducing the losses that would be absorbed by the industry. Since most cat bonds tend to cover per-event losses of a catastrophic nature and not aggregate losses, loss of principal to investors in these securities should occur following rare *single* events, consistent with the ratings of the securities. As part of Moody's risk modeling analysis, it is customary to assess the potential losses to cat bond noteholders resulting from the historically largest events. Such analysis reveals that even a repeat of hurricane Andrew would not trigger losses to any outstanding cat bond. As the hurricane season unfolded in 2004, none of the hurricanes included in this recent swarm produced losses close to the level associated with Hurricane Andrew and, thus, the expectation that any cat bond would trigger losses to investors was very low at the time. Thus, Moody's did not contemplate downgrading any of the outstanding cat bonds covering per-event hurricane losses as the storms were approaching land.

Other types of cat bonds—second-event or third-event notes--could be more susceptible to downgrades due to the occurrence of an event swarm. As discussed above, only after the triggering event occurs is that security exposed to losses due to a new event. None of the outstanding cat bonds of this type could have been affected by the hurricane swarm of 2004 in Florida.

### ***7.3. What to Expect in the Future?***

If there is something that investors should remember from the experience of the swarm of hurricanes that hit the U.S. this year, it is that cat bonds are devised to cover the occurrence of large but extremely rare losses due to natural hazards. Even an extraordinary occurrence like four significant hurricanes hitting the U.S. coast did not result in losses to investors in any of the outstanding cat bonds covering these perils.

## **Conclusion**

The use of catastrophe bonds as an alternative risk transfer mechanism is well established in the insurance and reinsurance fields. The capital markets have also become familiar with these types of transactions and some investment management firms and institutional investors include them regularly in their portfolios. Investors are attracted to catastrophe bonds for the opportunity to diversify into a new asset class that has virtually no correlation with overall market performance -suggesting that cat bonds are effectively "zero-beta" assets.

Cat bonds offer an alternative to traditional insurance and reinsurance to provide coverage against catastrophe risk and these securities have reached a certain degree of acceptance in the market. We find that market participants are more familiar than a few years back with the modeling assumptions and the methodologies used by the three modeling firms to develop their models. Cat bonds continue to evolve and adapt to become simpler and more attractive to investors in the capital markets.

The cat bond market continues to explore potential new products, which could include coverage for the usual perils but in different geographic locations around the world, as well as completely new perils.

## Notes

- 1 "Moody's Approach to the Rating of Catastrophe-Linked Notes", Moody's Special Comment, Sept. 1997;  
  
"Moody's Approach to Rating Catastrophe Bonds Updated", Moody's Rating Methodology, January 2004.
- 2 "Vita Capital Ltd. – a Catastrophe Bond Linked to Catastrophic Mortality", Moody's New Issue Report, January 2004.
- 3 Golden Goal Finance Ltd. – Fédération Internationale de Football Association ABS Risk Transfer Switzerland/Germany", Moody's Pre-Sale Report, September 2003.





## PART III

### **Role of Government and Public-Private Partnerships for Catastrophic Risks Management**

#### **A - Analytical and Comparative Reports**

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## PART III A

### *Chapter 12*

# **Comparative Analysis of Large Scale Catastrophe Compensation Schemes**

*by*

**Paul K. Freeman and Kathryn Scott\***  
University of Denver

This chapter first compares the large-scale compensation scheme of sixteen OECD countries. The role of the private market and governments in coping with the catastrophe losses is then described. Three groupings of the varied government programs are made based on whether the government primarily acts as insurer, reinsurer or underwriter of catastrophe risk. A comparison between the three groups focusing on the tradeoffs between moral hazard, adverse selection, loss potential, subsidy, and cost of insurance is made for the programs. OECD country experiences are used to identify characteristics of desirable programs and are extended to the recent experiences of Turkey. Finally, an analysis of the possible lessons for developing countries interested in establishing catastrophe compensation schemes from the experience of the OECD studied countries is undertaken.

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## Introduction

This chapter examines several aspects of government sponsored catastrophe insurance programs. The covariant nature of catastrophe risk makes it difficult for the private insurance market to create cost efficient insurance products. The capital required to support catastrophe insurance is much greater than the capital needed for insurance products directed at independent, non-correlated risks. This makes market based catastrophe insurance products expensive. One tool to reduce the cost of catastrophe insurance is to use government capital. Several insurance programs have been developed in the OECD countries that link government capital to insurance for catastrophe risk. This paper explores several issues related to government sponsored catastrophe insurance programs.

Part 1 is a comparative analysis of some government supported catastrophe insurance programs in several OECD countries. The analysis begins with a general description of the role of the government and the market in providing financial protection from catastrophe losses. Once the theoretical framework for the problem is described, it is used to compare the surveyed countries. A brief discussion on the social/political framework in various countries and the level of catastrophe risk is also discussed to reveal how these factors might influence the types of programs adopted in each country.

Since the Second World War, a nearly universal consensus has developed by governments in OECD countries that they are responsible to protect their citizens from losses caused by catastrophes, whether man-made or natural. The widespread involvement of governments in managing catastrophe risk is a reflection of the inability of the insurance market to efficiently finance catastrophe risk. Insurance works best when it deals with independent, non-correlated risk. Catastrophes, particularly natural hazard catastrophes, are typified by their co-variant nature: an event like an earthquake or flood will damage large numbers of similarly situated properties at the same time. The capital required by insurance companies to cope with co-variant risk is much higher than the capital needed to deal with independent, non-correlated risks. This increase cost of capital is reflected in expensive premiums.

The high cost of private insurance has led to government sponsored catastrophe programs. In part, these programs reflect the ability of governments to access financial resources at costs below those of the private insurance industry. Governments have a deep credit capacity: they can borrow by issuing debt and can raise resources rapidly through its ability to

tax (Cutler and Zeckhauser 1999). As a result, the government is a logical entity to provide reasonable cost catastrophe protection.

The reliance on governments as risk managers is problematic. Almost all government risk management and insurance programs are plagued by problems of moral hazard (Priest 1996). Moral hazard is the phenomenon that behavior changes if someone perceives that a third party bears the cost of their actions. If the government bears the costs of catastrophes, their citizens are unlikely to reduce the risk of their behavior. They rely on the government to “bail them out”. As a result, government intervention in the risk management process increases overall societal risk. This increase in risk is reflected in the costs of government managed catastrophe programs. As the costs increase, they bump against the budgetary limitations of how much governments are willing to pay for catastrophe losses.

One of the most important features of the private insurance market is its ability to control moral hazard. Through the use of insurance pricing based on actuarial risk, the use of coinsurance and deductibles, and placement of limits on the amount of insurance provided, the private market has created a series of policy tools to reduce the risk of moral hazard. These tools primarily rely on the capacity of the private market to segregate risks. By matching insurance protection and its cost to the risk parameters of each insured, the private market controls moral hazard. Governments are less capable of using the tools of private market place to control moral hazard. Government programs tend to treat all citizens the same. The need to provide “equitable” treatment overrides the need to reduce moral hazard by “efficiently” segregating its citizens into diverse risk pools.

This creates a natural tension for policy makers. Governments are best able to spread the cost of risk but increase overall societal risk by not containing moral hazard. The market is able to control moral hazard thus reducing overall societal risk, but lacks the financial capacity to efficiently spread catastrophe risks. Policy makers are interested in strategies that blend the strengths of the private and public sector: reducing moral hazard while providing needed financial capacity. The sampling of catastrophe programs surveyed by the OECD provides a platform for comparing how different governments blend government and private solutions to financing catastrophe risk. The tradeoffs between the different government programs are explored in Part 1.

Part 2 presents for policy makers a framework to analyze alternative approaches for coping with catastrophe risk. Based on the tradeoffs discussed in Part 1, what is the best model for integrating governmental action in a catastrophe financing program? This part notes that the answer to this question is largely dependant on the objective for government

participation. If the government role is to facilitate the private market with needed credit resources, the level of government involvement may be minimal. The program designed by the government should make its treasury available for a fee from the private market. In general, the government should support a voluntary insurance program with actuarially set rates that is supported by the government as a reinsurer. If the objective of the government is create an insurance program that substitutes for government post disaster aid, then the structure of the program may be much different. In this case, the interest in the government is reducing its commitment to provide financial aid after a disaster. This objective is met by a mandatory insurance program that has something paid by citizens who expect to receive post disaster financial support. In this case, the mandatory program may need subsidized rates to encourage participation. In essence, the “right” program is determined by the objective of the governmental participation in a sponsored insurance program. The theoretical analysis is linked to evaluate the recently established Turkey Catastrophe Insurance Program to see how its features match up to the objectives articulated for establishing the program.

Part 3 of the chapter explores what the lessons from the OECD catastrophe insurance programs are applicable to the needs of poorer countries coping with catastrophe risk. To begin with, the nature of catastrophe risk to the developing countries is described. On the whole, the catastrophe risk is much greater on both an absolute and relative basis in developing countries. At the same time, the interest of governments in allocating scarce resources to cope with catastrophe risk is minimal. The reason for this diminished interest is explored. For developing countries that are beginning to cope with issues of economic development and labor protection, risk management initiatives related to catastrophe risk may be viewed by policy makers as premature.

## **1. OECD Survey**

### ***1.1. Scope of the Problem***

The concern with catastrophe risk in the OECD countries is well founded. Natural and man-made disasters have increased dramatically in both their frequency and severity over the last decades. As Table 12.1 indicates, in the last 10 years, there has been more than double the number of great natural disasters as compared to the 1960s. Those impacted by the increase in natural catastrophes have also increased. According to the Red Cross' *World Disasters Report 2002*, “those affected - whether left injured, homeless or hungry - tripled to 2 billion during the past decade. Direct economic losses multiplied five times over the same period, to US\$ 629

billion in the 1990s” (IFRC 2002). Furthermore, the future does not bode well: Munich Re has projected losses from great natural catastrophes to rise to US \$300 billion annually by 2050.

**Table 12.1**

Decade	1950–1959	1960–1969	1970–1979	1980–1989	1990–1999	Last 10 years
Number of events	20	27	47	63	91	60
Economic losses	42.7	76.7	140.6	217.3	670.4	514.5
Insured losses	-	6.2	13.1	27.4	126.0	83.6

Losses in US\$ bn (2003 values)

Last 10:60s

2.2
6.7
13.5

}

The comparison of the last ten years with the 1960s shows a dramatic increase.

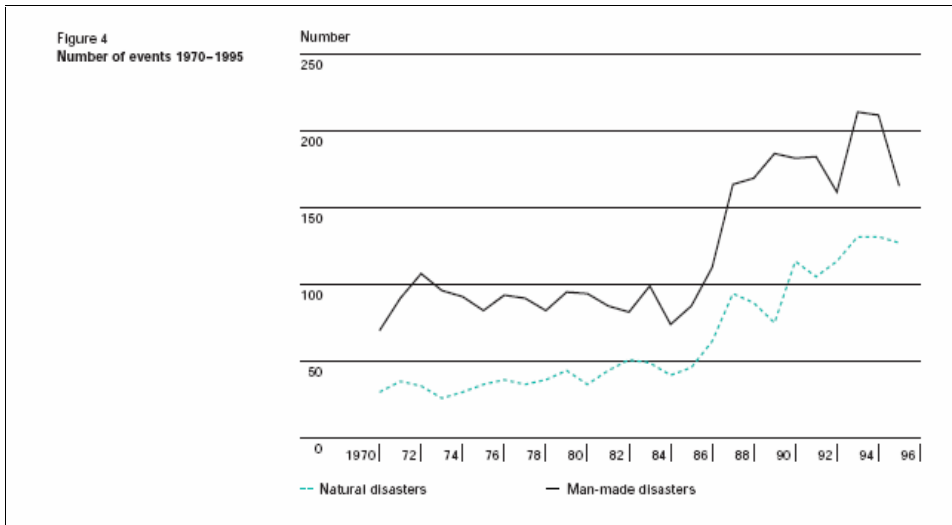
Source: Munich Re (2004). *Topics Geo*, 2003.

As for man-made disasters, there has been a similar rise. Swiss Re reported 238 major man-made disasters in 2003, compared to 65 in 1970 (Swiss Re 2004). The intensity of man-made disasters has also escalated. Catastrophes such as chemical spills, explosions, fires and collisions caused \$12 billion dollars in total economic losses in 2003. Most of this sum covers the damages from two major disasters, the Columbia shuttle explosion and the 3-day power outage in New York State. This increasing trend in man-made disasters has been underway for some time. As early as 1996, Swiss Re has noted the increasing number and costs of man-made disasters. Graph 12.1 shows the trend from 1970 through 1995.

The substantial increase in catastrophe risk has focused the attention of governments on appropriate strategies to cope with these losses. The natural tendency is for any government to rely on the private insurance industry to provide needed protection against losses from catastrophes.



Graph 12.1



Source: Swiss Re. *Sigma*, No. 1, 1996.

### 1.2. How Insurance Reduces Risk<sup>1</sup>

Over the past few years, the academic community has developed a clear understanding of how private insurance operates. There is a substantial theoretical and empirical body of work describing the private insurance market. More recently, the specific role of the private insurance market and the problem of catastrophe risk have received considerable academic attention.<sup>2</sup> The intervention of the government in financing catastrophe risk arises from a perceived inability of the private market to adequately cope with catastrophe risk. To frame the proper role that governments take to finance catastrophes, it is important to understand how the private insurance market operates.

As an economic tool, insurance has distinct advantages. Its primary advantage is the ability to reduce the overall level of risk to society. This reduction of risk occurs through three principal features of insurance: the aggregation of risks, the segregation of risks into separate pools, and the control of moral hazard.

### *Aggregation of Risk*

Insurance operates where losses have a probabilistic character. Losses that are certain to occur in a particular period cannot be insured against. Rather, one must either accumulate savings in advance to pay for the loss or shift savings (generally through borrowing) after the loss occurs to restore the prior economic condition. Insurance works when losses are probabilistic, either as to whether or not the loss will occur or to when the losses certain to occur will occur (like life insurance).

Insurance reduces the risk level to society by aggregating uncorrelated risks. The risk-reducing function occurs from the operation of the law of large numbers—the empirical phenomena according to which the probability density function of a loss tends to become concentrated around the mean as the sample number increases (Priest 1996). For statistically independent risks, the sum of the aggregated risks is less than the sum of the risks taken individually. This reduction of the mean of independent risks is at the heart of insurance. For each individual participating in an insurance program, they receive the relative benefit of their risk being valued like all other similarly situated persons. For each individual, their risk is lower when pooled.

As relates to catastrophes, the benefit of aggregating uncorrelated risks is lost. The law of large numbers will not apply if members of a risk pool are not statistically independent to some degree. Aggregating statistically dependent or correlated risks increases the variability of the risk pool. This means that the pool would have to maintain reserves greater than the reserves that each individual would have to maintain if uninsured. This is what happens with catastrophes. Since natural catastrophes are events that occur to large percentage of the population at the same time, they are highly correlated risks. As such, they cannot be reduced by aggregating the risks into a common pool. In fact, the reserves required by an insurance company to protect against the risk must be more than the reserves that each insured would individually need to keep to provide financial protection. The natural advantage of insurance is lost. Private insurance has difficulty efficiently coping with highly correlated events that can cause substantial economic damage.

The insurance industry has adapted several techniques to make co-variant risk insurable. The most common technique is enlarging the risk collective by bundling together several types of perils. Bundling occurs when separate risks like fire, flood, earthquake, and hurricane are combined or bundled into a single policy. Since each of the perils is uncorrelated to the others, the bundling of the insurance reduces the accumulated risk of any one hazard in the policy. Since the insureds know that they are not exposed

to all the risks in the bundle and may be reluctant to pay for risk that will not impact them, the purchase of bundled catastrophe risk often needs to be made mandatory. A similar result is obtained by bundling catastrophe risk with other insurance. The requirement that catastrophe insurance be purchased in combination with fire insurance is a tool to bundle two risks that are not correlated, thereby reducing the covariant nature of the entire bundled risk pool.

Catastrophe risk provides a distinctive problem for private insurance. The covariant nature of the risk removes the natural advantage of insurance to reduce risk by aggregating independent risks. For insurance to successfully cope with covariant risk, it must devise strategies to bundle correlated and uncorrelated risks. In so doing, it needs to introduce other characteristics into the insurance arrangement.

### *Risk segregation*

Insurance works best when insurance companies can segregate risk. Insurers distinguish relatively high-risk from low-risk insureds and then assign them to narrowly defined risk pools through their underwriting process. Through risk segregation, insurers reduce expected losses. This reduction occurs through two processes. The first is primarily mathematical. If there are both high-risk and low-risk populations among insureds, the summed variance of segregated pools will be less than the variance of a single undifferentiated pool. Because segregation reduces variance, it reduces risk.

The second risk-reducing function of segregation is to set an insurance premium that most accurately reflects the risk that an insured brings to a pool. Charging insureds a premium related to underlying risk informs insureds about the cost of engaging in activities that generate the risk. For example, a higher insurance premium for living in a flood plain is a market rationing device. Some homeowners are prevented from living in a flood prone region because of the higher premium charged. As a result, the overall cost of floods will be lower for society as a whole.

As well, risk segregation charges lower premiums to low-risk activities. As a result, the low-risk activity is properly encouraged. The ability of insurance to perform this function is a result of the ability to segregate risks into proper risk pools. By so doing, it reduces the risk of adverse selection: the phenomena that only those with risks higher than indicated by a pooled insurance premium will actually purchase the insurance.

### *Control of Moral Hazard*

Insurance also reduces risk by controlling moral hazard. Moral hazard is the phenomenon that one changes their behavior because their risk of loss is borne by someone else. As relates to insurance, the issue of moral hazard is whether an insured's behavior changes in a way to increase risk because they purchased insurance. A simple example is whether a driver is more reckless because his automobile is insured. Since the cost of his reckless behavior is paid for by the insurance company, does he change his behavior? If so, then a moral hazard problem exists.

As may be expected, the insurance industry has adopted a number of measures to reduce the impact of moral hazard. Among the tools commonly employed are the use of deductibles and coinsurance as part of the insurance contract. A deductible is set at a level that still provides incentive for the insured to act as they did prior to purchasing insurance because they must cover a significant portion of the loss themselves. Co-insurance operates like a deductible. Coinsurance is when the insurer and the insured share the loss together. For example, an 80% coinsurance clause means that the insured pays 20% of his losses while the insurance company pays 80%. In this way, the insured has an incentive to operate safely to avoid paying his portion of the loss. A final tool is to exclude some events from insurance coverage. The exclusion in life insurance policies against payment for death by suicide is a common example of the use of an exclusion directed at moral hazard.

By way of summary, insurance has the capacity to reduce societal levels of risk through risk aggregation and risk segregation. It can preserve the lower risk through the use of tools that address the problem of moral hazard.

### ***1.3. Private Market for Catastrophe Insurance***

The limitations associated with the private market coping with covariant risk do not mean that the private insurance industry is incapable of coping with catastrophe risk. The private market is the main means of coping with man-made catastrophes. In addition, the private insurance industry does provide significant insurance protection for natural catastrophes as well. As noted in Table 12.1, private insurance funds approximately 20% of all losses from natural catastrophes now.

In 2003, the OECD completed a study on flood insurance in their member countries. The study noted that nine OECD countries have voluntary, stand alone flood insurance policies available. Those countries include Australia, Austria, Belgium, Canada, Germany, Italy, Mexico, the Netherlands, and Slovakia (OECD 2003). An additional eight countries provide flood insurance bundled with other risks like fire insurance. Those

countries include Czech Republic, Israel, Japan, Mexico (it offers more than one type of policy), Portugal, Spain, Switzerland, Turkey and the United Kingdom. The report noted that of the 18.5 billion Euro of losses from the severe floods in Central Europe in 2002, only 20% of the losses were paid by private insurance. The low recovery from the insurance industry is a reflection of both the low limits on policies purchased as well as the low numbers of potential insureds that purchased policies. It is possible for the private market to provide substantial protection against floods. In the United Kingdom, 95% of all households have flood insurance that is bundled with their homeowners' policies.

Although catastrophes can be handled by the private market, the cost of private insurance is expensive. This cost is the result of two factors. The first is the problem of adverse selection. Adverse selection occurs when only the high risk group purchases insurance. This group is generally subject to repeated losses. To compensate, the insurers will insist on very high premiums for this group (Swiss Re 1998a). The second problem relates to the capital that needs to be reserved by the insurance companies to cope with catastrophe risk. Because of the covariant nature of the risk as discussed earlier, the insurance companies need additional capital to hedge catastrophe risk (Lewis and Murdock 1999). To pay for the increased capital, they need to increase the premiums for the catastrophe insurance they offer. For the same reasons, reinsurance companies also must increase their capital for catastrophe reinsurance and the prices they charge. By some estimates, reinsurance rates (reinsurance is the insurance purchased by insurance companies to spread their risk) in the United States for catastrophe protection have increased by as much as 150% during the mid-1990's (Cummins 1997). As the cost of natural catastrophes increase worldwide and the private cost of protecting against those catastrophes increases to address the covariant nature of the risk, the difficulty of providing affordable insurance becomes apparent.

The high cost of private catastrophe insurance has created a policy role for governments to address the financial needs of their citizens to cope with catastrophes. The range of governmental action is described in the next section.

#### ***1.4. Government Role in Catastrophe Risk Management***

The proper role of governments in financing catastrophe losses is part of a much larger debate on the role of governments as risk managers. The central theme of the argument is that the state or government is the most effective mechanism for spreading risk and losses. Governments are presumed to be the best economic agents to absorb risk. "It is profitable for all concerned that risks should be shifted to the agency best able to bear

them through wealth and its ability to pool risks. The government, above all other economic agencies, fits this description” (Arrow 1992). The capacity of governments to absorb the cost of catastrophes at a lower cost than the private market is the compelling justification for their involvement in managing catastrophe risk. As the costs of private insurance increases, the willingness to draw on the financial resources of governments increases. Naturally, there are constraints on the ability of governments to act as catastrophe risk managers.

The most obvious is budgetary constraints. The capacity of government to spread risks places considerable demand on tax resources. A variety of risks are given to the government to spread: retirement benefits, health, and defense are just a few of the risks that governments are asked to absorb. Catastrophes are just one of a number of demands made on the risk spreading ability of governments. For all governments, there is a limit to their capacity to raise taxes.

Even with budgetary constraints, all governments in the OECD countries provide post catastrophe aid. The provision of post-disaster aid is a transfer of risk from the population to the government. The fact that the transfer occurs automatically through the payment of taxes does not diminish its risk transfer attributes. The level of post-disaster aid can be substantial. The United States spends about \$7 billion a year in post disaster assistance (Moss 1999). In the broadest sense, the government is the insurer of risk since it pays all claims, even if it does not receive premiums for accepting the risk.

For many governments, there is an interest in limiting the role of direct post disaster aid. These governments have explored alternative strategies that have the government sponsor a catastrophe insurance program. The primary motivation is to have those receiving benefits from the government pay something for the benefit other than tax payments. The task is to design programs that efficiently use the financial strength of the government while limiting the impact of moral hazard. This generally involves creating a partnership between the government and the insurance industry to harness the comparative strengths of each party. The risk management literature extensively discusses the types of partnerships that may be developed between governments and private market to cope with catastrophe risk. Generally, these may be categorized in three broad areas: government as insurer using the administrative capacity of the private market to assist in programs that are fundamentally directed and paid for by governments; government as reinsurer providing secondary support to the primary role of the private insurance industry; and government as underwriter setting rules and regulations that enable the private market to operate without direct governmental financial support.

### ***1.5. Government as Insurer***

One approach is creating governmental sponsored insurance programs. These programs take on the characteristics of a private insurance but are neither guided by insurance principles nor financed principally by an identifiable fund of insurance reserves (Kane 1996). In essence, these programs are used primarily to redistribute losses without the risk reduction functions of insurance discussed earlier (Priest 1996). By and large, these types of programs would be characterized by centralized decision making with mandatory and uniform charges for insurance. They would be further characterized by claim payments of set amounts regardless of the level of loss. The main difference between these types of programs and pure aid is that something is generally collected from the public as a condition of their participation in the program. The amount collected and the payments made are generally uniform. Being uniform, they do not have the characteristic of an insurance premium: a charge related to the risk being assumed.

While governments are effective instruments to spread risk, they are notoriously ineffective in limiting moral hazard. Virtually every study of government insurance activities shows moral hazard problems to be severe (Priest 1996). The government as insurer seldom makes proper efforts to control moral hazard. Government programs can incorporate the tools used in the private market to control moral hazard, but they rarely do so to the extent of the private market. The techniques used by the private sector are best characterized as constraints on benefits to control moral hazard. Deductibles, co-insurance, and policy limits are all tools that reduce benefits to control moral hazard. Voter interest in benefits is unlikely to permit the government to control moral hazard to the same extent as the private market.

The dividing line between the government as insurer or as reinsurer is not clear. The primary distinction is whether the government requires the private insurance market to retain some portion of the risk. If there is no risk retained by the private insurance market, the program is a government insurance program. If some level of risk is retained, the program is characterized as a reinsurance program. On this basis, the programs in Spain, the National Flood Insurance Program in the United States, and the Turkey Catastrophe Insurance Pool all would qualify as government sponsored insurance programs.

### ***1.6. Government as Reinsurer***

This approach has been discussed in the literature as the *market enhancing view* of government policy (Lewis and Murdock 1999). This view looks for the government to facilitate more efficient private-sector insurance. This is done by the establishment of a government reinsurance

program that has the ability to directly access the government's treasury after other resources have been consumed (Cutler and Zeckhauser 1999). Generally, the government requires the private market to assume and pay for some level of risk. Generally, the government assumes the most expensive risk. The government relies on the administrative capacity of the private insurance market to perform needed services like marketing, premium collection, policy issuance and claims handling. The private market is paid a fee for these services. This approach blends the risk spreading capacity of the government with the ability of the private market to efficiently apply insurance principles. Formal government reinsurance programs for different catastrophe risks exist in New Zealand, Japan, South Africa, Norway, France, the United Kingdom, the United States and the Netherlands. These programs are directed at diverse catastrophe risks like earthquakes (Japan), terrorism (the United Kingdom), flooding (France), and political riots (South Africa).

### ***1.7. Government as Underwriter***

The third area of government involvement relates to governmental setting of rules and policies that assist the private market to insure catastrophe risks. For many man-made risks, the role of the government is to set the terms of liability so that the risks are insurable. There are two broad issues related to insurability or risks: the ability to identify the risk and the ability to set premiums for each potential class of customer (Freeman and Kunreuther 1997). Often, governments play a key role in setting the conditions related to a risk that make it insurable: it sets "underwriting standards" that permit the private sector to develop insurance products. In coping with man-made disasters, the primary issue is setting liability limits (Munich Re 2002). With proper government rule-making, most man-made disasters are insured in the private market. Generally, man-made disasters do not have the central problem of natural catastrophes: covariant risk. These disasters tend to be independent, non-correlated events. The main insurability issue relates to the potential size of the catastrophe. They are the type of risks that private insurance is designed to handle.

Governmental setting of standards of behavior is not only done to impact the insurability of risk. This is a general function performed by governments in all OECD countries. In the context of the relationship between the public and private sector in financing catastrophes, the government can play a distinctive role by more narrowly defining appropriate behavior and limiting liability. By so doing, it directly enhances the capacity of the private market to manage risk.



With these basic strategies defined, it is appropriate to examine some catastrophe insurance programs and understand how they fit the broad theoretical model.

### ***1.8. Government Catastrophe Funded Programs in the OECD***

For purposes of this paper, catastrophe programs in Australia, Belgium, Denmark, France, Iceland, Japan, Mexico, the Netherlands, New Zealand, Norway, Poland, the Slovak Republic, Spain, Switzerland, Turkey, and the United States were analyzed. The programs in these countries can be grouped into the three main categories defined in the earlier section: government as insurer, government as reinsurer, and government as underwriter.

In many OECD countries, the government creates “funds” to pay for catastrophe losses. These funds are generally created from tax revenue. It is a means to reserve against future obligations of the government to pay for disaster losses. This type of funding is the most common programs in the surveyed countries. In this group are Australia, Denmark, Mexico, the Netherlands, Norway and Poland. The permanent fund in Australia is the Natural Disaster Relief Arrangements (NDRA). Under this program, the Commonwealth provides funding assistance to States and Territories aimed at alleviating the financial burden of rebuilding infrastructure and making disaster relief payments. On a sliding scale basis, the Commonwealth reimburses States and Territories from one-half to three-fourths of the expenses incurred to cope with natural catastrophes. In addition to the NDRA, Australia will provide special funding for particular disasters. For example, the government provided AS\$151.7 million in funding for flood assistance in New South Wales and Southern Queensland for the 2000-2001 floods. There is a very limited market for residential flood insurance<sup>3</sup>.

Mexico has a National Fund for Natural Disasters (FONDEN) that was established in 1996. FONDEN is a budgetary allocation for disaster relief and reconstruction. FONDEN’s budget is currently set at \$350 million a year. The Netherlands has the Calamities Compensation Act that was established in 1998. It only applies to floods and earthquakes. The maximum to be paid each year is 450 million Euro. Poland and Norway have similar schemes. In Poland, the National Program for Restoration and Modernization pays for flood damages to individual, commercial and local government property. The Program is funded by the national and local governments. Norway has the National Fund for Natural Disaster Assistance that pays for natural disaster losses to roads, bridges, battlements, farmland, crops and forest areas. The maximum compensation per loss is NOK 405,000. The fund is publicly financed.

In each of these countries, there is some private insurance available for flooding risk. It should be noted that Australia has private insurance against floods, particularly for commercial properties. For flash floods, nearly 60% of all commercial properties are insured. There is much less penetration of the insurance market for non-flash floods, perhaps as low as 5%. There is flood insurance in both Mexico and the Netherlands. The Netherlands's Calamities Compensation Act only pays for damages that cannot be commercially insured.

These programs are *ex post* assistance programs. The conditions for benefits are set and funded by the government. Generally, the funds are meant to supplement the private insurance market.

### *Examples of Government as Insurer*

A number of countries have created government sponsored insurance programs. In these programs, the government collects a fee or premium for providing insurance coverage. Often the private insurance industry is used to provide needed administrative services. An example of this type of program is the Spanish program. The Spanish government plays a unique role in the publicly administered disaster financing program, Consorcio de Compensacion de Seguros (CCS). Founded in 1954, CCS is a public corporation providing 'extraordinary risks' insurance: coverage against natural disasters and risks with 'social repercussions' (terrorism, riots, etc.): in short, a broad range of natural and man-made disaster scenarios. Consorcio indemnifies claims resulting from extraordinary events and extends to both natural phenomena (earthquakes, tsunamis, tidal waters, extraordinary floods, volcanic eruptions, atypical cyclonic storms, falling astral bodies and aerolites) and political and social events (terrorism, riots and civil commotion). The CCS payments are subsidiary to payments made by the private insurance industry. CCS pays only if the risk was not covered by private insurance (for the poor if they did not buy insurance) or if the insurance company fails to pay because it is insolvent. The "extraordinary risk" protection is a mandatory additional coverage added to fire and natural perils, motor and railway vehicles and other property damage policies. The CCS surcharge is automatically included in the base policy's premium and credited to CCS every month. Deductibles for property loss amount to a maximum of 1% of the insured total and a minimum of 150.25 Euros. The private insurance companies set the base policy premium. The surcharge varies by the type of policy offered, but is a reflection of the base rate charged on the primary policy. The program collects a premium and CCS pays for catastrophe losses that are not otherwise handled in the private market. It is a government sponsored insurance program.

### *Examples of Government as Reinsurer*

The second broad category of program is those that employ some type of state guaranty to support the private insurance industry. The most common approach is for the state to provide reinsurance to the private insurance industry. In this scenario, the private market sells catastrophe insurance. The risk from the policies is resold to a government managed or funded reinsurance company. Generally, the catastrophe insurance must be purchased by businesses or homeowners that purchase first party insurance: fire, homeowners', automobile, or property policies. The mandatory coverage extends to catastrophes as defined by the government and can include man-made catastrophes (the recent terrorism insurance programs), natural catastrophes generally (France) or specific natural hazards like earthquakes (Japan) or hurricanes (Florida). The cost of the catastrophe coverage is added to the premium for the standard insurance policy. Generally, the additional catastrophe premium is computed as a percentage of the premium for the property policy. In each instance, some sharing arrangement between the private market and the government is made concerning the catastrophe premium collected and the risk to be borne by the government. In some instances, all of the risk and the catastrophe payment may be shifted to the government (France) or there may be a mandatory sharing arrangement between the government and the private insurance industry (Japan). As a rule, the government guaranties payment of all eligible claims even if the premiums collected are not adequate to pay all claims. It is this additional guaranty of the government that provides the needed capital for the insurance to work. Two of the most well-known of these programs are the public reinsurance programs in France and Japan.

The Japanese government administers the Japan Earthquake Reinsurance Company (JER), which, as the name suggests, provides financing in the event of earthquakes, volcanic eruptions and tsunamis. Homeowner's earthquake insurance is supplementary to fire insurance, reinsured solely through JER. All earthquake risks written by private insurers in Japan are wholly reinsured with the Japan Earthquake Reinsurance Company. The Japan Earthquake Reinsurance Company cedes a certain portion of the portfolio back to the original direct insurers and to another Japanese reinsurance company in accordance with a sharing arrangement established by the government. The remainder of the reinsurance liability is assumed on the basis of excess of loss insurance coverage concluded between the government and the Japan Earthquake Reinsurance Company. Based on the ceding of risk between the private sector and the government, losses would be shared on the following terms: payment up to 75 billion yen is to be borne 100% by the private insurance companies. Losses over 75 billion yen and up to 1.0774 trillion yen, are

shared equally between the government and the insurance industry. Losses up to 4,500 billion yen are borne 95% by the government and 5% by the insurance industry. Premiums are actuarially determined for each insured property.

The French Government sponsors two insurance programmes: the National Disaster Compensation Scheme (CAT NAT), and *Fonds National de Garantie des Calamités Agricoles*. CAT NAT is backed by a state-guaranteed public reinsurance program, *Caisse Centrale de Réassurance* (CCR). Insurance companies have the option of reinsuring unusually large disaster risks through CCR, which are then backed by the government as reinsurer of last resort. CCR offers two types of reinsurance protection: quota-sharing and stop-loss coverage. The quota-share insurance has CCR participating in losses in proportion to the sharing arrangement of the premium collected for catastrophe coverage. “Stop loss” reinsurance is a “non-proportional” mechanism by which CCR assumes risk after a certain disaster damage level has been attained. Because of CCR’s unlimited government guarantee, it has no capacity limit.

The catastrophe insurance is sold by the private insurance companies. Any non-life insurance policy taken out in France contains an additional mandatory surcharge (6% on automobile policies and 12% on all other non-life policies) that covers losses in the event of a natural disaster. The French government fixes the insurance premiums.

CAT NAT covers earthquakes, floods, landslides, hailstorms, avalanches, tsunamis and droughts. Payment requires a government declaration of a disaster, determined by a set of criteria pertaining to the disaster’s scope and magnitude. The program covers both personal and commercial losses on insured property above the amount reimbursed by private insurance companies.

The use of the government as reinsurer for the private insurance industry is also the tool used to cover terrorist risk. Since September 11, 2001, France, Germany, and the United States have created government guaranteed reinsurance like programs to provide protection against terrorism. Spain has had terrorism included in its catastrophe program since inception. The United Kingdom established a government guaranteed terrorism insurance program in the 1990’s.

### *Examples of Government as Underwriter*

As relates to natural catastrophes, there have been a number of proposals that maintain that with more governmental policy involvement, the private market for insurance would be enhanced. In the area of man-made environmental risks, there has been considerable attention focused on the

proper role of government in setting standards of behavior and establishing limits of liability to permit the private market to develop insurance for these risks. In the United States, private insurance for asbestos risk, underground storage tanks, and environmental contamination have been created based on explicit governmental regulations addressed to these risks. The regulations provided the “underwriting standards” for the private market (Freeman and Kunreuther 1997). In the realm of natural catastrophes, there have been suggestions that more effective private insurance markets could be created with governmental requirements for mandatory private insurance and stricter guidelines on land use planning and building construction (Kunreuther 1996). The governmental function required is not to provide financial support for well defined risks, but to clarify liability so as to permit the creation of private insurance.

### *1.9. Comparisons between the approaches*

A description of the various existing programs does not detail the types of tradeoffs imbedded in the different programs. As noted earlier, both governmentally sponsored and private insurance markets must deal with a series of issues to effectively operate. Principal among these are the problems of adverse selection and moral hazard. Intuitively, different approaches involve different tradeoffs. It is important for policy makers to understand the nature of those tradeoffs.

Some research exists that reflect on the nature of the tradeoffs inherent in different approaches to insuring catastrophe risk. In a survey that Swiss Re completed in 1998 of flood insurance programs worldwide, they identified three characteristics that distinguished the different programs: risk of anti-selection, loss potential, and the cost of risk assessment (Swiss Re 1998). The survey then compared six types of flood insurance programs to determine if the risk characteristics were low, medium and high for each risk category. The table is included here as Table 12.2. The term “anti-selection” by Swiss Re is commonly called “adverse selection”. In the private insurance market, a main concern is that only high risk persons will purchase insurance. If the insurance is priced on the basis of a mix of high and low risk policyholders, the premium charged are inadequate for the risk pool if only the high risk buy the insurance. The problem of adverse selection is particularly troublesome for natural catastrophe insurance programs. Generally, catastrophes occur in well defined geographic regions. Earthquakes occur along seismic fault lines, floods occur in low-lying areas, and windstorms are directed at coastlines. If only the highly exposed purchase insurance, the cost of the insurance would be prohibitively expensive. For the private insurance programs to work, they require that low risk populations be included in the programs. This is generally accomplished

by making the programs mandatory or subsidizing the rates. Purely voluntary natural catastrophe risk programs generally suffer from lack of participation. Only populations with very high risk are willing to participate.

On the y axis, Swiss Re defines a variety of flood insurance programs. There is a blend of both private and public programs. They define six different types of programs. The facultative individual cover is private insurance purchased for one property to protect against flood risk. This is the most common approach taken by large commercial customers. The Facultative Package is private insurance against floods that is bundled with other types of catastrophe protection. Compulsory Package with fire cover is mandatory privately provided insurance coverage that is bundled with fire insurance. Compulsory state solution is the French model: compulsory insurance for all catastrophe risk at a set premium. Facultative cover with low limits is private flood insurance with very low levels of protection. The final program is Compulsory cover with graduated premiums and deductibles. While Swiss Re does not identify any flood insurance program, based on this model, the Turkish Catastrophe Insurance Pool does duplicate this model for earthquake insurance.

The analysis by Swiss Re indicates voluntary (facultative) insurance programs carry a high risk of adverse selection: only those with a high level of risk are willing to pay for the insurance. The Facultative individual cover and the facultative cover with low limit both have high risk of adverse selection. If the insurance is coupled with other types of catastrophe risk (Germany), the likelihood of adverse selection is moderate. Mandatory programs (United Kingdom and France) have a low risk of adverse selection. On the other hand, the compulsory programs have a high risk of loss potential. This makes sense. If everyone has insurance against a covariant catastrophe risk, the aggregate losses to the insurance program will be very high. In addition, a mandatory program has a high level of moral hazard risk. There is little incentive for insureds to reduce their risk if they must purchase insurance and the rates they pay for the insurance are set regardless of the level of risk. It should be noted that the loss potential is reduced to medium if the premium is graduated to reflect risk. This reduction in the loss potential is a reflection of the reduction in moral hazard.

The third variable used by Swiss Re is the cost of risk assessment. This is the cost of evaluating the exposure of each insureds. As may be expected, the cost of risk assessment is high for voluntary programs while the cost is low for compulsory programs.

Broadly speaking, the following tradeoffs are reflected in the Swiss Re analysis. Compulsory programs have a much higher level of loss potential

reflecting a higher level of moral hazard. These programs are balanced by lower levels of adverse selection and the cost of risk assessment. Voluntary or facultative programs correspondingly have a high risk of adverse selection and cost of risk assessment, but lower levels of loss potential. The loss potential of compulsory programs can be reduced if graduated premiums or deductibles are used. As noted earlier, variable premiums and deductibles are tools used to reduce moral hazard.

The approach used by Swiss Re can be modified to help understand the tradeoffs inherent in the government natural hazard programs in the OECD countries. On the horizontal axis, five policy concerns related to different types of insurance programs are identified: moral hazard, adverse selection, loss potential, subsidy, and the cost of insurance. Table 12.3 varies from the Swiss Re table in that it accounts for moral hazard and subsidy. Subsidy is an indicator of the extent to which low risk policy holders subsidize high risk policy holders.

**Table 12.2. Comparison of Insurance Solutions and Specific Risk in Flood Insurance**

Insurance solution	Risk of antiselection	Loss potential	Cost of risk assessment
Facultative individual cover (eg industrial property, Italy)	high	medium	high
Facultative package solutions (eg residential property, Germany)	medium	medium	medium
Compulsory package with fire cover (eg UK)	low	high	low
Compulsory state solutions (eg France)	low	high	low
Facultative cover with low limit (eg Austria)	high	low	medium
Compulsory cover with graduated premiums and deductible	low	medium	low

Source: Swiss Re 1998a.

Table 12.3 shows the tradeoffs from different types of programs. For example, the government as insurer has a high risk of moral hazard, a high loss potential (which is related to the moral hazard risk), but a low cost of the insurance for the insureds. The low cost is reflected in the high level of subsidy. The same profile exists for a compulsory state reinsurance program. The academic literature maintains that these types of programs are not insurance. They are not governed by insurance principles (primarily that rates for insurance should reflect risk) or are paid by an identifiable fund of insurance reserves (actuarially determined) (Kane 1996). Rather, these programs are tax-transfer programs disguised as insurance (Priest 1996). In operation, these programs have the same risk profile as programs where the government is the insurer.

**Table 12.3 Insurance Solutions for Catastrophe Risk**

Insurance Solution	Moral Hazard	Adverse Selection	Loss Potential	Subsidy	Cost of Insurance
Government as Insurer	high	low	high	high	low
Compulsory Private Insurance (UK)	high	low	high	medium	medium
Compulsory State Reinsurance Solution (France)	high	low	high	high	low
Compulsory State Reinsurance Program with Graduated Premiums (Spain)	medium	low	medium	medium	medium
Voluntary State Program with Graduated Premiums	low	high	medium	low	high

As one moves to programs with more insurance like characteristics, the risk profile of the programs change. The moral hazard, the loss potential and the subsidy characteristics all decrease. On the other hand, the adverse selection risk and the cost of insurance to each policyholder increase.

Different approaches tradeoff identifiable characteristics. The government as insurer has high moral hazard risk but provides lower cost protection to a wider range of insureds. The government as reinsurer with actuarially set rates reduces moral hazard but at a higher cost of insurance. The acceptability of the tradeoffs for each country is a function of political values.

The comparative benefit of each approach is a function of the political values of each country. For example, countries with a strong sense of solidarity



are willing to have the government assume a high loss potential, moral hazard and a high subsidy between low risk to high risk taxpayers in exchange for low costs of insurance and the comfort that everyone is provided protection. This would typify the French system. By contrast, the government may make voluntary insurance available to its citizens with a relatively low level of moral hazard, low subsidy and high cost of insurance for policy holders. This approach provides accommodation to its taxpayers by making a program available, but minimal government cost. This typifies two of the programs in the United States: the NFIP and the California Earthquake Authority. It is not surprising that these two countries develop programs with substantially different approaches to the role of government in coping with risk.

An interesting phenomenon of the different catastrophe risk programs in the OECD is that some countries apply their programs to a wide range of risks while others limit the program to specified risks. The next section will explore this phenomenon from the perspective of the relative risks faced by each country from natural hazards.

### ***1.10. Natural Disaster Exposure and National Programs***

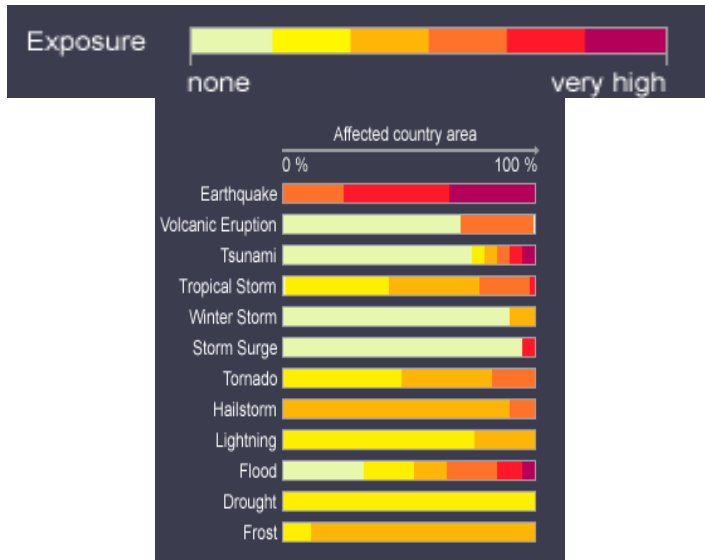
Besides political culture, another reason for the differences in approach between OECD countries is the level of natural disaster exposure. In one of its recent publications, Munich Re completed a study of a number of countries. The study focused on the level of exposure of a country to different natural hazards and the geographic spread of the hazard risk. The results for Japan are shown on Table 12.4.

Japan has a very high earthquake risk that impacts a substantial portion of the country. The most striking characteristic is the very high level of exposure of Japan to earthquakes over a large region.

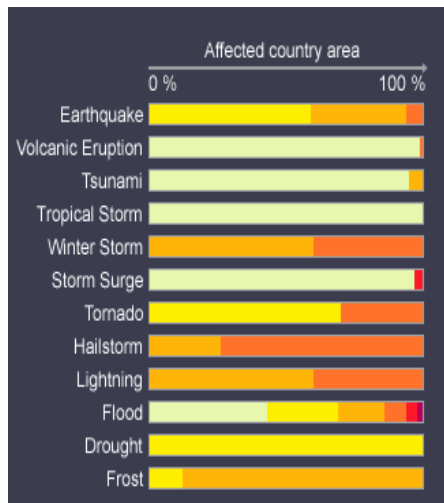
By contrast, Table 12.5 shows the same table for France.

The contrast with Japan is significant, as France has only one very high risk hazard, flooding. At that risk is for a very small region. The catastrophe insurance program in each country reflects these disaster risks. Japan focuses their government catastrophe insurance programs on their high risk exposures with broad geographic exposure. In France, there are no very high risk exposures with any geographic reach, merely a handful of low to medium risk hazards. It is not surprising that the French catastrophe insurance program covers a wide range of hazards. Like the political culture in different countries, catastrophe insurance programs are also a reflection of hazard exposure. Low risk countries are more inclined to provide protection for more hazards while countries with a high risk to one hazard are more likely to devote their resources to the high risk exposures.

**Table 12.4 Natural Hazard Exposure for Japan (Munich Re 2000)**



**Table 12.5 Natural Hazard Exposure for France**

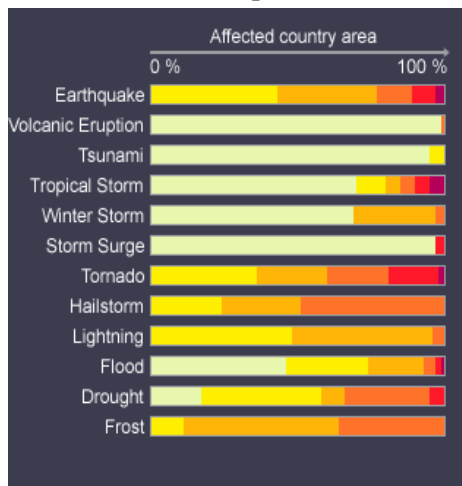


The United States provides an interesting contrast. As noted in Table 12.6, the United States has very high exposure to four hazards: flooding, tornadoes, tropical storms (hurricanes) and earthquake. Each of these risks is geographically limited. The United States has created three

separate programs to deal with flooding, tropical storms, and earthquake. The flooding program is the only program sponsored by the national government. The earthquake risk is handled by California and the hurricane risk is handled by Florida. There is no specific government program for tornado risk.

The relationship between hazard risk and program formation is important. Just like political preferences, the level of risk is related to potential solutions. For countries with very high levels of risk, they tend to develop programs that focus on that risk. Large countries with geographically diverse risks have insurance programs that are regionally centered. Countries with low levels of hazard risk make their programs more broadly based.

**Table 12.6 United States Exposure to Natural Hazards**



The prior sections have focused on the tradeoffs between different governmental programs to cope with catastrophes. In its survey of flood insurance programs, Swiss Re noted:

*“The wide variety of flood insurance solutions available in the different countries is quite astonishing. State and private insurers provide cover in a variety of casts, and the involvement of the reinsurance community can be anything from “zero” to “substantial”. Insurance penetration levels lie between 0% and 100% and the scope of cover-provided that insurance is available at all-ranges from “very restricted” to “unrestricted”. None of this comes as a surprise, however. Hazard risk and loss potential differ widely from one market to another, just as the economic*

*development levels and the structures of the national insurance industries do. This constellation is joined by specific issues associated with flood insurance. Clearly these circumstances do not allow for any ideal and universally valid or applicable solution for insurance against floods” (Swiss Re 1998a).*

Clearly, the same can be said for all catastrophes. The wide variety of exposure risk, political preferences, and the status of the domestic insurance market will heavily influence the national programs adopted by different countries. There is no clear best solution. Rather, the varied solutions are a mix of alternatives based on widely varying circumstances.

After surveying and comparing different government supported catastrophe risk programs in selected OECD countries, a natural extension of the analysis is defining the “best” characteristics of the programs. From a policy maker’s perspective, what are the features of existing programs that make them desirable to assist governments in managing catastrophe risk? With ever increasing losses from catastrophes, the demand for government assistance to cope with catastrophe losses will only increase. The recent increase in government sponsored programs to cope with terrorist risk is one recent example of new demands being placed on governments. What guidance can the existing programs provide to policy makers? The next section will provide a framework for analyzing this question.

## **2. Extending the Analysis to the experience of Turkey**

As noted in the prior section, there is a constellation of programs developed to cope with catastrophe risk. From a policy-makers perspective, it would be helpful to identify the best characteristics of a national catastrophe program. This section will extend the lessons learned from examining different natural hazard programs to pull out possible “best practices” and extend those practices to the recent experience of Turkey in developing a national program directed at residential losses from earthquakes.

### ***2.1. Framing the Discussion of Best Program***

Understanding the “best” system is primarily a matter of framing. An economist interested in a “(Pareto-)optimal response” might reply that none of the existing systems meets this objective. Rather, a more efficient alternative is to avoid public sector involvement and source needed resources from alternative capital market instruments (Cochrane 1999). An economist trained in social economics might frame the problem much differently (Lutz 1999). In this instance, a focus on the “common good”

rather than economic efficiency would create the proper measuring stick. The wide variation of current involvement in providing post catastrophe assistance, governmental resources available to support catastrophe risk programs, the level of catastrophe risk, and the viability of the private insurance market all influence the extent and nature of government involvement in financing catastrophe risk. Different governmental objectives will influence the role the government is willing to play in supporting new programs. It is precisely because of these variables that such a wide variety of programs have been tried by different governments. These alternative approaches limit any discussion of the most desirable system.

If the objectives of the government are well defined, one could develop an optimization program to evaluate different alternatives to meet varied objectives. In analyzing financial alternatives for developing countries to cope with catastrophe risk, there are a series of optimization programs being developed that compare the desirability of different tools to finance risk<sup>4</sup>. The programs objective is to define for policy makers the best tool to optimize the ability of governments to sustain consistent economic growth while accounting for natural hazard catastrophe risk.

In examining the catastrophe risk programs supported by governments in OECD countries, two primary objectives might exist. One approach is governmental concern that the cost of its post disaster aid is too high and being inefficiently provided. The government seeks an option to post disaster aid by changing its role as the provider of aid to supporting a market alternative to finance catastrophe risk. This concern is the primary driver of the recently (2000) created Turkish Catastrophe Insurance Pool (TCIP) (Guerenko 2004). Prior to the creation of the pool, homeowners relied on the government to provide replacement housing after an earthquake. In fact, the government was required by law to provide replacement housing. The purpose of the TCIP was to transform the role of the government from the “insurer” of the risk to a role as a financial guarantor or “reinsurer” for a market based homeowners’ insurance program. In measuring the success of the TCIP, the criteria for measurement must be to compare TCIP with the historical practice: is the TCIP more efficient in providing assistance to homeowners than the former practice of providing post disaster aid? Since the TCIP replaces an existing strategy, it is possible to measure its success against the historical practice.

A number of other catastrophe programs have arisen from an entirely different need. The recent government supported terrorist risk programs in the United States and European programs for Germany, France and Austria for example were created because the private market was unable to provide adequate protection against terrorism risk. The primary problems were the cost and/or availability of capital to the private market to make risk

financing available. For these programs, the financial strength of the government was required to make the programs available and affordable.

The purpose of describing these two alternative objectives is to make the obvious point that the “best” system for providing government support for catastrophe risk is linked to the objective of the program. The “best” program is the one that most efficiently meets the governmental goals taking into account a series of constraints. Those constraints include the status of the domestic insurance market, available government resources to implement new programs, the magnitude of the risk being addressed by the program, and current governmental expenditures on catastrophes. Since these characteristics vary country to country, it is not surprising that so many different programs have emerged.

That being said, the prior analysis provides some guidance on financing catastrophe risk. The fact that OECD countries provide government support for financing catastrophe risk indicates a consensus exists on a collective obligation to provide governmental resources for catastrophes: the risk of catastrophe loss should not fall only on the shoulders of those injured. An effective government supported catastrophe insurance program needs to: (1) meet a defined government objective and (2) reduce the consequences of adverse selection and moral hazard. As noted earlier, adverse selection occurs when those with the highest risk disproportionately participate in an insurance program. Insurance works because it pools risk. The pricing of the risk in the pool is based on average risk. This is a mixture of high and low risk populations. If only those with high risk are in the pool, then the premiums collected will be inadequate to pay for claims. Participation in the risk pool has been “adversely selected” by only those with high risk.

Moral hazard is the phenomenon where behavior is changed because another party assumes the risk of one’s behavior. As relates to catastrophe risk, the problem is most commonly seen in those who live in high risk areas. They are generally unwilling to change their behavior by moving from the high risk area or pay for risk mitigation measures if the government reimburses them for potential losses. As noted earlier, moral hazard risk also exists in the private insurance market. In the private market, sophisticated techniques have been developed to limit the moral hazard risk. The most common tools make the insured still responsible for a portion of his losses. This is done through deductibles and co-pay arrangements. The intent is to provide incentive for the insured to engage in risk reducing activity.

The purpose of the program will influence its structure. If the purpose is to provide a market because the private market is restrained by the cost of capital, it is likely that the government will limit its involvement to providing financial support to the private market. The California Earthquake

Authority and the United States' terrorism insurance program typify this arrangement. The government provided financial backing to the private insurance industry to permit them to provide insurance coverage that might not otherwise be available. The private insurance companies were primarily responsible for designing and selling the insurance. These programs have low insurance penetration: less than 30% of potential insureds have purchased insurance.

If the purpose of the program is primarily to substitute government post disaster aid with an insurance program, then the structure of the program tends to be much different. Generally, this type of program uses mandatory insurance. The most common tool used is to bundle the catastrophe insurance with other insurance. A primary objective is for the government to collect some money for obligations they will need to eventually pay anyway. The collection of funds in advance is preferable to waiting until an event occurs and spreading the cost *ex post*.

Governments have acted as either the primary insurer or as a reinsurer. The main advantage of acting as a reinsurer is the reduced administrative load on the government. The government can rely on the ability of the private market to sell and issue policies, collect premiums, and manage claims. This reduces the need for the government to duplicate an administrative services network already created by the private market.

This provides several approaches to determine the "best" structure for a program. If the government is neutral as to whether insurance is purchased, the best program would be a voluntary reinsurance program priced at actuarially fair rates. This would ordinarily be the case where the government is providing financial support to supplement the private market. This limits the risk to the government to a call on its Treasury for a contingent future payment. If the rates are actuarially fair, then the government is being adequately paid for providing the needed credit support. By providing reinsurance, the government can rely on the insurance industry to handle all administrative needs. As well, the insurance industry can structure the program to cope with the issues of adverse selection and moral hazard.

If the government is concerned that the catastrophe insurance be purchased, a mandatory program provided by the private sector at actuarially fair rates with reinsurance from the government is the best option. If the insurance is too expensive at actuarially fair rates, then the government probably needs to subsidize the rates to make the program politically palatable. This is especially the case if the insurance program substitutes for post catastrophe government aid. Generally, the program is made mandatory by bundling the insurance with some other type of

insurance commonly purchased, like homeowners or automobile insurance. The mandatory component of the program should address the problem of adverse selection. The problem of moral hazard still looms. Moral hazard can be reduced by making the catastrophe risk premiums vary with the level of risk. As well, some type of deductible and co-payment should be included in the insurance. The moral hazard risk in a mandatory insurance program is probably less than the moral hazard imbedded in a pure government post disaster aid program.

To get compliance with a mandatory program, the government must make clear that those exposed to the program's catastrophe risk can only look to the insurance to pay for their losses. If there is a perception that substantial post-disaster government assistance will be available, there will develop considerable resistance to purchasing the mandatory insurance. A mandatory program has the benefit of setting the terms of government financial support for catastrophe losses in advance. With an effective program in place, it should reduce the pressure to provide *ad hoc* post disaster support.

With these broad principles in mind, it may be helpful to apply them to a recent catastrophe risk insurance program. By so doing, it is possible to see the constraints in applying these principles.

## ***2.2. Evaluation of the Program Principles to the Turkish Catastrophe Insurance Pool***

One of the most recent comprehensive insurance programs instituted in an OECD country is the Turkish Catastrophe Insurance Pool (TCIP). Earthquakes in August and November 1999 devastated north-western Turkey. The extensive physical damage, which was re-estimated at US \$ 10.2 billion, was largely absorbed by the public sector which re-built physical infrastructure, government buildings and private houses. The total budget for the Government of Turkey (GoT) between August 1999 and December 2002 amounted to US \$6.4 billion, or 3 per cent of GDP (OECD 2004).

To mitigate the contingent financial costs arising from the probability of other seismic shocks and to provide an adequate level of earthquake coverage at affordable rates, a compulsory earthquake insurance scheme, the TCIP, was established in 2000. The World Bank played a major role in providing technical advice and financing for the TCIP. The TCIP is a compulsory government sponsored insurance program for earthquake risk. The expected annual losses to Turkey from earthquakes are US\$ 1 billion. A major earthquake in Istanbul could have direct losses in excess of US \$25 billion. Historically, private earthquake insurance existed in Turkey. The



penetration for the private insurance was very low: 2% outside Istanbul and 15% within Istanbul. There was little incentive to purchase insurance since the National Disaster Law required that the government fund replacement housing for those destroyed in an earthquake nearly free of charge. The TCIP was created to provide affordable earthquake insurance for domestic dwellings while reducing the GoT's fiscal exposure to earthquake losses.

The TCIP mandated that all registered residential building owners purchase a separate earthquake insurance policy. To provide incentives for the insurance to be purchased, the government mandated that deed offices only register transactions affected on insured buildings and required municipalities to check for insurance policies when opening a new account for water or gas services to dwellings. Currently, this requirement is only required in five provinces. Depending on the results in these provinces, the requirement may be extended to the rest of the country. The policy covered up to US\$50,000 in losses per dwellings with no coverage for contents. The Disaster Law was amended by governmental decree so to properties that could be covered by the TCIP would not be eligible for government aid. The TCIP is the sole source of earthquake insurance for the first US\$50,000 of losses: private insurance is available for higher limits. While the Disaster Law was modified, a new Earthquake Insurance Law was proposed. There were 15 rating categories created based on hazard zone area and type of dwelling. The insurance is sold through 32 authorized insurance companies who perform the underwriting, collect premiums, issue policies and settle claims. A deductible of 2% exists on each policy. The insurance companies are paid a commission for their services. The claim paying objective for the TCIP in 2004 is to create claims paying ability for up to US\$ 1 billion in losses. A reinsurance program was created with a consortium of 60 international reinsurance companies, the World Bank, and the Government of Turkey as the reinsurer of last resort.

To date, the program has had limited success. On a countrywide basis, approximately 16% of total insurable dwellings (approximately 13 million) now have coverage. In Istanbul, the penetration rate is now 27.3%; it had been as high as 32%. For a "mandatory program", these are relatively modest levels of penetration.

From 2000 through November 2004, eighty-five earthquakes occurred in Turkey and the scheme paid total damages of US \$5.72 million to 4,919 homeowners. For the two most serious earthquakes (Afyon in 2002 and Bingol in 2003), the GoT waived the provisions of the Disaster Law requiring the purchase of insurance and declared all citizens eligible for government support, insured or not. The costs of non-insured victims in the 2002 and 2003 earthquakes cost the Treasury an additional US \$200 million.

Based on the earlier discussion, the TCIP was designed as a substitute for mandated post disaster government assistance for homeowners. The earlier discussion suggests that the government support a mandatory insurance program with government reinsurance. The mandatory nature of the program eliminates the risk of adverse selection. The premium payments received by the government can be used to offset future government payments for housing reconstruction. The program should have graduated premium rates. To reduce the administrative burden, the program should rely on the existing private insurance companies to provide needed technical support. The insurance should be bundled with some other needed financial product. The GoT should limit its role to the reinsurer for the program. The program should try to limit moral hazard by using deductibles and correlating premiums to risk. The insurance is intended as a substitute for government aid.

The characteristics of the TCIP closely follow the model. It is a mandatory program with actuarially set rates. It relies on the private sector to perform most administrative duties. It uses deductibles to limit moral hazard. It bundled the purchase of insurance to the receipt of public utilities and the recording of property transactions. In these respects, it is very well designed. The major flaw is the unwillingness of the GoT to make the insurance the sole source of paying earthquakes claims. If Turkish homeowners perceive they will receive government aid regardless of their purchase of insurance, the resistance to purchasing the insurance will increase.

How does the Turkish experience stake up with the discussion on desirable characteristics of government supported catastrophe programs discussed earlier? The program meets most the criteria for a long-term sustainable approach to the problem. It charges premium on actuarial rates that should reduce moral hazard. By making the program mandatory, it reduced the risk of adverse selection. By engaging the private sector in the process of administration, it reduced the bureaucratic burdens often associated with government directed programs. By bundling the insurance with access to public utilities, it provides a means to enforce the mandatory nature of its program. In terms of program design, the approach taken by the GoT is solid. The low level of market penetration is likely related to the GoT's willingness to provide post disaster aid to homeowners.

### ***2.3. Conclusions Based on Turkey's Experience***

Providing guidance to policy makers on the most desirable form of government catastrophe insurance programs is difficult. Generally speaking, there are two basic objectives for these programs. One objective is to provide credit support to the private market to make catastrophe insurance

available. For this type of program, the government should limit its involvement to reinsuring a voluntary market based private insurance program with actuarially fair rates. The government should be paid an amount that compensates it for providing credit support. A second type of program is one that substitutes an insurance program for post disaster aid from the government for catastrophe losses. This type of program should be mandatory. To the extent possible, the government should rely on the private market to provide needed administrative services. Rates for the insurance should be actuarially determined. If the rates are too high, the government may need to subsidize the premium for the insurance. To succeed, the government needs to make the insurance program the primary source of paying for losses from catastrophes. If it is perceived that the government is still willing to provide substantial post-disaster aid, it will destroy the incentive to participate in the program.

While theory and experience provides some valuable lessons on the desirability of alternative programs for financing catastrophe risk, this is a problem that could benefit from empirical research combined with proper economic modelling. In truth, the best approach to evaluate the best way for governments to support catastrophe insurance programs is still a matter largely of political choice, not empirical evidence. As this topic receives more attention, it is likely that further empirical research will help illuminate the policy options.

### **3. Lessons for Emerging and Developing Countries**

A main focus of this report is the application of the experiences of the OECD countries to the needs of the developing world for strategies to cope with the financial risk of catastrophes. As noted in the introduction, there is a fundamental difference between the experiences of the OECD countries and the developing world. The OECD programs are all *ex ante* measures: they were put in place before catastrophes occur. They were designed to set the terms for governmental assistance following a catastrophe. Most developing countries react to disasters rather than plan for their consequences. Before much can be learned from the OECD experiences, developing countries must first decide that planning for catastrophes is important to them.

While the benefit of planning for catastrophes is clear, planning has an associated cost: it requires budgetary allotments to finance *ex ante* risk management measures. For countries with severely constrained financial resources, the case for justifying the allocation of those resources to finance losses from catastrophes is not clear-cut. Two arguments hold sway that

militates against the allocation of poorer countries' resources to finance losses from catastrophes. First, it is an inefficient allocation of resources. In the OECD countries, governmental concern about the economic security of its citizens from catastrophe losses occurred after governments had resolved risk issues associated with economic development and workers rights. As noted in the discussion on Turkey in the prior section, Turkey developed an insurance scheme as a substitute for substantial governmental assistance to homeowners after earthquakes. For many poorer countries, governments are focused on economic development. They provide minimal funds from their budgets now for catastrophe assistance. It may be that security for catastrophe losses is still of secondary concern.

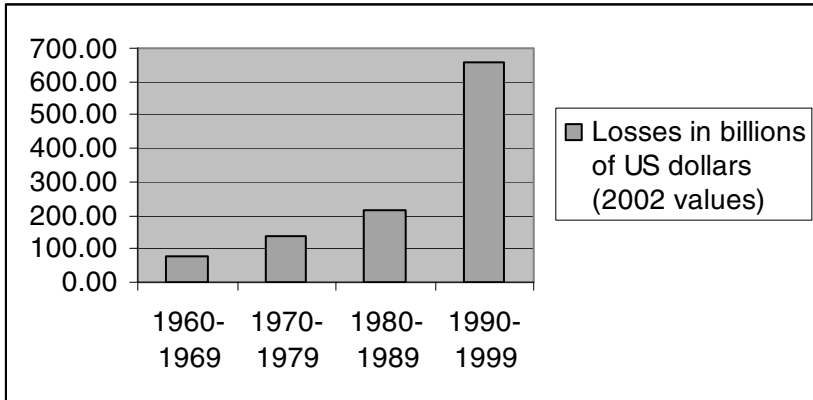
The second obstacle is the realization that the developed world is willing to provide resources needed to cope with catastrophes on an *ad hoc* basis after a catastrophe occurs. Aid, grants and loans provided after a disaster are much less expensive than allocating funds from limited budgets. In fact, depending on the amount and the terms of funding available for catastrophe assistance, it may be much more efficient to allocate budgetary funds for activities that the international community is less willing to fund.

Part 3 focuses on the potential application of the experiences of the surveyed countries in coping with losses from catastrophes to the needs of developing and emerging countries. The first section will review the increasing costs of catastrophes in the third world. Once the problem has been identified, a discussion of the willingness of poorer countries to allocate scarce resources to cope with catastrophes will be undertaken. Next, the current means by which governments in poorer countries cope with catastrophes is reviewed. Finally, the potential lessons from the experience of the surveyed countries for poorer countries are explored.

### ***3.1. Catastrophe Exposure in the Developing World<sup>5</sup>***

Earlier in this paper, the general statistical information on the costs of natural and man-made disasters was reviewed. The problem is even more severe in developing countries. For those interested in the topic of natural hazard risk and economic development, one fact is central: the losses from natural catastrophes continue to escalate at an alarming rate. The economic cost of disasters has been increasing over decades.

**Figure 12.5 Economic Losses due to Natural Disasters from 1960 to 2000.**

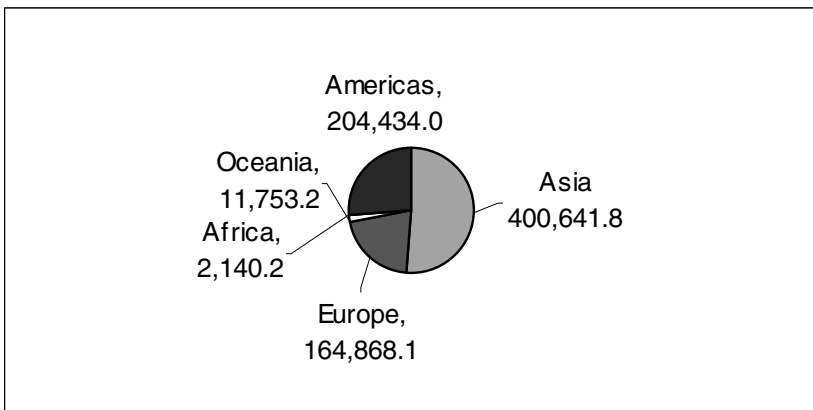


Source: Munich Re.

According to Munich Re, real annual economic losses averaged US\$75.5 billion in the 1960’s, US\$ 138.4 billion in 1970’s, US\$ 213.9 billion in the 1980’s, and US\$ 659.9 billion in the 1990’s. Munich Re estimates that global economic losses for the most recent 10 years (1992-2002) were 7.3 times greater than the 1960s.

A substantial portion of disaster damages are in Asia, nearly half the total losses. The following chart details damages by geographic region.

**Figure 12.6 Total Amount of Disaster Damage between 1991 and 2000 in millions of US dollars (2000 values)**



Source: EM-DAT: The OFDA/CRED International Disaster Database.

In the last two decades, more than one and a half million people have been killed by natural disasters. The total number of people affected each year has doubled over the past decade. According to UNDP, human deaths are the most reliable measure of human loss and are the indicator used in designing their recent disaster risk index (DRI).

Examining casualties from different disasters by region provides some revealing information relative to the costs of disasters. The Asia-Pacific region experiences the greatest impacts both in terms of total lives lost and when lives are calculated as a proportion of regional population, due to earthquakes, tropical cyclones and floods. The exception to this comes from the high concentration of deaths associated with drought in Africa. Drought events are often part of a bigger picture that can include armed conflict, extremes of poverty and epidemic disease with death touching only the surface of livelihood disruption and human suffering. The erosion of development gains under such circumstances is clear.

Natural disasters occur when societies or communities are exposed to potentially hazardous events, such as flooding, earthquakes, or typhoons and when people are unable to absorb the impact of or recover from the hazardous impact. While it is commonplace to speak of about natural hazards, both vulnerability and hazard are conditioned by human activities. Reducing the number and effects of natural disasters means tackling the development challenges that lead to the accumulation of hazard and human vulnerability that prefigures disaster. The accumulation of disaster risk and the unequal distribution of disaster impacts prompt a questioning of the development paths that have been undertaken by countries at risk from disasters. Natural disasters destroy development gains, but development processes themselves play a role in creating disaster risk. When a school built without earthquake resistance collapses, is this disaster risk undoing development or inappropriate development creating disaster risk?

The losses from disasters clearly impact economic development. This interrelationship is described on the following chart from UNDP:

Linking disasters to economic development is complex. A recent publication by Charlotte Benson and Ed Clay detail the most recent thinking on the subject.<sup>6</sup> The findings of the study indicate that major natural disasters can and do have severe negative short-term impacts. Disasters, especially when they occur frequently, have negative longer-term consequences for economic growth, development, and poverty reduction, although these effects are more difficult to isolate and quantify. The vulnerability of countries to natural hazard risk is determined by a complex, dynamic set of factors such as economic structure, stage of development, and prevailing economic and social conditions. Vulnerability can be reduced

by appropriate investment in disaster mitigation and favorable developments in the structure of the economy, in production technologies, and in the wider economic and domestic policy environment.

**Table 12.7 Disaster Development**

	<b>Economic Development</b>	<b>Social Development</b>
<b>Disaster limits development</b>	Destruction of fixed assets. Loss of production capacity, market access or material inputs. Damage to transport, communications or energy infrastructure. Erosion of livelihoods, savings and physical capital.	Destruction of health or education infrastructure and personnel. Death, disablement or migration of key social actors leading to an erosion of social capital.
<b>Development causes disaster risk</b>	Unsustainable development practices that create wealth for some at the expense of unsafe working or living conditions for others or degrade the environment.	Development paths generating cultural norms that promote social isolation or political exclusion.
<b>Development reduces disaster risk</b>	Access to adequate drinking water, food, waste management and a secure dwelling increases people's resiliency. Trade and technology can reduce poverty. Investing in financial mechanisms and social security can cushion against vulnerability.	Building community cohesion, recognising excluded individuals or social groups (such as women) and providing opportunities for greater involvement in decision-making, enhanced educational and health capacity increases resiliency.

Source: Reducing Disaster Risk: A Challenge for Development (UNDP 2004).

The growing urbanization of the world's population has compounded the problem: now, a minor event can cause significant damage in a heavily populated area. The proportion of people in developing countries living in cities has doubled since 1960. More than 40 percent of all people live in urban areas, and this figure is expected to surpass 55 percent by 2030. Nearly half of these cities are subject to extreme weather events. The same features that made them attractive to settlers—such as natural flood plains, alluvial soil, and river or sea access – also bring danger. Thirteen of the world's 19 mega cities—cities with 10 million or more inhabitants—are in coastal zones, and over 70 of the world's 100 largest cities can expect a strong earthquake at least once every fifty years.

### *The vulnerability of the poor*

Twenty-four of the 49 poorest countries face a high level of disaster risk; at least 6 of the world's poorest nations have been hit by between 2 and 8 major disasters in each of the past 15 years. A recent UN study has shown that at least 13 of the 25 countries most prone to disasters—particularly storm surges, landslides, extended droughts, and floods—are small island

states (SIDS) (UNDP 2004). SIDS are particularly vulnerable because of their small economies, dependence on agriculture and tourism, and narrow resource base. Given their vulnerability and the extent of the environmental risk, some of these small states may eventually disappear.

Economic losses from natural disasters are smaller, in absolute terms, in developing than in developed countries. However, because of lower levels of infrastructure and capital stock, the economic impact is far higher, relative to GDP. Between 1985 and 1999, the world's wealthiest countries sustained 57.3 percent of measured economic losses because of disasters, representing 2.5 percent of their combined GDP. Among the world's poorest countries, however, economic losses from disasters accounted for 24.4 percent, or 13.4 percent of their combined GDP.

Loss of life is far greater in developing countries. Between 1990 and 1998, more than 97 percent of all deaths from natural disasters were in developing countries. Developing countries also tend to suffer more deaths in each disaster—an average of 1,052, compared with 22.5 in highly developed nations.

### *Vulnerability of Specific Countries to Natural Disaster Risk*

Munich Re's analysis measuring vulnerability to specific natural disasters among developed nations that was used in Section 1.11 is not available for most developing countries. While aggregate figures are known, the analysis lacks specific details regarding many developing countries. The United Nations Development Program (UNDP) has an initiative to measure the vulnerability of specific countries to different hazards. For example, the top five countries most vulnerable to earthquakes are Iran, Yemen, Turkey, Afghanistan and India. Floods: Somalia, Morocco, Papua New Guinea, Egypt and Botswana. Tropical cyclones: Honduras, Nicaragua, Cape Verde, Swaziland and Bangladesh. It is critical that the governments of these countries have the capacity to finance post-disaster reconstruction; otherwise, their long-term ability to reduce poverty will be significantly restricted.

Many countries in the developing world already face daunting challenges to increase economic growth and decrease poverty. Responding to substantial socioeconomic and climatic changes with its resultant impact on key economic sectors will add to an already difficult burden. Sudden-onset extreme natural hazard events are a chronic problem for a select group of developing countries: 28 have suffered direct losses of more than \$1 billion from natural catastrophes in the past 20 years<sup>7</sup>.



### *Need to Plan for Catastrophes*

The most vulnerable countries need to account for the costs of natural catastrophes as a component of overall planning. In creating country-level assistance programs, the international aid and finance community prepares macroeconomic projections and analyses of macroeconomic policies as a component of development strategies. Estimating levels of future growth and identifying the existing and prospective resources required to meet those growth objectives are key to developing economic projections. Historically, estimates have not accounted for potential natural disaster losses. To be meaningful, however, projections must account for items that significantly impact the estimates. As the size of the losses increase, the need to formally include disaster losses in the planning process is needed (Gilbert, Kreimer 1999).

Three reasons compel the need to incorporate catastrophes into economic projections. First, if disaster impacts are not anticipated, the diversion of scarce financial resources to relief and reconstruction efforts causes high opportunity costs as other projects contributing to economic growth and the eradication of poverty cannot continue as planned. Second the continuing and significant reallocation of resources post-disaster wrecks havoc on the budgetary planning process. The creation of annual budgets is often a complicated, politically difficult process. Shifting resources in response to disaster needs disrupts fragile compromises formed to create initial budgets. For many countries, this shift creates considerable institutional friction (Lewis, Murdock 1999). Third, poorer countries rely on international assistance to pay for a substantial portion of their losses. The resources available to the international development community are limited and have remained stagnant for nearly 10 years. As the cost of disasters increase, the demand on the international financial community to provide needed resources has also increased. For example, the Inter American Development Bank has increased its average annual disaster related spending by a factor of 10 in the past five years in comparison to the previous 15 years (Clarke 2000). A step in relieving pressure on domestic fiscal and international aid budgets is to quantify the potential exposure to disasters for the countries they assist. Once quantified, alternatives to plan for the disasters can be developed.

Planning for disasters is not simple: Planning requires both reliable estimates of the probable damages that a disaster may cause and a framework to incorporate catastrophe shocks to capital stock into economic models. Obtaining reliable estimates for future probable damages is challenging. As detailed earlier, the losses from disasters have been increasing at an accelerating rate. To estimate the economic impact of chronic exposure to natural disasters, one must measure both the expected *severity* and the

expected *frequency* of catastrophic events. Once the severity and frequency of an event is determined, it must be matched to the assets at risk.

During the past decade, scientific understanding of the causes and consequences of natural catastrophes has dramatically improved. Models to predict the frequency and severity of catastrophe events have been blended with sophisticated techniques to identify assets at risk (Swiss Re 2003). In the developed world, the substantial catastrophe risk insurance market has driven catastrophe modeling. The lack of extensive catastrophe insurance in developing countries means little catastrophe modeling exists for these countries. This makes effective planning difficult. Without knowing the catastrophe exposure, it is difficult to make plans to cope with the magnitude of the risk.

The international financial institutions have been interested in focusing their clients on the need to fiscally plan for catastrophe risk. They have undertaken a number of technical assistance projects in highly vulnerable countries to generate the needed information to create a contingency financing plan. The current programs in Mexico and Turkey benefited from significant contributions from the World Bank and other international financing organizations.

Despite the apparent need for proper planning, there are countervailing pressures that limit the willingness of countries to plan for and finance *ex ante* risk management measures. Some of these pressures will be discussed in the following section.

### ***3.2. Priorities for Risk Management in Developing Countries***

As discussed in Part 1, an active role of governments in financing losses from catastrophes in the developed world is a recent phenomenon. Governments in developed countries have gradually assumed risk for catastrophes since World War II. David Moss, in his book *When All Else Fails: Government as the Ultimate Risk Manager* details the willingness of governments to assume increasing responsibility for its citizen's welfare is a function of development. Historically, governments address different risks as their societies move through stages of growth. Governments tend to first focus on risks associated with business development. In the second phase, governments shift their attention to risks linked to the employment of labor in the economic development process. In the third phase, governments increasingly assume more risk on behalf of the consumer and their citizens. In this phase, governments take on greater responsibility for consumer, environmental and natural hazard risk. Moss argues that as governments move through these three main phases, they aspire to two main roles in risk:

(1) reallocate/shift risk away from citizens and consumers; (2) reduce risk through subsidies or mitigation programs.

According to Moss in the first phase, governments tend to support businesses as the country shifts from an agrarian to an industrial-based economy. The government uses its law-making power to shift risk among different segments of the economic community to advance and encourage trade and development. “By the end of the nineteenth century, American lawmakers had enacted a wide range of risk management policies, all intended to promote trade and investment. Most notable among them were limited liability, banking regulation, bankruptcy law, a fixed exchange rate, and the predictable enforcement of property rights.” Limited liability is a prime example of government’s risk management ability. It shifts risk away from investors to greater economic activity.

During the second phase, governments shift their focus to labor. Issues related to minimum wage, proper working conditions, health protection, social security, worker’s compensation and other risk issues relative to labor are addressed. As a result, “instead of worrying about how best to allocate default risk among debtors and creditors, leading reformers and policymakers now pondered how best to allocate worker risk.”

The third phase sees an overall increase in the government’s risk burden, assuming broad “social protection” risk for citizens at large. In some cases, the government reallocates risk from consumers and borrowers to manufacturers and lending institutions. In other cases, the national government assumes an increasing role in risk borne by its citizens. The government involvement in natural hazard risk is a reflection of this Phase III role of national governments.

The experience of Japan highlights the Phase III concerns of a country as relates to catastrophe risk. After the Second World War, the Japanese government’s role as relates to catastrophes has significantly increased. Japan’s first comprehensive disaster law was the 1961 “Disaster Countermeasures Basic Law,” which centralized and consolidated a comprehensive disaster management system. National aid provision was reinforced by a 1962 law. During the 1970s and 1980s, special laws were enacted to refine disaster management for earthquake, heavy snow, and volcanoes. Importantly, many of the 1960s laws emphasized non-structural mitigation through policies such as land use restriction. The disaster law was updated significantly in 1995 due to experiences during the Great Hanshin-Awaji Earthquake. Today, Japan has a disaster management system that is among the most sophisticated, comprehensive, and centralized of the OECD countries.

Most poor countries are still in Phase I and II of Moss’s model. They are focused on economic development and labor protection. . Moss aptly points

out that developing countries are faced with a tremendous balancing act. “How to manage economically dysfunctional risks without stopping up the wellspring of economic progress is one of the most difficult challenges facing policymakers in every developing country.”(Moss 2002) Many emerging countries are simply overwhelmed with their development needs so that catastrophe management is relegated to the sidelines.

### ***3.3. Funding from the International Aid Community***

There is a second process at work that restricts the interest of poorer countries in financial planning for disasters. Historically, the wealthy countries in the world provide needed assistance after a catastrophe occurs. This creates the same moral hazard at the national level that was described at the individual level earlier. This particular moral hazard is known as the Samaritan’s Dilemma. The dilemma arises when those at risk (including governments of vulnerable countries) expect to receive support if disaster strikes and therefore under invest in protective measures-physical and financial-to reduce the costs they will incur when disaster does strike. And, given the humanitarian imperative, it is hard for those in a position to help to make a credible commitment to scale back post disaster assistance even if those suffering did not take appropriate protective measures.

Cambodia provides an example. After the 2000 floods, the government relied extensively on assistance from the international community. The World Bank and the Asian Development Bank provided new credits and diverted approximately \$80 million of existing loans. In addition, a range of international groups provided funding for relief efforts (UN and Red Cross played critical roles), reconstruction of highways (Japan has committed substantial sums to improve the levees around Phnom Penh and to rebuild portions of the national highway system), and flood control projects. Cambodian response to the 2000 floods consisted of utilizing funding from sources other than the national government.

Of course, there are some measures underway in the developing countries to cope with the financial costs of disaster. There are other efforts underway to have governments focus on *ex ante financial* planning for disasters. Technical assistance projects in the Caribbean basin, the Pacific Island states, Honduras, El Salvador, Vietnam, India and the Philippines have been recently financed by the international financial institutions to analyze possible *ex ante* catastrophe financing programs.

Understanding the limited interest in poorer countries to allocate resources for government funded or supported catastrophe financing programs, what lessons can be applied from the experience of the surveyed countries?

### ***3.4. Policy Implications for Emerging Countries***

Based on the experience of the surveyed countries, the following principles have application for developing countries:

- It is appropriate for governments to play a role in managing the financial risk of catastrophes for their citizens. All the surveyed countries developed an active *ex ante* role for the government in financial management of catastrophes;
- Developing countries should define and measure their exposure to catastrophe risk. By identifying their risk, it is likely that more effective planning can be done to gather financial resources to cope with that risk. For many highly vulnerable developing countries, catastrophe risk is an issue of economic growth. As such, it should receive the same attention as other Phase I style economic development risks;
- Countries should focus their efforts on coping with their high vulnerability catastrophes. Comprehensive programs like those in France and Spain operate in countries with low catastrophe vulnerability. The highly vulnerable developed countries like Japan limit their resources to their high hazard risks;
- There is enormous advantage to having an operational private insurance industry. A viable private market may be able to absorb some catastrophe risk that would otherwise become the responsibility of the government. Even if the industry is too lightly capitalized to provide any meaningful financial protection, the administrative resources of a viable insurance industry can provide a platform for establishing a government funded and directed program. The private industry can help in performing needed services like marketing, premium collection, and claims payment;
- There is a wide constellation of possible governmental options to cope with losses from catastrophe risks. The OECD study (2004) describes a full range of governmental options. Which options to choose are a reflection of the level of hazard risk, the financial condition of the government, the strength of the private insurance market, and the political culture and preferences of countries. The 'right' approach for any individual country needs to include an understanding of these various components of the decision process.

For emerging countries in the midst of building political, judicial, economic and social institutions, managing natural hazard risk is difficult. However, the experiences of the surveyed countries show that meaningful efforts to protect countries from the losses of catastrophes are possible.

## Conclusion

The last fifty years have seen two linked phenomena: the rising costs of catastrophes worldwide and the willingness of governments in OECD countries to adopt programs to protect their citizens from the costs of catastrophes. The willingness of governments to assume a greater risk management burden is a reflection of the economic prosperity of the past 50 years. Once governments have secured economic development and looked after worker rights, they have been willing to assume greater responsibility for broader social protection. The assumption of catastrophe risk on a large scale basis by OECD countries is a reflection of the increased role of governments in providing social protection.

The selected surveyed countries represent various alternatives of different governments to cope with the financial costs of catastrophes. At their core, all of these are *ex ante* programs that define the terms and conditions of governmental financial support after a disaster. The compensations schemes generally entail a partnership between the government and the insurance industry. These partnerships use the administrative capacity of the insurance industry to handle operating details of the programs. The relative roles of the government and the private sector reflect the financial strength of the insurance industry in the various countries as well as the budgetary limits of the governments in each country.

There are two primary financial models. The first model is the government as insurer of catastrophe risk. In this model, the government collects fees and absorbs defined catastrophe risk. This type of programs is generally mandatory with government set premiums. The other model is the government as reinsurer. In this model, the government provides financial support to the private market. The private market retains a portion of the risk for its own account. These programs can be either mandatory or voluntary, but all have actuarially set rates and defined reserve funds. The Japanese Earthquake Reinsurance Company is a representative example of this approach.

The different models tradeoff identifiable characteristics. The government as insurer has high moral hazard risk but provides lower cost protection to a wider range of insureds. The government as reinsurer with actuarially set rates reduces moral hazard risk but at a higher cost and more limited protection. The acceptability of the tradeoffs for each country is a function of political values. As such, there is no right program.

The programs developed by each country also reflect the level of catastrophe risk to the country. Countries with high catastrophe risk limit their programs to the identifiable risk. The varied hurricane, flood, and

earthquake programs in the United States represent programs that cope with high hazard risks. Countries with low levels of risk provide broader protection that covers a wider range of risks. The program in Spain is a good example of this model.

As developing countries recognize catastrophe risk as an issue requiring government attention and resources, the OECD experiences provide a wide array of policy alternatives to finance the losses from catastrophes. At a minimum, the experience of the OECD countries illustrates a few key principles: it is appropriate for governments to play a role in absorbing the costs of catastrophes; that governments should develop an *ex ante* program to define their responsibilities; and an active private insurance industry is an invaluable resource in assisting the government in creating its role in catastrophe risk management. As the role of governments in providing social protection expands, the relative role of the private sector and the government in managing risk will be subject to debate. The experiences of the OECD countries in creating and managing their varied catastrophe compensation schemes provide a broad variety of alternatives for coping with the costs of catastrophes. Current experience does not identify any clear winning or losing strategies. Rather, it identifies highly diverse alternatives to cope with a complicated problem.

## Notes

- 1 This discussion relies on an article by George Priest that appeared in the May 1996 issue of *Journal of Risk and Uncertainty* (Priest 1996).
- 2 *The Financing of Catastrophe Risk* is a 1999 book edited by Kenneth Froot that focuses on the role of private insurance and catastrophe risk (Froot 1999). The role of insurance in managing environmental risk was the focus of the 1997 book *Managing Environmental Risk through Insurance* by Paul Freeman and Howard Kunreuther (Freeman and Kunreuther 1997).
- 3 The OECD completed a short paper Flood Insurance in June, 2003. The paper surveys selected flood insurance programs in various OECD countries. The statistics related to insurance penetration and percentage of loss payments related to floods is from this publication.
- 4 This work has been pioneered by Professor Georg Pflug of the University of Vienna. The application of the technique can be seen in work done for the Inter-American Development Bank in Disaster Risk Management: National Systems for the Comprehensive Management of Disaster Risk and Financial Strategies for Natural Disaster Reconstruction (Freeman *et al* 2003).
- 5 In 2004, the United Nations Development Program issued its report, Reducing Disaster Risk: A Challenge for Development (New York: UNDP). The report contains detailed information on the impact of natural catastrophes on developing countries. The information and charts in this section come from this report.
- 6 Benson and Clay (2004), Understanding the Economic and Financial Impacts of Natural Disasters (Washington DC: The World Bank).
- 7 These are Algeria, Egypt, Mozambique, China, India, Bangladesh, Taiwan, Indonesia, Philippines, Korea, Afghanistan, Armenia, Georgia, Iran, Mongolia, Thailand, Argentina, Brazil, Chile, Colombia, Cuba, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, and Venezuela (Munich Re 2001).



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## PART III A

### *Chapter 13*

# **Rapid Onset Natural Disasters: The Role of Risk Financing in Effective Catastrophe Risk Management**

*by*  
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This chapter provides a conceptual framework for designing a comprehensive risk management strategy for rapid onset natural disasters at the country level, with a particular emphasis on the role of catastrophe loss funding. The chapter discusses the key policy and technical issues involved in building financially sustainable catastrophe risk transfer and funding programs in disaster prone countries, and their links to risk mitigation. The chapter also deals with the cognitive and political economy issues that are likely to arise and ways to accommodate them.

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## Introduction

The purpose of this chapter is to develop a risk<sup>1</sup> management framework for financing capital losses arising from rapid onset natural disasters<sup>2</sup> in developing countries. The objective is to provide governments and market participants with an analytical approach designed to shift the balance of catastrophe risk management away from ex post, ad hoc responses, in the direction of active ex ante risk management strategies. The philosophy of this paper is well caught by the following quote by a senior U.S. official responsible for flood plain management<sup>3</sup>, while acknowledging the particular circumstances of the poor:

*Various legislation (e.g. flood insurance) calls for individuals to bear the full cost for their decision to utilize flood-hazard locations. This... is not happening. Strict enforcement of present measures is needed, with strong penalties for non-compliance. Taxpayers should not be expected to bail out uninsured flood victims. Those who continue to live in hazardous areas with full knowledge of the risk should be expected to suffer the consequences. The federal government must integrate its disaster assistance policies and programs with those that promote longer-term solutions to flood problems. Relief should be linked to responsibility. Many citizens simply expect public aid when calamity strikes. With 50 federal programs to supplement their courage, people have every incentive to build in flood prone areas and leave it to Uncle Sam.*

The structure of the paper is as follows:

- Section I addresses the costs of rapid onset natural disasters and the potential weaknesses of prevailing ex post financing responses. It also outlines a conceptual risk management framework for rapid onset natural disasters, including risk measurement, mitigation measures and the role of various risk financing techniques.
- Section II provides an in-depth discussion of risk analysis and measurement techniques that are required in order to develop a coherent risk funding approach.
- Section III describes the range of ex ante risk financing strategies, including catastrophe insurance pools, reserve funds and contingent credit facilities, and how they can be used and combined.
- Section IV outlines the design issues that must be addressed in creating a catastrophe insurance pool, including the legal and institutional framework, the role of government and market participants, incentives for risk mitigation and insurance policy design.

- Section V provides the summary and conclusions, and identifies key issues for consideration in the future as countries strive to manage the growing risk of rapid onset natural disasters.

## **1. The Costs of Rapid Onset Natural Disasters in Developing Countries, Limitations of the Existing Coping Mechanisms and an Alternative Approach**

### ***1.1. Costs of Rapid Onset Natural Disasters in Developing Countries***

The most massive economic losses from rapid onset natural disasters occur in developed countries, where the value of exposed capital is higher in absolute terms. There have been 15 natural disasters in the United States in the last 15 years that have resulted in a total of \$43 billion in losses<sup>4</sup>.

However, the relative impact of natural disasters is greater and more disruptive in developing countries, where infrastructure is less resilient, building standards are lower, incentives for mitigation are absent, private markets do not provide catastrophe insurance for homeowners and small businesses, and there are greater constraints on government resources available to cope with disasters. As a consequence, hazard related events cause more loss of life and injury, and the subsequent fiscal and economic consequences are more extensive. Of the 40 worst catastrophes in terms of the number of victims in 1970-2001, 39 occurred in developing countries<sup>5</sup>.

Specific events demonstrate the dramatic impact of catastrophes on developing countries. For example, the toll from the 1999 Marmara earthquake in Turkey was close to 16,000 killed and 44,000 injured, with physical damages of about \$10 billion or 5% of GDP, or 21% of government revenues.<sup>6</sup> The 1985 El Salvador earthquake destroyed property and infrastructure equal to 27% of national GDP, or 158% of total annual government revenues, while the direct losses from flooding in Bangladesh in 1998 were equivalent to 17% of GDP, or 152% of government revenues. Even in large countries the impact can be significant; the Gujarat earthquake in India killed almost 14,000 people and injured 167,000 others, causing \$2.1 billion in damage, equivalent to only 1% of GDP but a substantial 7% of state government annual revenues.

While major infrequent catastrophes such as those cited above have dramatic impacts, many developing countries, particularly in Asia and Latin America, have to cope with the costs of earthquakes, typhoons and/or floods that occur relatively more regularly. Although the human and economic losses that occur from these individual disasters may not be large in absolute

terms, the cumulative impact can be substantial. For example, the Philippines is vulnerable to typhoons, floods, earthquakes and volcanic eruptions, suffering damages from natural disasters averaging 0.7% of GDP annually in 1970-2001.

In India, more than 360 natural disasters have been recorded over the past 35 years with reported direct losses on public and private economic infrastructure of approximately \$30 billion (nominal values at then applying exchange rates). It is estimated that, on average, the direct cumulative costs of natural disasters in India account for up to 12% of central government revenues.

Rapid onset natural disasters of these magnitudes or frequencies typically have a significant adverse impact on growth and development prospects in developing countries, as economic activity is disrupted and resources are diverted from new investment to relief and reconstruction. Many of these disasters have a disproportionate impact on economic activity in rural areas, which have smaller economic and social safety margins. These sections of society tend to be heavily reliant for day to day survival on lifeline infrastructure such as safe water and roads, and not to have immediate access to available emergency response mechanisms.

Moreover, the frequency of weather related catastrophic disasters appears to be increasing over time, while the economic impact of these events is becoming more devastating as developing countries continue to increase their overall exposures. For example, the reported frequency of natural disasters in India has been increasing over time, with the number of events about 50% higher during 1981-95 (181 events or 15 per year) compared with 1965-80 (121 events or 8 per year). This trend has continued with 75 events reported in 1996-2001. While there appears to be a pattern developing of more frequent hydro-meteorological hazards, the biggest impact on the rise in losses over the last 30 years has been the increase in risk exposures due to a rapidly growing concentration of people and assets in highly disaster prone urban areas<sup>7</sup>. The potential for higher losses will continue to rise with further urban development<sup>8</sup>.

## ***1.2. Limitations of Ex Post Financing Responses***

In most developing countries insurance markets are not well developed and coverage for natural disasters is very limited. In practice, hazard risk coverage tends to be limited to major industrial and commercial properties. Hazard insurance for homeowners (other than terrorism) is sometimes present where property rights have been established, but is usually restricted to upper-income households.

As a consequence of limited fiscal resources, cognitive and related political economy issues (see Box 13.1), and very low insurance penetration, governments have generally responded to natural disasters after the fact. Typically this means relying on domestic budgets, including diversion of resources from other projects, and on extensive financing from international donors. Mobilizing emergency funding from external donors has become the linchpin of some governments' strategies for funding disaster reconstruction and has become a major component of lending programs for the World Bank and other multilateral development banks.

### **Box 13.1 Cognitive and Political Economy Issues**

Research has demonstrated that most people are not rational when dealing with low probability events and often make poor decisions in dealing with them. The nature of a risk can be important in determining a response. For example a dread factor has been found with certain risks such as the possibility of cancer or nuclear accident which tends to increase their subjective probability. Natural disasters on the other hand tend to be discounted. The U.S. Insurance Research Council found in a 1996 study that while 95% of U.S. houses are insured for common perils like fire, only 20% of homes exposed to flooding are insured against floods (see Box 13.2.). Reasons given for this include certainty equivalents which are less than the insurance premiums required to remove them (i.e. people underestimate the probability and severity of a loss, unless an event has occurred relatively recently), overestimation of the response of their fellow citizens and government and lack of awareness of the availability of insurance (which is sometimes heavily subsidized for those most at risk). In the US people exposed to flood clearly overestimate the amount of ex post federal aid available, much of which is in the form of loans from the Small Business Administration. Flood insurance coverage, which is subsidized, normally provides much better ex post indemnities. In countries with disaster laws that ostensibly make housing good after a disaster (usually earthquake), people are often still living in tents many years after the hazard event.

Even where insurance is available, politicians are often caught between conflicting forces. Not only do they have an imperative to be seen to be dispensing money to victims after a disaster, but often the construction industry has a strong lobby, not least because of the importance of this industry to economic activity. When housing shortages exist the political discount rate becomes even higher. Thus while the statistical and physical measures underlying insurance pricing can demonstrate the level of risk in certain locations they can also be seen as a threat to development within the electoral cycle. Some cities, even in industrial countries, have been known to suppress flood maps for this reason. One of the authors was publicly chastised in parliament in his home country for sponsoring a study of cyclone risk in a state subject to such hazards, but also with a burgeoning tourist and retirement sector.



Over time, the extensive reliance of developing country governments on donor assistance, combined with the willingness of donors to provide emergency grants and loans, has created an environment in which countries that are prone to disasters have few or no incentives to take proactive measures to manage disaster risks. While ex post disaster funding is an important element of a risk management strategy, over-reliance on this approach by both governments and donors provides no incentives for the implementation of policies to reduce risks (such as better urban planning, higher construction standards, etc.).

In the authors' view this approach is becoming increasingly unsustainable. Over time, as developing countries accumulate more assets (buildings, infrastructure) in limited geographic spaces, their potential loss exposure increases. With sub-standard construction and land-use practices, and the propensity of some regions to experience more natural disasters, the level of countries' vulnerability and risk exposures also increases. These two factors together point to the likelihood of growing real losses from natural catastrophes in the future. Moreover, the capacity and willingness of donors to fund disaster relief and reconstruction is ultimately constrained<sup>9</sup>. Therefore, funding gaps between available donor resources and post-disaster funding needs are likely to appear (or grow if already present) if disaster prone countries continue to rely on ex post donor funding without engaging in ex-ante risk management, including risk financing.

In addition to being potentially unsustainable, experience across a broad range of countries has demonstrated that an over reliance on reactive, ex post approaches to natural disasters can be sub-optimal. Ex post funding approaches are subject to the following risk enhancing possibilities:

**Slow release of funds.** Multilateral post-disaster reconstruction aid can take a relatively long time to be negotiated and to disburse, relaxed requirements notwithstanding. Perhaps more importantly there is strong evidence that some disaster related loans have not disbursed because of a fundamental lack of local human and institutional capacity to deploy the available funds. Regardless of the cause the human impact and the level of disruption of economic activity may be far greater due to a delayed response.

**Ineffective use of funds.** Resource allocation after a catastrophe may be partly ad hoc (and subject to political agendas) due to extreme urgency, which often precipitates a lack of public scrutiny and leaves ample room for political considerations in determining post-disaster investment priorities. For example, in some countries, governments have committed to incur the costs of rebuilding destroyed housing, regardless of the economic status of the owners. This diversion of limited fiscal resources away from productive

development projects which are likely to restore economic activity and support the poor can have longer-term adverse economic and poverty effects.

**Insufficient funds.** Most developing countries face ongoing fiscal constraints. The quantity of funds available for relief and reconstruction may not be adequate, even with additional borrowing and grants from the donor community, leaving a ‘resource gap’. Such a funding gap has negative implications for the provision of public services, particularly if the post-disaster resources are insufficient to restore existing lifeline and health services infrastructure. Longer-term impacts can also emerge from disruption to educational and social infrastructure.

### ***1.3. A Rapid Onset Natural Disaster Risk Management Framework***

In light of the limitations of ex post disaster financing strategies, countries that are prone to natural disasters should have a strong interest in developing better policies and tools to take a more proactive approach to natural disaster risk management. In essence, countries should look at their risk exposures on a systematic basis and determine the amount of risk they can retain versus the risk that should be transferred based on their financial profile. A strategy should then be developed to:

- Mitigate risk exposures to reduce the overall expected losses,
- Improve disaster response planning and capacity, including more effective targeting of ex post relief and reconstruction funds,
- Explore ex ante risk funding and risk transfer techniques to limit reliance on ex post donor funding sources, to secure more immediate liquidity post event and introduce incentives for active risk management.

The basic elements of a risk management framework are as follows:

- The first step involves utilizing risk measurement and analysis techniques to assess potential losses from natural hazards. This requires the collection and analysis of data related to the probable occurrence of natural disasters and the calculation of severity of loss and likely damage that would result.
- The second step is to determine how an array of risk reduction techniques (mitigation) can be used to reduce the identified loss exposures. Reducing the loss from future catastrophic events should be an essential part of any risk management program; the most beneficial mitigation programs are those that are done before or at the time of new construction.

- The third step is to determine the most effective risk funding and risk transfer mechanisms, allowing for longer-term economic and social imperatives. Part of this analysis involves calculating the difference between expected losses and available ex post resources, the potential “resource gap”. Another key step is to assess the appropriate balance between ex post and ex ante funding mechanisms.
- The final and fourth step is to examine the legal and institutional framework for disaster response and ex post funding. Policies and institutional arrangements should focus on coordinated, advance planning for disaster response at various government levels. Fiscal resources can be used to provide incentives for government units at all levels to implement mitigation measures, and to develop the capacity and safeguards to required to employ ex post funding sources effectively.

Ex post sources of funding include redirected budget, direct aid, tax increases, diverted loans (usually involving the development banks), and increased borrowings, including from the central bank. In choosing between these sources of funds, the government will have to assess the costs and benefits of shifting resources and priorities from planned expenditures to disaster response, as well as calculating the macro impacts of incurring additional debt.

Ex ante funding techniques include the establishment of insurance reserve funds (backed by hedging instruments such as reinsurance), inter-temporal smoothing (finite reinsurance), risk transfer (usually specialized catastrophe insurance and reinsurance), and the arrangement of contingent debt facilities. Some countries, including India, Mexico and the Philippines, have established calamity funds (typically as budget line items) with annual appropriations to deal with the ongoing risk of smaller, more frequent disasters.

Calculation of the difference between ex post funding sources and expected losses, the resource gap, will provide insight into the potential value that can be gained by utilizing ex ante financing techniques. While these market based approaches to funding natural disasters can appear to be costly, they may still be more efficient than relying on internal budgetary resources to finance the peak potential hazard related losses of the country, which may be grossly insufficient.

Based on such analyses, some countries and states have developed special state mandated catastrophe insurance programs, usually as a private/public partnership supplementing the private insurance market. These programs provide coverage to homeowners (and possibly small businesses) for specific catastrophe risks. Industrial countries and states

with such arrangements include France, California, Florida, New Zealand, Norway and more recently Taiwan (China). The Turkish TCIP, initially targeted at earthquake risk, is the first state mandated catastrophe insurance pool established in a developing country.

## 2. Risk Measurement and Analysis

The first step in developing a catastrophe risk management strategy is to perform a loss risk assessment. The result of this analysis provides an objective estimate of potential losses and helps to focus the global risk management effort. It will also facilitate the calculation of the pure risk premium and market clearing premium for risks covered by a catastrophe insurance pool.

A loss risk assessment has four stages:

- **Hazard module.** First, the natural disasters and geographic areas to be studied must be selected. The characteristics of historical events and physical models are utilized to generate stochastic events using simulation techniques. The hazard module then analyzes the intensity of the event (e.g. ground shaking in an earthquake; peak winds in a typhoon) at specific locations when a stochastic event has occurred.
- **Exposure module.** Next, the exposed asset base is estimated for each location using available property data or is derived from population distribution data. The exposure model calculates the value exposed by multiplying the building stock by the average building replacement cost.
- **Vulnerability module.** Third, the vulnerability model is used to calculate the damage to each type of building from a given intensity event at a specific site. Building classifications are based on factors such as construction material and type, usage, number of stories and age. A damage ratio is calculated relating the repair cost to replacement cost for each peril at various intensities and locations.
- **Loss analysis module.** Fourth, the damage ratio from the vulnerability module is multiplied by the value of the exposed risk at a location to calculate an estimated dollar loss. Results are calculated for each type of property at each location and then locations are aggregated as required to arrive at the estimated loss.

There are five key measures of loss risk that can be derived from the data produced through the loss risk assessment.

- **Average annual loss** is the expected loss per year when averaged over a very long period. This is the amount that governments ideally would

budget for in planning disaster response strategies under Arrow Lind assumptions<sup>10</sup>.

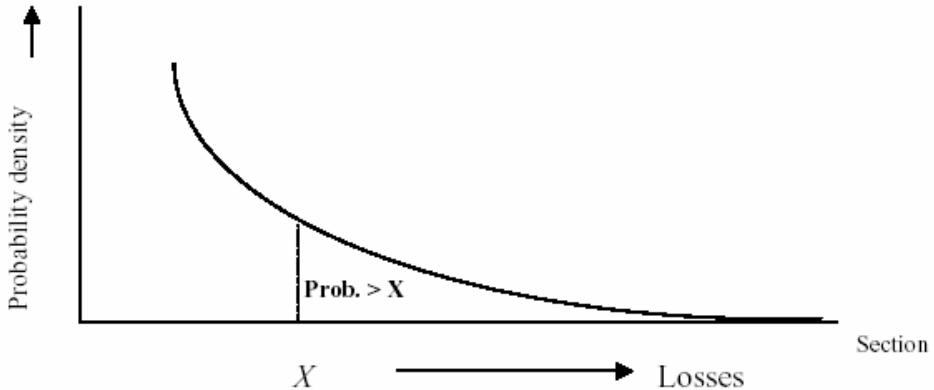
- **Probable maximum loss** is the largest likely loss to housing and infrastructure in a given region from all perils resulting from a single catastrophic event for a given return period<sup>11</sup>. This measure is used by insurance professionals as an estimate of loss severity in determining reserves and other forms of claims paying capacity needed to finance a catastrophic loss.
- **Loss exceedance curves** are utilized to calculate 1) the probability that all losses in one year could exceed a certain monetary threshold, and 2) the probability that one event in a particular year could exceed a certain value. Also, these curves are used to calculate the probabilistic estimate of average annual loss, which is a basic input into deriving insurance premiums. An example of a loss exceedance curve is provided in Figure 1.
- **Pure risk premium** is the portion of the insurance premium that is, when aggregated with pure risk premiums from other risks, intended to pay for cumulative losses of an insurer or reinsurer. The pure risk premium is generally expressed as the average annual loss per 1000 dollars of exposed value.
- **The market value premium** is the cost of transferring the total risk to the private insurance and reinsurance market, which is typically a 3-6 multiple of the pure risk premium. The market value premium adds expenses, underwriting and loss adjustment costs, profit, cost of capital reserves, and inflation to the pure risk premium<sup>12</sup>. A reinsurer will calculate the impact of providing coverage for a specific risk on its overall portfolio of risks to determine the marginal capital costs incurred, as well as the marginal impact of the risk on overall portfolio returns.

Policymakers in developing countries face challenges in employing loss estimate models. The key difficulty is in obtaining reliable scientific data about hazards, such as earthquake fault characteristics and flood mapping data. In addition, data on property types and values may not be available or specific enough to be useful. Finally, there is often little information on the vulnerability of different building types. Each of these limitations introduces uncertainties into the loss estimate methodology and increases the dependency on expert opinion in loss estimation. Finally, the cost of developing and maintaining loss models can be high<sup>32</sup>.

In Turkey, for instance, extensive earthquake risk modeling was carried out with technical assistance funding from the World Bank to prepare the

launch of the TCIP. Experience has shown that sound risk modeling reduces the uncertainties (and reinsurance costs) involved in estimating and allowing for risk for international reinsurers and thus can help bring down the cost of reinsurance for developing economies.

**Figure 13.1 Loss Exceedance Curve**



### 3. Ex Ante Funding Techniques -- Catastrophe Insurance Pools

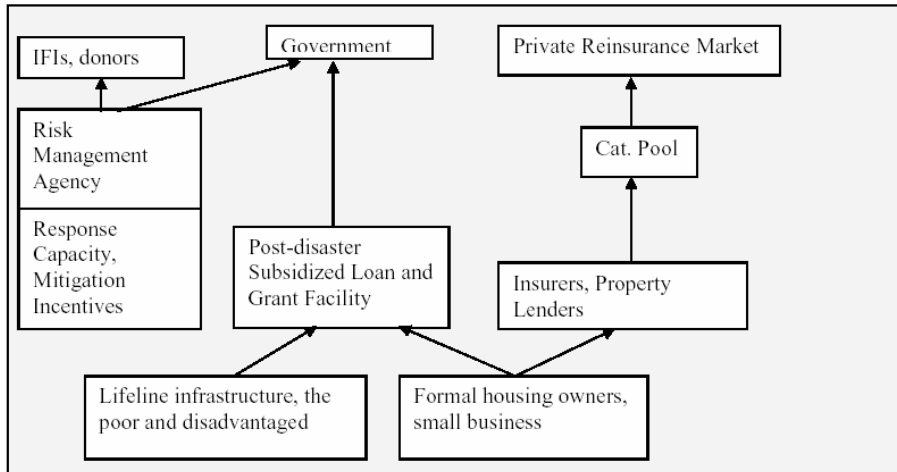
Once loss estimates have been calculated, they can be used to determine whether ex ante risk financing and risk transfer techniques would be effective in meeting any resource gap left after cost effective mitigation measures are instituted.

For housing and other private sector risks, and in the absence of an effective insurance market, catastrophe insurance pools turn out to be a better funding solution than reserve funds for infrequent (one in 100-250 years) events. Aside from the economic inefficiencies involved in governments bailing out those who could afford insurance (assuming it is available at a fair and efficient price), it is unrealistic to expect governments to create reserves that could accumulate over such a long period without these funds being subject to other more immediate (and sometimes legitimate) claims. It is also unrealistic to expect private insurance companies to build up special catastrophic reserves for severe but unlikely events in the absence of tax and accounting incentives and given the reality of shareholders' shorter-term business planning horizons. Thus reinsurance and other capital market instruments often prove to be the most efficient risk funding mechanism available. Contingent debt facilities can also be a useful tool for financing catastrophe pool loss exposures, particularly in the first years of operation, when a rapid build up of surplus (i.e. de facto capital) is

required. Contingent debt can also help such funds to ride out the volatile reinsurance pricing cycle (See Annex 13.2, Annex 13.3).

### Box 13.2 Three Element Country Risk Management Framework

The three elements of a coherent risk management strategy are a nationally coordinated disaster response and mitigation capacity (for example FEMA in the USA) with specific mandates to restore critical infrastructure and look after the poor after an event, a capacity to provide catastrophe insurance to those who can afford it (basically better off households and small business), even if efficient private markets are absent, and a political economy facility so that politicians can be seen to looking after the uninsured. This latter item will usually take the form of modest grants and subsidized lending. A further characteristic of integrated systems is the referral of disaster information to experts before a disaster is declared, thus providing a political circuit breaker. The generic structure of such an integrated approach follows:



Government reserve funds and other inter-temporal smoothing devices, such as calamity relief funds found in Mexico, India and the Philippines, can play a legitimate role in funding government exposures to critical infrastructure loss and social obligations to the poor after a disaster. Here again contingent debt can supplement market risk transfer instruments. If combined with a sound disaster planning framework and appropriate incentives for risk management, this type of ex ante appropriation of funds can result in faster, better targeted disaster assistance than ad hoc post-event responses.

The emergence of this insurance and contingent debt based model for ex ante funding of catastrophe risk has provided an opportunity for the development of more effective risk management strategies in developing countries. While not all disaster-prone countries will have the right conditions for utilizing a catastrophe insurance pool, each would benefit from a more coherent risk management strategy that explicitly addresses the need for advance planning, mitigation measures, development of response capabilities and alternative market-based funding strategies (Box 13.2).

The remainder of this section of the paper provides a closer look at experience to date with insurance pools, because of their potential to have a fundamental role in reducing governments' contingent liabilities to those who should be able to care for themselves.

### ***3.1. Rationale for State-Mandated Catastrophe Pools***

Rapid onset natural disasters can cause extremely large losses to national or regional economies and the costs may be well in excess of what government resources can finance. Potentially huge losses are more difficult to diversify and therefore insure using domestic insurance capacity. International reinsurance companies with global risk portfolios thus play a key role in the catastrophe risk market, absorbing the catastrophe risk from primary insurers.

In industrial countries, there is both greater private sector insurance capacity to cover catastrophe risks as well as more flexibility to finance unplanned fiscal costs for relief and reconstruction. However, even in wealthy countries with well developed insurance markets the loss potential can be so large that the insurance markets are unable to provide sufficient capacity at acceptable prices. Following a major loss, reinsurers often require substantially higher premiums to cover the same risk, in essence reducing or withdrawing cover through price increases. This effect, combined with the cyclical capacity levels found in reinsurance markets, translates into highly volatile pricing for catastrophe risk.

Another important rationale for government sponsored insurance solutions is that catastrophe insurance products are not priced on an actuarial basis like normal insurance risks, where the pure premium (before expense and profit loadings) usually dominates the cost structure. In the case of catastrophe insurance, the cost of the economic capital that must be reserved against potential catastrophes can be large compared to the expected loss from a catastrophe. This is particularly the case for international reinsurers underwriting the less frequently affected, but potentially very costly 'upper layers' of catastrophe excess of loss (XOL) reinsurance. Thus even where a high insurance penetration is found there can be significant technical challenges on the supply side of catastrophe insurance markets.



In some countries special government sponsored catastrophe insurance programs have been developed, in response to a perceived market failure, in order to provide affordable insurance coverage (Box 13.3).

### ***3.2. Experience with State-Mandated Catastrophe Pools and Reserve Funds***

To date, 11 national catastrophe risk management programs have been established and operate successfully in 10 countries.<sup>33</sup> Each of these catastrophe insurance programs emerged following highly devastating natural disasters to address the subsequent inability of the local insurance market to provide affordable catastrophe insurance coverage for a specific peril. Most of the programs:

- Provide regionally-based coverage for dwellings and contents against specific natural hazards,
- Charge premium rates reflecting the characteristics of the risk, with an element of solidarity involved, and generally do not receive direct government subsidies,
- Address mitigation by encouraging retrofitting and safer construction practices through premium discounts,
- Carry out sales and servicing of policies through the established distribution networks of private primary insurance companies and their agents.

These programs also help alleviate political pressure, both from homeowners and mortgage lenders, for allocation of substantial government resources in the aftermath of natural disasters for reconstruction of private housing.

The role played by government typically involves the provision of additional risk financing capacity, either directly (e.g. Japan) or indirectly (e.g. the United States). In the latter case, the government becomes the reinsurer of last resort by default, to be called upon in case of highly catastrophic events for additional claims paying capacity. The challenge in the latter ad hoc model is not to create sufficient moral hazard to undermine the whole risk management effort.

The government also provides regulatory oversight to ensure that catastrophe insurance pools are managed responsibly, with high quality underwriting and proper investment of capital reserves. The goal is to create a pool that sells an insurance product that is highly likely to pay out in the event of a catastrophe.

### Box 13.3 Market Failure and Public Response

Where effective private catastrophe insurance markets do not exist a number of governments have stepped in to either create the conditions for a private market to emerge (generally by providing government backed reinsurance) or have generated an entirely new proxy market. The French ‘Nat Cat’ system and the various Florida windstorm schemes have elements of the former, while the US flood insurance scheme and the Turkish earthquake pool have more in common with the latter. The challenge is to make such schemes actuarially viable, which means wide coverage and reasonably fair pricing, while dealing with the political economy realities inherent in the immediate post disaster environment (see Boxes 13.1 and 13.2), and encouraging active risk management in the community. The price of not allowing for political necessity can be seen in Turkey, where, following two relatively minor seismic events in 2003, the Turkish Parliament passed special purpose laws in order to release funds for housing reconstruction, despite the existence of TCIP and related prohibitions in an earlier Disasters Decree. Future modification of the Turkish system will need to allow for this reality.

The French and American schemes mentioned above, while requiring adjustment from time to time, have probably come closest to making the necessary trade offs. The original (1982) French system, which ensures that private sector insurers can deliver catastrophe cover, even for hazards deemed to be ‘uninsurable’, specified ‘Risk Exposure Plans’ defined by zone and town. In the absence of effective incentives this attempt at planned mitigation failed and in 1995 a new approach was introduced. This imposes rising deductibles on insurance payouts as hazard events repeatedly strike a town which has not engaged in active risk management (known as Risk Prevention Plans). Because public officials do not want to be blamed for reducing claims payments this approach has been far more effective. By 2002 over 8,000 plans had been set up and 3,500 approved, out of 13,000 towns exposed to hazard events.

The U.S. National Flood Insurance Program (NFIP), which was set up in 1968, is managed by the Mitigation Division of the Federal Emergency Management Agency. As with the French system the scheme has a Federal government liquidity guarantee in the event of an extreme event or series of events, although FEMA is expected to pay back any moneys advanced by Treasury. Another commonality with the French system is that few incentives initially existed to take up the program. By the end of 1973 there were less than 300,000 flood policies in force. Congress began to build incentive into the system that year, following serious floods in the early 1970s.

Key incentives now include a mandatory requirement that flood insurance be purchased before Federally backed property loans are granted in Special Flood Hazard Areas – generally areas subject to a flood return period of less than 100 years. Only communities satisfying certain mitigation requirements may participate in the NFIP in respect of properties which change hands or for new construction or substantial refurbishment. Uninsured flood victims will also usually be required to buy flood insurance as a condition for receiving Federal Assistance, including Small Business Administration loans. Today approximately 20,000 communities participate in the flood insurance system, and there are 4.4 million policies in force.

However, because of a systemic overly sanguine view regarding levels of post flood federal support (partly stimulated by the propensity of federal elected officials to undermine state and local government efforts to tie mitigation to payments<sup>34</sup>), flood insurance penetration in the U.S. remains lower than under the French system (see Box 13.1.).

Ideally, a state-mandated or sponsored catastrophe insurance pool should increase the country's catastrophe risk absorption capacity, while not competing with effectively working markets. The objective is to build on the existing market. The World Bank has been adapting the catastrophe insurance pool model to the developing country context so that it can create a proxy market in countries with relatively undeveloped insurance industries. The first practical experience with this initiative was the TCIP where the World Bank worked with the Turkish government, private insurance markets and international reinsurers to develop this earthquake insurance facility. In addition, it has provided a contingent credit and reinsurance premium funding facility to support reserve (capital) build up in the early stages (see Annex 13.3 for the relative roles of reinsurance and the World Bank contingent credit facility in TCIP's 2004 risk funding/ transfer program).

The TCIP was created in the aftermath of the 1999 Marmara earthquake to:

- Make liquidity readily available to owners of residential properties destroyed or damaged by an earthquake to repair or replace their dwellings.
- Reduce the Turkish government's fiscal exposure and the risk to the economy due to major earthquakes.
- Reduce the government's financial dependence on the World Bank and other donors' financial assistance in the aftermath of major earthquakes.
- Encourage appropriate building standards for housing.

The TCIP's earthquake insurance cover is legally compulsory<sup>35</sup> for many urban Turkish homeowners (although the compulsion is not well enforced). The pool provides cover up to approximately \$50,000 (at current exchange rates) for each dwelling for a premium that varies across the country depending upon seismicity of the area, and the type and quality of housing construction. Local insurers act as distributors of the TCIP policies and provide additional coverage in excess of that offered by the pool. Since its inception in 2000, the TCIP's penetration ratio has averaged about 17%, the highest among all known programs in terms of overall national catastrophe insurance penetration for homeowners. As with the U.S. flood and French Cat Nat experiences ongoing refinements will be required to provide the appropriate incentives for more homeowners to sign up.

Since the TCIP was established, a number of other disaster prone countries have approached the Bank for advice and support. Identification and pre-identification programs are under way for the creation of similar catastrophe risk insurance programs in disaster prone countries in Central Europe, Latin America, East Asia and South Asia.

## 4. Catastrophe Insurance Pool Design<sup>13</sup>

The design of catastrophe insurance pools should focus on developing a structure that provides affordable catastrophe coverage of acceptable credit quality and contributes to increasing overall insurance penetration in the local market. This can be achieved by relying on an efficient and low cost distribution mechanisms and securing access to international reinsurance market and other sources of funding. The design process involves a broad range of issues that fall into four major categories:

- **Design of insurance coverage.** Design of an affordable insurance coverage starts with the identification of perils and exposures to be included in the coverage. The process considers the affordability constraints of the target population, the allowed variation of premiums by risk (the level of solidarity in the premium structure); the level of participation in the program (compulsory vs. voluntary); and other issues of policy design, including acceptable deductibles, limits, extent of coverage, and applicability of co-insurance.
- **Institutional structure.** The design of the institutional structure entails the determination of the role of government, domestic private insurance companies and international reinsurers in the operation of the program; the establishment of its governance and management structures, as well as the distribution and claims administration arrangements.
- **Legal framework.** The legal basis for a catastrophe insurance pool should be put in place to provide the incentives for purchasing insurance and undertaking mitigation activities by homeowners.
- **Risk financing and transfer strategy.** Decisions will have to be reached on the initial pool capitalization requirements and its claims paying capacity; retention of risk by the pool vs. reliance on reinsurance and capital markets; the use of contingent credit arrangements to boost its claims paying capacity to promote survivability; asset management, and the role of the government as a reinsurer/guarantor.
- **Mitigation incentives.** The two key insurance related mitigation incentives are a credible statement from the authorities that they will only provide modest support to the better off after a disaster occurs and the linking of insurance availability (United States), or insurance payout (France), to mitigation planning and implementation. For such an approach to be viable the authorities need to ensure that an efficient and relatively fair (actuarially) catastrophe insurance market or proxy market exists.

The design process will invariably require iteration among these five sets of issues in order to develop an internally consistent and optimal model for the particular circumstances of the country and risks to be covered. A more detailed discussion of the four above mentioned steps in the program design process follows.

#### ***4.1. Insurance Product Design***

**Perils.** The initial decision to be made in designing a catastrophe insurance pool is to choose the perils to be covered. This decision can present a challenge in an environment in which there is more than one serious natural disaster risk. Initially, the viability of an insurance coverage for each of the risks should be evaluated separately. Then it can be determined whether to start with one risk and add others later, or to issue a single policy covering both perils.

**Exposures.** The second key decision is to identify which exposures are to be covered, such as homes, businesses, offices, etc. In addition, it will have to be decided whether to limit coverage to direct losses or expand it to include indirect losses such as business interruption.

**Premiums.** The next step in product design is the determination of the premium structure. Initially, this would start with the pure risk premium and market value premium as reference points. However, in practice, it is usually the case that the public is not willing to pay the market value premium that would cover all expected losses, including the most infrequent but extreme events that can add significantly to the risk premium. Instead, the starting point is normally to estimate an affordable premium level, then to adjust the policy coverage downward accordingly. Another challenge is to decide the extent to which premiums will be varied by risk, which requires a more complex set of underlying data on vulnerability. Policymakers will also have to determine the degree of solidarity to be embedded in the premium structure, while ensuring that owners of expensive properties pay a premium which is seen to be fair. One tool to avoid moral hazard is to subject claims payments to “average,” a form of scaling down<sup>37</sup>. Homeowners desiring a higher level of coverage can often purchase it through the private insurance market, which tends to service better off segments of population in developing and transition markets.

**Participation incentives.** An important issue is whether the insurance program will be compulsory or voluntary for homeowners. A compulsory program may be warranted where there is little awareness about insurance and mitigation on the part of the public, where there is a risk of adverse selection or where high enrollment is needed to bring the level of penetration high enough for the pool to be financially viable (also see

footnote 32). Voluntary programs require active public education and mass marketing campaigns to succeed. A key consideration is the tradeoff between achieving wide penetration through a compulsory program and creating a negative perception of catastrophe insurance as a tax.

**Coverage.** The extent of coverage will then have to be determined taking into account the premium levels, administrative costs and calculations of the costs of adding capacity to the pool through reinsurance and the capital markets (risk financing and transfer strategy). Coverage can be adjusted to market clearing levels through deductibles, limits and maximum payouts. For example, the TCIP policies have a deductible of 2%, exclude indirect losses and damages to movable property, and the maximum payout has recently been raised from \$24,000 to \$50,000. These provisions also introduce an element of co-insurance into the equation so that homeowners share some of the risk and potential rebuilding costs. A determination will have to be made whether the coverage should be issued as a stand-alone policy or as an add-on to existing homeowners policies, taking into account the objectives of achieving effective distribution and wide penetration by keeping the costs of catastrophe coverage affordable.

**Political economy.** It is important that any disaster funding system allows politicians to be visible in a positive way after a disaster occurs. Otherwise the system is likely to be undermined by special laws and other mechanisms designed to enable politicians to release funds over which they have a greater degree of control. Such unplanned fiscal expenditures can often increase the amount of risk in the community and ultimately lead to extreme moral hazard, whereby citizens see no benefit in purchasing insurance or mitigating risk. A better strategy is to acknowledge the political economy reality and institutionalize the political response to disasters so as to minimize any long term detraction from a community's preparedness to deal with risk. One such strategy would be to leave a limited but not insignificant role for government funds in providing immediate post disaster relief, including temporary housing, and subsidized but limited rehabilitation loans, even for the well off (see Box 13.2.).

**Underwriting.** The insurance pool manager should also ideally have a mandate to deny catastrophe insurance coverage to buildings that are not compliant with the building code. In practice this raises difficult issues in a post disaster environment, and a better approach, assuming reinsurer support is available, would be to provide reduced coverage if standards are not being met.

## ***4.2. Legal Framework***

If the government is to play a formal role in a catastrophe insurance pool then it will have to establish a legal basis for this activity. Each of the 11 existing state mandated catastrophe pools were established through legislation. The legal framework should spell out the institutional structure of the catastrophe pool, including the governance and management arrangements; the incentives to encourage purchase of catastrophe insurance product where appropriate; provisions for risk based premiums and coverage, and provisions to encourage safer construction practices and better risk mitigation.

Ideally, such legislation should encourage widespread participation in the program, including if necessary, a legal requirement of compulsory insurance for those who can afford it. The credible elimination of government financed housing reconstruction for those members of society with access to insurance markets (whether private or government sponsored), together with introduction of risk based premiums<sup>38</sup> and policy coverage limitations that allocate some of repair and reconstruction costs to the insured would, over time, create incentives for homeowners to undertake mitigation measures<sup>39</sup>.

## ***4.3. Institutional Structure***

A key design challenge is to determine the respective roles of government, domestic insurance companies and international reinsurers in the operation, financing, management and governance of a catastrophe pool. How these are determined will depend on circumstances in the insurance market, including an assessment of the strength of the domestic insurance industry as well as the government's fiscal position. Presumably, the government is involved because the private insurance markets are unable to provide sufficient cover at an affordable cost. The government has a significant role to play in governance and regulatory oversight of such insurance entities once they are operational to ensure their financial soundness and fulfilment of social objectives.

The selection of the pool manager is a critical decision that should be taken at an early stage in the design process. This decision will have to be made at the front end so that the managing entity can work with the government team to develop the systems and business relationships that will be needed to launch the pool. The normal candidates for this role would be major domestic insurance and reinsurance companies. For example, the TCIP is managed under contract by Milli Re, the largest domestic reinsurance company in Turkey.

In most developed and some transition countries, private insurers are able to provide some catastrophic insurance cover and the government supplements this by providing additional reinsurance capacity. However, in developing countries it is usually the case that the domestic private insurance industry is undercapitalized and unable to retain any significant part of catastrophic risk. In this environment, the appropriate role for most domestic insurance firms is the distribution of policies and the management of claims. Part of the design process will entail structuring the business relationships and processes between the pool manager and the firms that distribute policies and manage claims in a way that would secure companies' commitment to the program and thus would ensure its success.

The role of international reinsurers is particularly critical to successful design of a risk aggregating mechanism such as a catastrophe pool. The government will have to work with the international reinsurance market at an early stage in the design process in order to assess the terms on which international reinsurers will be willing to accept the risk ceded by the pool. This assessment will be a significant factor in determining the viability of the future enterprise. A broad consultation process involving key reinsurance players will help facilitate a broad consensus on the structure of the national risk aggregator, so that reinsurers will be willing to commit capacity when the program becomes operational.

Governance arrangements for a catastrophe pool should focus on ensuring independence for the board of directors and professional management so that the business viability of the pool is not compromised by political interventions and the pool is well-protected from misuse or confiscation of funds. The composition of the board of directors should represent the interests of the government, the insurance industry and policyholders. The underlying legislation should establish the board's responsibility for setting up the strategy and policies of the pool and for overseeing the performance of management. The Board should be required to disclose information about the pool to the public in order to generate public trust and confidence.

#### ***4.4. Risk Financing and Transfer Strategy***

The risk financing and risk transfer strategy of a catastrophe insurance pool has to optimize the relationship between premium levels, policy coverage and the pool's creditworthiness. The normal yardstick for creditworthiness is that the pool should be able to cover between one in 150 and one in 250 year events (i.e. probability of occurrence in a given year of between 0.67% and 0.4%) without becoming insolvent. As coverage levels increase for a given amount of premium and reserves, the creditworthiness of the pool may deteriorate. However, if coverage levels are set too low in



relation to premiums then it will be difficult to achieve sufficient market penetration for the pool to be successful due to the unattractive terms of the coverage offered. The level of coverage in relation to premiums is driven by the pricing dynamics of the global reinsurance industry, as well as by the pool's overheads, and the targeted level of its creditworthiness.

A fundamental issue that pool managers must address is the sourcing of capacity for the pool. The pool sponsor will normally be expected to provide some initial capacity and working capital: and will have to determine how much risk the pool should retain and how much should be ceded to the reinsurance market. Initially, most of the claims paying capacity is likely to come from the international reinsurance market, particularly as the number of participants in the pool grows. Another alternative for adding capacity is the issuance in the capital markets of catastrophe bonds. The pool manager should seek to diversify sources of capacity as well as achieving the best possible pricing terms. However, in order to maintain the creditworthiness of the pool at adequate levels and ensure the affordability of premiums the government will be expected to play a role of reinsurer of last resort by providing additional capacity to the pool on less than market terms; alternatively, it may decide the pool should pay claims on a pro rata basis after an extreme (say one in 500 years) event, which is likely to be politically unpopular with the insureds.

Catastrophe insurance pools face a particular challenge during the initial years, when the occurrence of a catastrophe before sufficient reserves have been accumulated can easily result in insolvency. An explicit strategy has to be developed to promote survivability of the pool in this transition period, including the optimal amount of risk to be retained. At this point in time a pool needs more reinsurance capacity relative to its own reserves. One useful tool for enhancing the capacity of a pool to withstand an early disaster is a contingent credit arrangement; the TCIP, for instance, is relying on a contingent credit provided by the World Bank. The investment strategy for the pool's reserves is also intrinsically tied to the pool's survivability. For developing countries, particularly smaller size economies, it is prudent for the bulk of the reserves to be invested out of the country to avoid extensive losses on both the liability and asset sides of the balance sheet in case of a large disaster. Finally, the risk financing framework for the pool will have to specify the course of action in the event that a catastrophe renders the pool insolvent and it has to start over.

## 5. Summary and Conclusions

The reliance of countries that are prone to rapid onset natural disasters on ex post funding sources, particularly donor assistance, may not be sustainable and in many respects is not optimal from a risk management and capacity building viewpoint. In certain cases such a strategy may adversely affect long-term growth prospects. Fortunately, a set of analytical tools and risk management techniques now exists that can enable countries to establish more systematic, forward looking natural disaster risk management strategies.

For new risk management initiatives to succeed in developing countries, it is essential that they be well designed and managed. This means a coordinated effort among the risk management agency in the country, the insurance and reinsurance sectors, the construction sector and external advisors with established track record in other countries.

A well-conceived national risk management strategy will first entail an analysis and quantification of risk, the establishment of a legal and institutional framework for disaster management, implementation of incentives for risk mitigation and capacity building and, often, the development of appropriate ex ante risk funding instruments, including reinsurance and IFI contingent debt.

Ex ante financing mechanisms provide liquidity immediately following natural disasters and this alone may be sufficient reason to consider them, even if a resource gap does not appear to exist. Catastrophe insurance pools and other risk aggregating mechanisms (including government budget instruments) can provide a convenient institutional setting for developing a risk management approach where insurance markets are incomplete. A well structured catastrophe insurance pool, for example, will achieve affordable premium levels combined with sound insurance policy design; good governance and professional management; effective risk management; and incentives for the private insurance industry to distribute the insurance product efficiently and effectively.

## Notes

- 1 In this context risk means potential for significant loss.
- 2 A disaster is the manifestation of risk. It requires a combination of hazard, exposed capital (including human and social capital) and vulnerability of that capital to the hazard.
- 3 Platt, page 234.
- 4 Ibid. pg. 5.
- 5 Swiss Re, *Sigma*. No.1 (2002). pg. 23.
- 6 Gurenko, Eugene. “Building Effective Catastrophe Insurance Programs at the Country Level: A Risk Management Perspective” in *Catastrophe Risk and Reinsurance: A Country Risk Management Perspective*, Risk Books, London 2004. pg. 4.
- 7 IFRC, *World Disaster Report*, 2001
- 8 Swiss Re, *Sigma*. No. 2 (2003), pg. 13.
- 9 See data in the IMF’s paper “Fund’s Assistance To Countries Facing Exogenous Shocks”, August 8, 2003.
- 10 Arrow, 1970.
- 11 The inverse of probability of occurrence.
- 12 Walker, George. “Catastrophe Risk Models for Asia from a User Perspective” in *Catastrophe Risk and Reinsurance: A Country’s Risk Management Perspective*. Risk Books, London (2004), pg. 3.
- 13 A more detailed account of catastrophe pool design features issues is provided in Annex I.

## *Annex 13.1*

### **Operation of Catastrophe Insurance Pools**

**Project management unit.** An important key to success will be establishing implementation arrangements within the government to address each of the steps on the critical path needed to put the pool into operation. Before legislation is passed and the catastrophe pool is established as a legal entity, the government will have to establish an internal unit or working group with responsibility for managing the project. This group should have the participation and support of the insurance supervisor and appropriate government ministries, and include in a consultative process key domestic insurance and reinsurance companies, mortgage lenders and other relevant market participants. Such a group is likely to be hosted by the Ministry of Finance or by the office of insurance supervision.

**Selection of pool manager and board of directors.** One of the key initial functions of the project management unit will be the selection through a formal procurement process of the pool manager and other advisers that will be needed during the pool design and implementation stage. The unit could also be involved in recommending to the government the membership of the board of directors. Once the pool becomes a legal entity, the board of directors has been formed and the pool manager is selected and contracted, then the government unit can revert to providing occasional support and monitoring the performance of the pool manager in project implementation.

The responsibilities of the pool manager should include implementing the policies set by the board; supervising the distribution of policies through insurance companies; managing claims payments; arranging for risk transfer to the global reinsurance and capital markets; and managing the pool's operations so as to ensure its financial viability. Management of operational matters such as policy processing, information technology, marketing, claims settlements and investments can often be handled most effectively through outsourcing.

**Preparation of business plan and budget.** Subsequent to the selection of the board of directors and managers of the pool, the manager should focus initially on the preparation of a business plan and budget for the implementation phase of the pool, to be approved by the board of directors.

The design and implementation phase will require the completion of a number of demanding tasks, some of which will necessitate the procurement of expert advice. The establishment of a twinning arrangement between the pool manager and an existing catastrophe pool can be a useful source of expertise and assistance. Engaging specialized consultants will be necessary for some activities.

The key tasks that have to be accomplished include:

**Risk modeling and pricing.** It may be necessary to conduct additional risk measurement and analysis studies in order to develop loss estimates to provide the basis for premium and coverage calculations. Engineering consultants should analyze and quantify the impact of historical and probable future catastrophes, to determine the probable maximum loss and aggregate losses that would occur as a result of these catastrophes. The consultants should work with insurance specialists to present the findings in a way that facilitates risk modeling of catastrophes under varying scenarios, as input to the determination of policy coverage and premiums. This work will also contribute to an underlying natural disaster risk management strategy for the country.

**Insurance policy design.** The insurance policy design should take into account government proposals, current insurance policy conditions, and available international experience. Consultations with local property insurers and reinsurers and examination of current practices should be undertaken to form a view on structuring deductibles, coinsurance and to develop reliable underwriting guidelines. The financial and fiscal implication of various coverage options should be modeled, with the outputs contributing to the formation of the risk financing and transfer strategy.

**Distribution systems.** Consultations with domestic insurance companies, agents and loss adjusters should be undertaken to structure their participation and provide incentives for their contribution to the success of the pool, including possible linkages to existing property insurance policies. Contractual arrangements, procedures and information technology linkages for distribution of policies and settlement of claims will have to be developed, building on existing business practices and relationships to the greatest extent possible. If a viable insurance distribution system is not available alternatives, including utilities, tax collection mechanisms, and bank branches, will need to be considered.

**Information technology systems.** The IT systems should be designed to record in a database the properties that are insured, and to monitor exposure and handle premium transactions with insurance companies and claims transactions with loss adjusters. The system should also have the capability to monitor the exposure of the catastrophe pool, both for risk

management purposes and to assist in dealing with international reinsurers and the capital markets. Ideally, the systems will build on those already in use by the insurance industry. The systems should provide both on-line access and call center service, with a back-up system for securing data. If premiums are risk based, software should be developed and required for use by insurance companies and agents to price policies. Insurers, agents and loss adjusters may have to make changes in their own IT systems, and training will have to be provided to them as well as the staff of the pool manager on how to use the pool's IT systems and risk pricing software.

**Auditing and monitoring systems.** The IT systems will have to be designed to enable monitoring of the functioning, recordkeeping and flow of funds for pool activities, for both the distribution system and for relationships with reinsurers. As part of the development and management of the distribution system, a key challenge will be to establish monitoring systems to ensure that all funds received by intermediaries are remitted in a timely manner to the pool manager. Internal audit processes and reporting procedures to the pool's board of directors will have to be established.

**Risk financing and transfer strategy.** The board of directors and manager will likely need expert advice on development of the risk financing and transfer strategy. A reinsurance intermediary should be chosen through international competitive bidding to design a program based on modeling that includes the capacity requirements and structure to achieve the objectives of the pool. The intermediary may also be charged with negotiating with re-insurers and/or capital markets, evaluating the quotations and products offered by the markets, and, following a decision by the board on the strategy, placing the program in the market.

**Investment policy and fund management.** As the size of reserves grow, asset management becomes increasingly important. A segregated trust or escrow account should be established to hold invested funds for benefit of policyholders to protect them from possible creditor action or other use. The board of directors and pool manager will have to determine a funds management strategy and exercise careful oversight of the investment manager(s) chosen to invest pool funds. An advisor is often engaged in such circumstances to assist the board/ manager develop and implement a long term investment mandate for the pool reserves, to determine fund manager selection criteria and to develop a monitoring approach. A custodian would also have to be appointed to safeguard the assets.

**Marketing and public education campaign.** A domestic public relations firm should be engaged to develop a marketing and public education campaign that will inform the public about the catastrophe pool before it is launched. The objective of the campaign is to explain and build

public confidence in the pool in order to maximize participation by potential insureds. Marketing and public education activities will need to continue after the pool is launched in order to contribute to increasing the penetration of the pool over time.

**Liaison with local governments.** The pool manager will need to liaise with local governments because property registrations and records at local authorities will form the basis of insurance cover. If the program is compulsory the local tax authorities may be involved in enforcement.

**Liaison with structural engineering firms.** Catastrophe insurance pools can contribute to the enforcement of building codes through commercial arrangements with independent engineering firms that would be retained to certify the construction quality of new residential dwellings to be insured by the pool. If mitigation incentives in law require inspection and certification of new dwellings, the pool manager will have to establish business relationships with structural engineering firms and arrange for inspections of these dwellings when applications for insurance are received.

### *Operational Challenges in Managing Catastrophe Insurance Pools*

Once the pool is launched, the government, the pool's board of directors and its management will have to monitor its operations to ensure that it functions effectively and meets the objectives for which it was formed. Based on experience, the scheme may need some modifications to improve its operation.

**Maintaining/increasing insurance penetration.** A key objective is to ensure that the penetration of the program is sufficient to maintain its viability. After some experience is gained, it may be necessary to review the pricing, coverage and distribution arrangements to address impediments to higher penetration rates.

**Distribution incentives.** Related to the penetration issue, it may be useful to review the business arrangements between the pool manager and insurance companies and agents, including the incentive structure, to ensure that commissions are adequate to motivate them to sell policies, while not set so high that the financial viability of the distribution process is undermined.

**Information flows.** The operation of the information technology systems will have to be monitored to ensure that information on policies, premiums, claims and payments is properly and efficiently maintained.

**Role of global reinsurance companies.** The success of the pool will depend on the continued support from global reinsurance companies.

Regular communication between the pool manager and reinsurance companies will contribute to this objective.

**Management of risk accumulations.** As the number of policies grows, the pool manager will have to ensure that reserves and capacity of the pool, including reinsurance and capital market support, is sufficient to cover expected losses.

Many of these operational issues are being addressed in Turkey, where the TCIP has experienced success in its initial years of operation but still faces some ongoing operational challenges. The TCIP rapidly achieved a level of 2.4 million policies in 2001, or about 20% penetration, but the number has fallen to 1.9 million policies in 2003, or 15% penetration. This is resulting in a slower than planned accumulation of reserves.

For instance, there remains an open issue between the TCIP, which has exclusive rights to issue earthquake insurance policies up to a basic limit defined by the disasters law, and domestic insurance companies. The private insurers would like to integrate the TCIP compulsory earthquake policy into their own homeowners property policies in order to reduce transaction costs and to increase incentives for agents to sell more policies. This, at times, has impeded the full cooperation of the insurance companies with the scheme.

On the positive side, thus far the TCIP has been successful at achieving required levels of reinsurance and has retained the cooperation of the global reinsurers despite the shortfalls in growth in premiums compared to initial projections. From its inception in late 2000, it has already paid out on over 3,300 claims from 47 separate earthquakes, without recourse to reinsurance capacity. In this regard, the scheme has been operating as planned.



*Annex 13.2*

**Catastrophe Reinsurance Pricing Volatility**



Source: Congressional Budget Office based on data from Paragon Reinsurance Risk Management Services

*Annex 13.3***Contingent Debt Facility and Reinsurance****TCIP 2004**

Excess Capacity GOT	
\$200 M R/I	
\$178 M R/I	\$22 M WB
\$120 M R/I	\$80 M WB
\$42 M R/I	\$28 M WB
\$60 M - retained	
\$20 million WB	

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## PART III A

### *Chapter 14*

#### **Designing a Disaster Insurance Pool**

#### **Participatory and Expert Approaches in Hungary and Turkey**

*by*

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The Hungarian and Turkish governments have recently implemented national insurance systems to transfer risks from floods and earthquakes, respectively, from households to public insurance pools. To date, neither system has met the expectations of the respective governments in terms of insurance uptake and political support. The study described in this chapter implemented a model-based participatory process for designing a nationwide flood insurance pool for Hungary with a focus on the highly vulnerable Upper Tisza region. The consensus reached by the stakeholders in this pilot study demonstrates that a participatory process, aided by a simulation model, can potentially provide insights on the political viability of a disaster loss-sharing system. This study raises the question whether the Hungarian and Turkish governments might have benefited from involving the stakeholders in the design of their recent insurance systems.

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## 1. Introduction

One of the more controversial issues in countries highly exposed to disasters is the respective roles of the government and the private market in preventing disaster losses and providing post-disaster assistance to flood victims. Economists view private responsibility for disaster risks as important for providing market incentives for individual loss-prevention measures and to discourage development in high-risk regions, but the attribution of responsibility invokes fundamental questions of equity and social solidarity in responding to extreme circumstances, especially in poor and vulnerable regions. How much should persons living in non-risk areas and taxpayers contribute to preventing losses and compensating victims in vulnerable communities, and to what extent should those living or locating in high-risk areas bear the burden to encourage them to relocate or take loss-reduction measures? Experts, alone, cannot decide on these value-laden questions, but they require consideration in a broadly based democratic process that takes account of the conflicting views of what is a fair and effective insurance/solidarity system.

The drawbacks of relying solely on an expert-driven process for designing a national insurance pool have become apparent in Hungary and Turkey, where national insurance pools have recently been put into place. In Hungary, the uptake is far lower than needed for the viability of the recently legislated flood insurance system. In Turkey, a recent governmental decree implementing the Turkish Catastrophe Insurance Pool (TCIP) may be jeopardized by the reluctance of the Turkish parliament to legislate its continuation. The TCIP was an initiative of the Turkish government and the World Bank. The recent Hungarian insurance system has passed the Hungarian parliament, but the details were negotiated between the government and the insurance companies without the direct involvement of other stakeholders.

A pilot study carried out by IIASA with the Hungarian Academy of Sciences and Stockholm University<sup>1</sup> developed and tested a model-assisted, citizen-participatory procedure for designing a disaster reduction and insurance system. The focus was on the vulnerable Upper Tisza river region in northeastern Hungary. Renn et al. (1995) define public participation as “...forums of exchange that are organised for the purpose of facilitating

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<sup>1</sup> The study was funded by the Swedish FORMAS.

communication between government, citizens, stakeholders and interest groups, and businesses regarding a specific issue or problem” (p.2). In this paper we describe a participatory process that combines stakeholder interviews, a public questionnaire and a stakeholder workshop. A challenge for this process was to identify the conflicting perspectives and preferred policy directions for flood risk management held by the stakeholders, and more concretely to identify a politically viable policy path for a nation-wide, public-private insurance/compensation system (see Linnerooth-Bayer and Vári, forthcoming). A unique feature of this process was a computer simulation model that illustrated the outcomes of the competing policy measures suggested by the stakeholders for reducing and sharing flood losses.

The pilot “Tisza study” was a success in that the stakeholders, who held strongly competing views of the flood risk pooling issue and its resolution, reached a consensus on a way forward. The stakeholder consensus differed importantly from that legislated by their parliament, and the Hungarian system – like its Turkish counterpart – has not received wide-scale public support. The Hungarian stakeholders agreed on a radical change from current practices, and only households with partial insurance cover would be eligible for post-disaster government assistance. They were unanimously opposed to mandatory insurance policies, which they viewed as a tax, and most stakeholders opposed risk-based premiums in poor regions opting instead for social solidarity (similar to the French insurance pool). These results contrast with the recent and controversial Turkish insurance pool. Of course, the Hungarian results cannot be transplanted to Turkey, but the political difficulties encountered by the TCIP raise the question whether a stakeholder participatory process, by informing the Turkish government and World Bank experts, might have avoided the current parliamentary stalemate?

After describing the flood risk problem in Hungary and specifically in the Upper Tisza river basin, we report results from the stakeholder interviews and nation-wide public survey. We then describe the catastrophe/policy model that simulated the distribution of future flood losses among the flood-basin residents, the government and insurers based on policy options that emerged from the stakeholder and public views. Armed with this model, the active stakeholders were revisited, which resulted in a revised set of three policy paths. The final round of this study took the form of a deliberative stakeholder workshop where participants chose and argued for their preferred policy option and reached consensus reached on a public-private insurance system in Hungary. We compare this consensus with the recent legislation creating public-private insurance systems in Hungary and Turkey.

## 2. Background

One of the highest flood-risk areas in Hungary, and one of the poorest regions in Europe, is the Upper Tisza river basin in the northeastern part of the country. The Tisza River originates in the Carpathians in the Ukraine and flows from Romania and Slovakia to Hungary, and eventually into the Danube in Serbia. The intensity and frequency of flood disasters in this region and throughout Hungary appear to be increasing. Pecher et al. (1999) point out that from 1877 to 1933 the average period between high-water discharges resulting in disastrous floods on the Tisza River was 18 years; from 1933 to 1964 it was only three to four years. Since 1998, record-breaking water levels of the river have occurred almost annually, but the extensive network of levees surrounding the river has prevented major losses. The flood of 2001, however, burst through the protective levees causing extensive damage. Since flood waves originating in upstream Ukraine arrive in Hungary at very high speed, there is a little time for warning and preparation.

Communities in the Upper Tisza region, and especially the high-risk areas near the Tisza River and its tributaries, are among the poorest in Hungary. Among the less qualified Roma population, the rate of unemployment in the region is very high, and agriculture by itself cannot support the local population. Riverine floods and inland waters have aggravated this situation considerably. There are communities, for instance, where free seed is distributed, but the residents are unwilling to sow mainly on account of the flood risk (Horváth, et al., 2001).

More positively, the area has a large and undeveloped potential for recreation, tourism, as well as nature conservation. There are pristine, almost untouched areas surrounding the meandering Tisza River, and its flood plain is sprinkled with old villages, traditional farms and historic buildings. Tourism was on the rise until 2000, when the area was stigmatized by a cyanide spill into the Szamos and Tisza rivers caused by the breakage of a tailings impoundment maintained by the AURUL Australian-Romanian joint venture mining company in northwestern Romania. Until this episode, water sports had developed intensively in the area; however, infrastructure supporting these sports remains underdeveloped, and there is large uncertainty about the future of the region with regard to tourism.

While there is little controversy that flood risks are a problem in the Tisza region and throughout much of Hungary, there is little agreement on *why* they are a problem or *what should be done* about them. The challenge to some stakeholders is to design cost-effective flood-control interventions, and according to others, to move people out of areas where the costs are too high. Seen differently, however, overflowing rivers are a natural part of the

flow and ebb of ecosystems, and the challenge is to live in harmony with the river. Likewise, there are different views with regard to who should bear the losses. Many view their government as responsible for protecting the public, and the government should absorb the losses; social solidarity with flood victims is a valued public virtue that promotes a humanitarian and equitable society. Others are concerned about disincentives created by overly generous public compensation and see individual responsibility as the cornerstone of a flood risk system.

The challenge for this pilot project was to design and test a stakeholder process that takes account of these contending constructs of the problem and its solution and that seeks consensus on a flood risk management system. The process described in the next sections included stakeholder interviews, a public questionnaire, a flood-risk policy model and a stakeholder workshop.

### **3. Round one: Stakeholder interviews to identify feasible policy paths**

Nearly all Hungarians have a stake in the flood risk management system for the Upper Tisza region, either directly by their exposure to flood risks or indirectly by their tax payments for flood loss mitigation and relief, their flood insurance payments that subsidize those living in high-risk areas and their foregone public amenities because of flood-relief expenditures (for instance, after the 1998 Tisza flood the central government justified the suspension of building a new section of the Budapest subway in order to divert funds for flood relief). For the purpose of eliciting stakeholder views on flood risk management strategies for the Upper Tisza region, round one of the participatory process was carried out with face-to-face, open-ended interviews with stakeholders who are actively involved in and informed of the policy issues. These included twenty-four persons representing central, regional and local government agencies, farmers and entrepreneurs, NGO activists and insurance companies (Vári, 2001). From these interviews, three prototypical flood-policy strategies emerged: state protection, individual responsibility, and holistic development of the region.

*State protection:* One widespread view saw the government as continuing to absorb a large share of the costs of reducing flood risks in the area and supporting reconstruction by its investments in levees, its generous compensation of flood victims and controlling development in the flood-risk areas by top-down zoning regulations. Justification for this strategy was based on claims that the government is responsible for protecting its citizens, and if it is negligent in providing this protection, it must be held accountable and absorb the losses. Critics saw this hierarchical approach as leading to a worsening of the central government's budget deficit and,



despite regulation, encouraging undesired development in the flood-prone areas.

*Individual Responsibility:* Alternatively, the government can withdraw resources from this area and rely more strongly on market forces to encourage individual responsibility for reducing losses and for insuring against them. The stakeholder discourse in Hungary is notably short on this strategy. With the exception of blaming the new landlords in the Tisza area for not maintaining the water drains and culverts, the stakeholders made little mention of individual loss-reducing measures. Nor was there a sense that individuals and communities should be fully insured. This is true throughout Central Europe. For instance, after the 1997 Polish floods, the Prime Minister made a public statement that uninsured victims had only themselves to blame for their financial losses and should not expect government compensation. This remark raised such a public outcry that the Prime Minister was forced to apologize (Stripple, 1998).

While the individualistic view of flood risk management has been conspicuously absent from the mainstream policy discourse in Hungary, it is beginning to assert itself as Hungary enters the global marketplace and as government authorities recognize that they cannot continue massive public support programs. Budget austerity is thus forcing a partly reluctant government to switch towards more individual responsibility and “borrow” the market discourse that dominates the discussion in countries such as the United States and Great Britain. If uninsured disaster victims are guaranteed grants that enable them to continue to rebuild their property in hazard-prone areas, and more people build in those areas, taxpayers will be subject to increasingly larger expenditures for bailing out victims of future disasters. This moral hazard argument led the authors of a recent book, suggesting reforms to the U.S. natural disaster program, to argue for making private responsibility and insurance a cornerstone of catastrophic risk management (Kunreuther and Roth, 1998).

The policy path emphasizing individual-responsibility can be justified on what at first appears to be an efficiency argument. With increased emphasis on incentives promoting loss-reducing measures, everyone stands to gain: the taxpayers because of decreased demand for post-disaster aid and the Tisza residents if they are compensated for their loss-reduction expenses. The Hungarians stakeholders, however, were reluctant to accept this Pareto efficiency argument. They saw few realistic measures local residents can take to reduce flood damages. Besides switching to more flood-resistant crops or abandoning agriculture altogether in favor of small handicrafts like rug weaving, the only remaining option is to leave the area. The relocation strategy is often advocated in wealthy countries, but it is problematic in Hungary where more than 50 per cent of the territory is at risk to flooding.

As some stakeholders point out, the poor residents can only relocate to the cities increasing urban problems and resulting in the abandonment of historic villages.

*Holistic development:* The third view promotes the ecological preservation of the area and egalitarian policies towards the poor, including subsidized programs to help farmers change land-use practices, the re-naturalization of the river by removing levees in some areas and the provision of infrastructure for soft tourism. These voices are strongly opposed to levees and other structural flood protection measures that, they claim, only push the risks downstream and endanger ecosystems. Fairness in this line of argument stands in opposition to the paternalistic fairness of the hierarchical discourse and the efficiency arguments of the individualist. Ecosystems should have standing in the policy debate, and the very poor should be given priority in a kind of equality for all. Commercial insurers are regarded with suspicion since risk transfer should not be an issue in an ecologically and socially just society.

These three perspectives – state protection, individual responsibility, and holistic development - form the contested policy terrain in Hungary. Each discourse constructs the problem and solutions in a way that reinforces the underlying worldview. Within this struggle, institutions and individuals may argue for the same policy, but for different reasons and based on different claims of fairness, which is a core concept behind the search for viable policy paths.

#### **4. Round Two: The Public Survey**

Based on the stakeholder interviews, a questionnaire with face-to-face interviews was administered to 400 persons in Hungary. The purpose was to elicit public stakeholder views on Hungary's options for reducing flood risks and providing assistance to victims. Four separate locations in Hungary were chosen in order to include stakeholders at high risk to flooding in both rural and urban areas, as well as urban and rural stakeholders who subsidize those living in high-risk areas through their tax and insurance payments. The sample size in each area was 100. Settlements in rural areas were chosen randomly, and the number of participants was determined according to population size. The sample was selected to be representative in terms of gender and age for each region. For more details on the survey, see Vári, et al. (2003).

The public survey confirmed that when it comes to floods the majority of Hungarians continue to view their world as it has been, that is, with a paternalistic state taking the main responsibility for their well-being. The main causes of flooding were seen as lack of maintenance of the levees,

clearing of large forest areas in the catchment area and insufficient height and strength of the levees. Significantly, the least important cause was attributed to the local people taking insufficient preventive measures or building in flood-risk areas. At the same time, a third of the respondents blamed the authorities for having issued building permits in areas with high inundation risk. In mitigating the risks, low rankings were given to measures such as financial incentives, including risk-based insurance premiums, to encourage inhabitants to migrate out of high-risk areas, the introduction of alternative agricultural practices and re-naturalization of parts of the river. These results confirm the findings of the stakeholder interviews, that a majority of Hungarians tend to blame their government or neighboring countries for escalating flood losses, and few appear to hold those living and working in the high-risk areas as contributing substantially to this escalation.

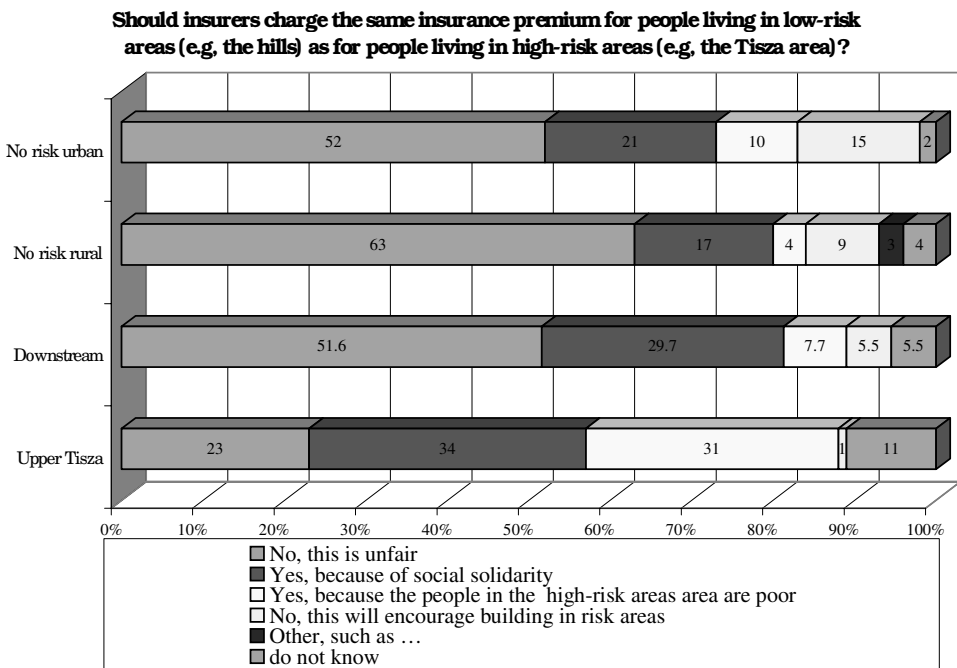
Along this same perspective, responses strongly indicate that responsibility should be mainly in the hands of the central government rather than in the hands of property owners living in high-risk areas. In terms of responsibility the central government was ranked in first or second place (of four alternatives) by 92 percent of the respondents, the neighboring countries by 51 percent, the municipalities by 49 percent and the property owners by only 10 percent of the respondents. Corresponding to the view that the central government is mainly responsible for flood losses, a large majority of the respondents would fully or partially support Hungary's generous public compensation system. Importantly, however, an equally large majority was, at the same time, sympathetic with switching to more individual responsibility, meaning that many persons are in favor of both state protectionism and individual responsibility. Indeed, later questions show a great deal of support for a joint public-private insurance system for Hungary.

What motivates Hungarians to express such strong solidarity with flood victims? Considering Hungary's history of government protection against flooding, it is not surprising that half (51%) of the respondents justify financial assistance to flood victims on claim that flood protection is the *responsibility* of the government and thus flooding is the fault of the government. If the river overflows the levees and floods the villages, the government is to blame since it has not built the levees strong or high enough. Alternatively, about a quarter of the respondents (26%) justify victim relief on the grounds that the government has always provided compensation, and a fifth (19%) justified financial support to the victims on the solidarity principle. This strong majority does not mean that there are no contending views in Hungary. A small but important minority of respondents is *not* in favor of compensating flood victims. Among the cons, the respondents differentially thought that compensation is too costly for the

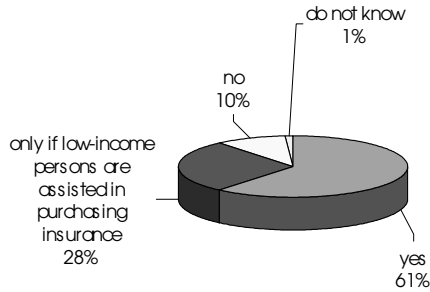
taxpayers, or that it often goes to the wealthy or that compensation discourages people from purchasing insurance.

This plurality of views was apparent throughout the survey results. For example, there were mixed views on whether households in low-risk areas would be willing to pay higher flood insurance premiums to subsidize the premiums of those in poor, high-risk areas. As shown in Figure 1, more persons in low-risk areas considered cross-subsidization unfair, but a surprising number, between 20 and 30 percent, supported cross subsidies on the grounds of social solidarity especially with poor regions. This result was consistent with responses to taxpayer support: nearly *one-third* of the respondents in the low- or no-risk areas support taxpayer solidarity with Tisza flood victims. It is remarkable that approximately *76 percent* of the respondents thought the government should compensate every victim regardless of the victim’s economic circumstances or role in preventing losses.

**Figure 14.1 Respondents’ views on risk sharing by region**



**Figure 14.2 Respondents' views on whether property owners should insure themselves against flood damage**



A large majority of respondents fully or partially subscribe to continuing Hungary's generous victim compensation system, and at the same time a majority of interviewees are in favor of more individual responsibility. Exploring this duality further, as shown in Figure 14.1, over 60 percent of the sampled persons (but fewer in the Upper Tisza region) thought it desirable that property owners have insurance against flood losses, and only about half as many (but higher in the Upper Tisza region) shared this opinion on the condition that low-income individuals receive public assistance in purchasing insurance. Although private insurance was viewed for the most part as desirable, *only about a third of the respondents thought it should be mandatory and another third thought it should be conditional on assistance to low-income persons*. Most importantly, half the respondents supported a mixed public-private system of victim relief. This finding is consistent with earlier results indicating that many Hungarians regard government compensation and private insurance as complementary.

It is beyond the scope of this paper to discuss all the questions on the public survey. As a short summary, the questionnaire results confirmed that the Hungarian public has differentiated and contending views concerning the management of flood risks in the Upper Tisza region. These views appear to depend to some extent on economic interests – those living in high and dry areas are less disposed to generous taxpayer aid and other forms of solidarity with flood victims – and to an important extent on notions of a fair society – almost a third in the high-dry areas do support this aid. The results showed little sympathy with extreme market positions, nor for extreme ideas on a

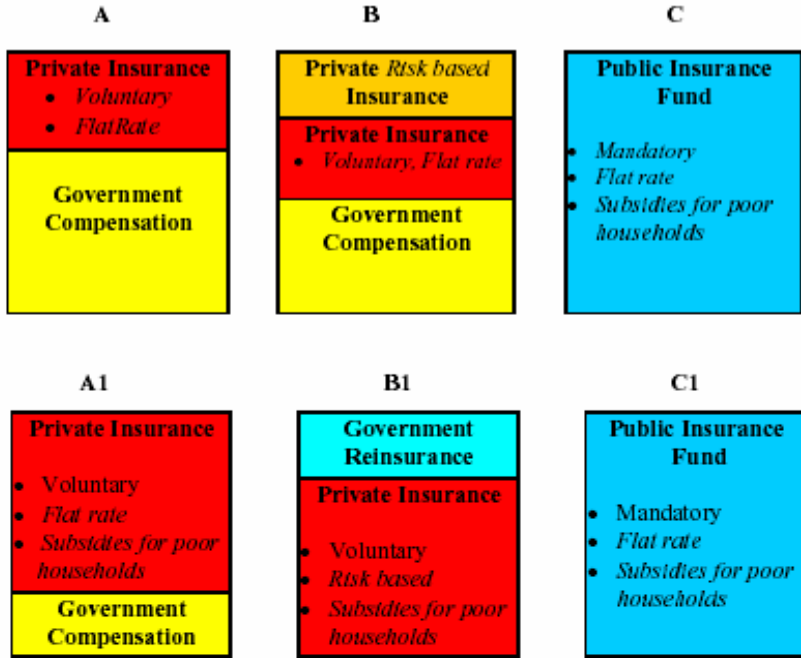
more ecological and naturalistic path for the region. Hierarchical government still commands wide support in Hungary. However, in light of recent history, the minority views in favor of increased individual responsibility and more holistic development policies are revealing and important.

## 5. Round three: Designing a national insurance program

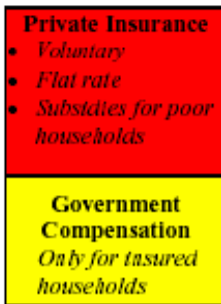
The challenge for this pilot study was to develop a citizen participatory process that can accommodate the different perspectives and articulate a way forward. Ideally the process would lead to a flood insurance program that is compatible with the Hungarian legal, economic and political context and is viewed as efficient and fair by the stakeholders. Following the first two information-gathering rounds (the stakeholder interviews and public questionnaire), the research team proposed three policy paths or options that appeared consistent with the majority and minority views of the stakeholders and that were compatible with the political and institutional setting. These options took account of (1) the apparent widespread stakeholder support for continuing large government involvement in a national insurance program with post-disaster relief to flood victims; and (2) the simultaneous endorsement of introducing limited individual responsibility and insurance. The three policy options for a nation-wide public/private insurance system are shown in Figure 3 and described below:

- **Option A** continues current practices by combining extensive government post-disaster relief with voluntary, flat-rate (cross-subsidized) insurance;
- **Option B** places more responsibility on households living in high-risk areas to reduce their risks and purchase insurance. The government thus compensates victims by a lesser amount (perhaps only assuring their subsistence), and the public role is supplemented by two insurance layers: voluntary (but bundled) private insurance based on a flat-rate premium and, if a household wishes greater coverage, voluntary, risk-based insurance (this option was suggested in the World Bank report, see Halcrow, 1999).
- **Option C** is notably similar to the TCIP in that it reduces the role of private insurers with the creation of a fully public, but privately administered, insurance system (government disaster fund) financed by mandatory contributions from all property owners throughout Hungary. Unlike the TCIP, however, the Hungarian system contributions would not be based on flood risks, and the government would subsidise insurance premiums for low-income households.

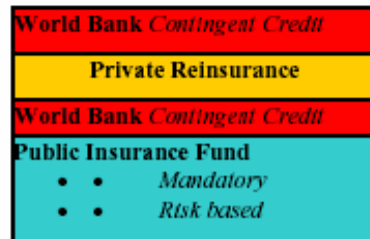
Figure 14.3 Insurance Program Options



The consensus recommendation



The TCIP



## 6. Round four: Revising the policy options with support from a flood risk policy model

To demonstrate the financial consequences of the three pooling options (A, B and C in Figure 14.3) a flood risk policy model was developed for a pilot area in the Upper Tisza region in collaboration with VITUKI Consult (Brouwers, 2002; Ekenberg, et al., 2002; Ermolieva, 2002, Galambos et al., 2001; Hansson, et al., 2001). Depending on the option chosen, the aim of the model was to simulate the incidence of future flood losses on three key stakeholder groups: flood victims in the pilot basin, the insurance companies and the central government. The simulation model generated a probabilistic distribution of future flood losses in the pilot basin over a ten-year horizon, and illustrated the effects of this distribution given selected policy interventions. It consisted of four modules: (1) a one-dimensional, hydrological model of the river based on probabilistic input of water levels at the source, (2) a GIS-based flood model with values for residential properties, industry and crops in the pilot area, (3) an inundation or flood-loss model with property vulnerabilities and (4) a policy module that illustrated the effects of policy changes. Modules 1-3 integrated assessments of the probability of the peril (high water) in the selected geographic region, the probability of levee failure or over-topping of the levee, the vulnerability of the properties concerned and the potential financial loss. The policy module simulated the effects of selected insurance-pool options on the profits of insurers, on the government budget and on those living in the pilot basin.

The model was designed to be as realistic as possible given available data and knowledge, but it was not presented to the stakeholders as full reality. Ravetz (2003) suggests that models be viewed as metaphors, as illustrations of reality without any pretence of representing the full complexity of the physical and behavioural context. Many simplifying assumptions with respect to the data, the scale of the analysis and the functioning of the physical/economic system were necessary. For a detailed description of the model, assumptions and parameters, see Brouwers (2002).

Armed with model simulations for Options A, B and C shown in Figure 14.4, the IIASA team returned to the active stakeholders to refine the policy options based on the interviewee's values, knowledge of the political playing field and the economic constraints (see Ekenberg, et al., 2002). A slightly different picture emerged from the more detailed discussions with the stakeholders informed by the model results. The revised options (A1, B1 and C1 illustrated in Figure 4) differ from those described above mainly in the reduction of government compensation to victims, fully eliminating this compensation in Options B and C. The full elimination of any post-disaster

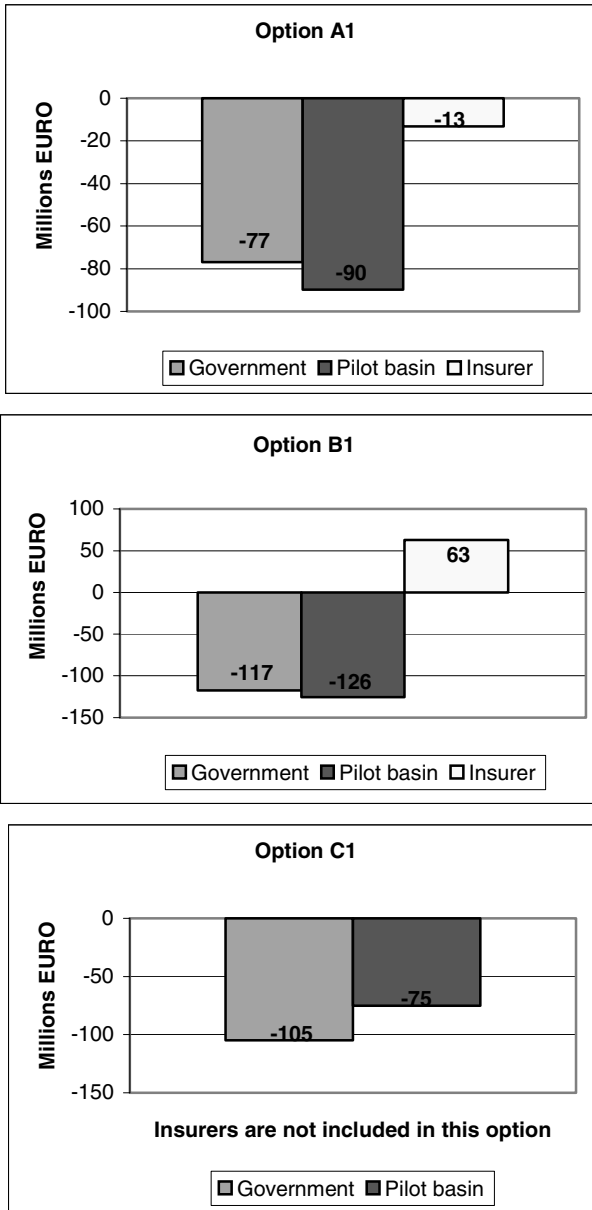


government support for rebuilding the homes of flood victims (and other forms of compensation) was a radical shift from earlier stakeholder positions, and was triggered by the recognition that *solidarity need not mean extensive post-disaster compensation but could also take the form of subsidies for pre-disaster loss reduction and insurance* was a breakthrough in the stakeholder process. Indeed, across-the-board government relief might mean that households with insurance actually receive more than 100 percent of their damages, which was rejected by several stakeholders as unfair. This combination of government relief through a market mechanism, which would also appeal to social justice, was a first hint at a consensus policy package.

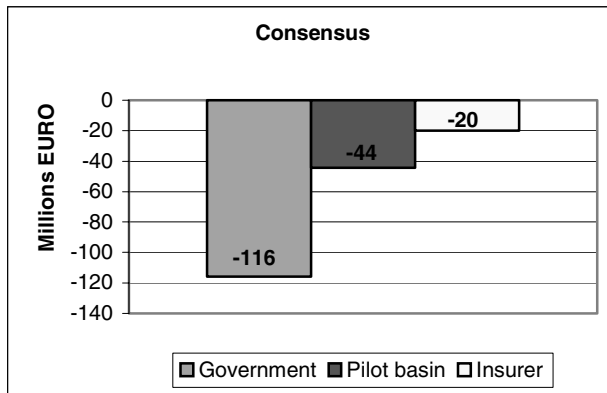
Another interesting view, which is counter to the economist's emphasis on building incentive structures to dissuade people from locating in high-risk areas, is the wish to keep people in risky areas. Keeping in mind that a significant part of Hungary is at high risk to flooding, relocation might be more expensive than other measures. "In the Upper Tisza basin, people can survive on very little money and lead reasonable lives, which would not be possible if they were relocated to the cities" (Interview with a local mayor, 2002). Correspondingly, many stakeholders expressed dissatisfaction with instituting risk-based premiums. An exception, not surprisingly, was voiced by a representative of the Association of Hungarian Insurers (MABISZ), who would like to see more risk-based insurance but with the government aiding those who cannot afford the high premiums: "The government should subsidize the poor by the difference between the risk-based and flat-rate premiums" (Interview with a MABISZ representative, 2002). There was generally broad support for assisting low-income households in high-risk areas.

The divergent and mixed stakeholder views on the role of the government, individuals and insurance companies in absorbing flood losses led to the revised set of options (A1, B1 and C1 shown in Figure 4) for the nation-wide insurance program (For details see Linnerooth-Bayer and Vári, forthcoming). In effect, the stakeholders participated in revising the options to reflect what appeared to be a more moderate support for state protectionism toward more market-oriented and egalitarian perspectives. The revisions reflected the almost unanimous view that poor households should be assisted, and the polarized views on the respective roles of private, risk-based insurance and a government fund. How the three different options distributed simulated losses to the government, residents of the pilot basin and insurance companies are illustrated in Figure 14.4.

**Figure 14.4 The simulated decadal distribution of losses according to Options A1, B1, C1 and D**



**Figure 14.4 (continued) The simulated decadal distribution of losses according to Options A1, B1, C1 and D**



## 7. Round Five: The Stakeholder Workshop

The stakeholder workshop was held in September 2002 in Vasarosnameny, a town in the Upper Tisza flood-risk area. Participants included representatives of the key stakeholder groups, including the local mayor, a resident of a non-risk area, the leader of a local environmental group, officials of the regional water management authority and the national authority for disaster management, and a representative of a major international brokerage firm. Unfortunately, the representative from the Hungarian insurance association was not able to attend (because of a last-minute invitation to attend a meeting on this topic with government representatives).

The workshop was a forum for stakeholders to argue their policy positions and consider the arguments of the other participants, what theorists refer to as deliberation (Elster, 1998, Reardon, 1998; Habermas, 1984). The idea was to explore the terrain where citizens can agree on a policy direction, but for different reasons. This may or may not exist, but by exploring this terrain, deliberation and citizen participation can be an effective means of formulating citizen grievances, ideas and views and feeding them into the policy process (Renn and Webler, 1995).

The moderated workshop began with a discussion on flood risk management issues in the region followed by the introduction of the three revised options shown in Figure 3. The policy model showed simulation results of how these options distribute flood losses among the three stakeholder groups. The participants were asked to choose their preferred

insurance policy option, and they were given time to change the option of their choice in any way to correspond more closely with their view of an efficient, fair and workable system. The participants were then grouped according to the option chosen and asked to negotiate a common view in their subgroup – a kind of mini consensus within a single perspective (a similar discursive process was carried out in focus groups for pension reform, see Ney, 2002).

After arguing for their competing policy directions, the workshop participants turned to a lively and heated discussion on a possible compromise. This deliberation led to an imaginative new system as shown on 34: *Only households with private insurance would qualify for government assistance after a disaster, but the government would heavily subsidize poor households in their purchase of voluntary, private flood insurance.* It was also agreed that the government would not provide reinsurance for private insurers. This type of insurance program is similar to what is being currently discussed in Italy. The details are shown in the box below, and the results of the simulation model are shown in Figure 14.4.

#### **Box 14.1 Consensus Option**

- Government compensation only to insured households;
- A private insurance system with
  - bundled or separate policies for all types of natural disaster risks,
  - covering approximately 50% of the damage, and
  - voluntary, flat-rate premiums;
- Government subsidies for poor households up to 100% of premium.

This consensus is a radical departure from current practice insofar as the government compensates victims *only* if they have purchased partial cover from private insurers. As shown on Figure 3, the Hungarian stakeholders supported a layer of government compensation as well as a voluntary, private system with substantial cross subsidies or solidarity among premium payers. This latter feature is characteristic of the French national insurance system (Linnerooth-Bayer, et al., 2001). In contrast to the French system, however, the Hungarian taxpayer will play no role in guaranteeing the solvency of private insurers by offering public reinsurance. A public guarantee is also not necessary since the private insurers can collect premiums that allow them to purchase reinsurance on the private market.

At least one caveat is in order. The solution on which the stakeholders decided would probably not have been endorsed by insurance companies, as

it would have required them to offer greatly expanded cover at flat-based rates. The simulation model shows that insurers could expect a net loss with the consensus option (see Figure 14.4). No high-level representative from the insurance industry was present at the final stakeholder workshop due, as we have already mentioned, to a last-minute cancellation. In a follow-up interview, we learned that the representative of insurance industry had not been able to make it to the meeting, as he had been expected in the Prime Minister's office to negotiate directly with government representatives.

As a result of these negotiations, the Hungarian government decided upon a novel flood insurance program. According to the new legislation, the government will fully underwrite flood insurance in high-risk areas, and taxpayers will provide a backup if the premium pool is insufficient to cover claims. Consistent with the insurers' perspective, and in direct contradiction to the results of the stakeholder compromise, insurance premiums will be risk-based. Moreover, the premiums of poor households will only be subsidized up to 30 percent.

The outcome of this new law is disappointing. As of September 2004, only 159 households had purchased flood insurance policies (Várkonyi, 2004). The Achilles heel of the new system seems to be that poor households will only receive a 30% subsidy for their private, risk-based insurance premiums. Our study strongly suggests that this will not encourage many poor households in risky areas, such as the Tisza region, to buy insurance. If so, then the next major floods will significantly harm and threaten the most vulnerable Hungarians. Given that the great majority of Hungarians still feel that the government should be responsible for flood prevention and compensation, it would not be unlikely that a public outcry would follow the floods, perhaps forcing the government to abandon its plans and compensate all flood victims. Then, a lose-lose scenario would have unfolded: one in which the Hungarian government would have to spend large sums (both in the short and long term), while poor Hungarians would be left at the mercy of the weather gods for the foreseeable future.

## 8. Comparing the stakeholder consensus with the Turkish system

The Turkish Catastrophe Insurance Pool (TCIP), which was designed by World Bank experts together with officials from the Turkish treasury, is the first of its kind for an emerging economy country (see Gurenko, 2004; Balamir, 2002; Andersen, 2001). Earthquake vulnerability has increased in Turkey mainly due to increased urbanization, faulty land use and construction, inadequate infrastructure and environmental degradation. Recent estimates suggest a yearly probability of 0.02 of a major earthquake in Istanbul, which is estimated to result in 30 to 40 thousand deaths and

damage or destroy up to 400,000 buildings (Erdik, 2000). Like in Hungary, the government has traditionally assumed the main financial responsibility for replacing private homes and other buildings destroyed in earthquakes. This practice has given homeowners little reason to purchase private insurance, and has also reduced incentives for building or retrofitting the existing building stock to meet standards, especially on the part of absentee property owners. Finally, if property owners expect government assistance after disasters strike, this will encourage further development in disaster-prone areas.

Designers of the TCIP attempted to solve the fundamental problem – non-affordability of earthquake insurance in poor countries – by offering limited cover and by transferring some of the risk out of the country with World Bank support. As shown on Figure 3, the World Bank will finance two layers of risk by means of a contingent credit facility with highly favorable terms.

In contrast to the consensus view of Hungarian stakeholder, which rejected mandatory insurance, a government decree in Turkey has made earthquake insurance policies obligatory for all property owners. Also, in contrast to the Hungarian consensus, the Turkish policy holders will pay a risk-based premium based on their risk zone, the construction of their property and risk reducing measures to a privately administered, public fund. On one point, the TCIP is in full agreement with the Hungarian consensus: only persons holding insurance policies will be eligible for additional government assistance after a disaster.

With risk-based pricing and no subsidies for policy holders, how is the TCIP affordable to poor households in high-risk areas? The World Bank experts explain its affordability based on two provisions: First, the subsidized reinsurance has an effect on price. Second, all households outside of municipalities (which are the poor rural households) are exempt from purchasing insurance, and the government will provide post-disaster assistance (Gurenko, 2004). Except for these provisions, however, there is no solidarity in the system. This stands in contrast to most other systems. For example, the French all-hazards insurance program deliberately incorporates national solidarity through taxpayer involvement as well as through rejecting risk-based premiums. The program is reinsured through a public administered fund, the Caisse Centrale de Réassurance (CCR). If this fund is insufficient, taxpayers will be called upon to contribute. The French recognize that the system provides disincentives for individuals and local communities to take risk-reduction measures. A recent and imaginative decree to counter this problem sets a deductible that increases with the number of disasters in the same area.

Even the US has an explicit policy of offering additional public assistance to insured disaster victims, as well as generally assisting uninsured victims. Many critics of the Turkish insurance pool doubted whether the government could uphold its resolve not to assist uninsured victims after a major earthquake. Their doubts were confirmed when the government offered generous compensation to uninsured victims of a recent earthquake in central Turkey.

To date, the penetration of earthquake insurance in Turkey is steady at about 3 million policies, representing about 22% of dwellings. The goal of the TCIP is to increase cover to 60% by 2008, but many observers are skeptical if this goal can be reached, or even if the system is viable. The TCIP was implemented through a temporary governmental decree, and the Turkish parliament must pass follow up legislation to make this a mandatory program. To date, the parliament has not passed this legislation, which appears to be politically unpopular. We can only speculate that parliamentarians are concerned about mandatory insurance and also the lack of solidarity in the system. A stakeholder process might have flagged these difficulties before implementation of the TCIP.

## 9. Conclusions

For the Hungarian pilot stakeholder study, the final solution is not as important as the demonstration of a participatory, deliberative *process* that respects and builds on conflicting stakeholder views and achieves consensus on a policy path. Starting with a very broad survey of views, interests and perspectives, the range of policy options was narrowed and refined through iterative interactions with stakeholders, who were knowledgeable, influential, and representative of different worldviews and perspectives. This iterative interaction with the stakeholders profited from the flood risk policy model, which simulated the effects of selected insurance-pool options on the profits of insurers, on the government budget and on those living in the pilot basin.

The process gradually moved from a contested terrain characterized by arguably non-viable policy solutions to increasingly viable options, culminating at the stakeholder workshop with agreement on a single policy recommendation. This agreement was achieved through a process of deliberation and argumentation. The arguments appeared to be based on different ideas of what is a fair insurance program, and also quite significantly on pragmatic considerations as well as economic interests. Importantly, many participants transcended their own economic interests to argue for one or the other concept of a fair program. One of the more significant findings of the public survey was that over *thirty percent* of the

respondents living in high and dry areas were, nonetheless, willing to purchase flood insurance at rates that assured subsidies to those living in risk areas. Another significant finding was the almost unanimous agreement that the government should assist poor inhabitants living in flood-risk areas, and a milestone in achieving a consensus was the eventual recognition by the key stakeholders that this assistance need not be in the form of direct post-disaster compensation or rebuilding houses. Rather, it could take the form of a pre-disaster policy, namely subsidizing insurance payments of poor households.

The policy recommendations from the stakeholder process were only partly heeded in recent Hungarian legislation for a national flood insurance system. According to the new system, the government fully underwrites flood insurance in high-risk areas, and taxpayers provide a backup if the premium pool is insufficient to cover claims. Consistent with the insurers' perspective, and in direct contradiction to the results of the stakeholder compromise, insurance premiums will be risk-based. Moreover, the premiums of poor households will only be subsidized up to 30 percent. To date, the purchase of flood insurance in high-risk areas is disappointingly low.

A main similarity with the TCIP and the Hungarian stakeholder consensus is that the central governments in both countries will reduce their fiscal responsibilities since they will be obligated to compensate earthquake/flood victims only if they have insurance. This is a major break from traditional practices in both countries, and some question its political feasibility. The important differences are twofold: First, in contrast to Turkey, disaster insurance in Hungary as proposed by the stakeholders would not be mandatory. In fact, all the stakeholders opposed obligatory insurance as a tax, although the practice of bundling flood cover with property insurance that is mandatory for a mortgage has already led to a very high uptake of insurance in Hungary. As a second contrast to Turkey, insurance payments in Hungary would not be risk based, and in a further show of social solidarity the government would provide subsidies to poor households for purchasing private insurance.

While economists view this finding as inefficient and ultimately leading to higher economic losses, their concern with distorted prices and misplaced incentives may be less appropriate for developing countries. Whereas risk-based premiums are viewed as essential in wealthy countries to avoid subsidies to large-scale and expensive development in high-risk areas, for example, the coast of Florida, the loss-reduction measures that poor farmers can take in the Tisza region are limited and may not increase substantially with the incentives imposed by risk-based pricing of insurance. Moreover, the main concern is not that expensive development will move into the Tisza



area, but that the poor farmers will leave and seek non-existent jobs in the cities. In the case of poor countries, it may be prudent to follow the U.K.'s example by beginning with subsidized insurance premiums and gradually moving to risk-based policies as the region and country develops.

The Hungarian stakeholder consensus based on only nine workshop participants clearly cannot claim to be representative of the full policy terrain in Hungary; in fact, the insurance company voice was under represented at the workshop. The purpose of deliberative stakeholder processes is not to replace representative democracy, but to sensitize political representatives and policy makers to the diverse constructions of the problem and its solutions, and to explore the terrain for agreement. While the results of the Hungarian process cannot be transplanted to Turkey, they do raise the question whether a stakeholder process in Turkey, where the stakeholders are informed by a seismic catastrophe model, might have flagged the difficulties now apparent with legislating a continuation of the program.

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## PART III. B.

### **Role of Government and Public-Private Partnerships for Catastrophic Risks Management**

#### **B - Country Surveys – OECD Countries**

*Chapter 15* **The French Experience in the Management and Compensation of Large Scale Disasters**  
by S. Vallet.

*Chapter 16* **Disaster Risk Management in Japan**  
by K. Kawachimaru.

*Chapter 17* **Natural Disasters Fund (FONDEN)**  
by C. Bayo Martinez.

*Chapter 18* **The Spanish Experience in the Management of Extraordinary Risks, Including Terrorism**  
by I. Machetti.

*Chapter 19* **The Turkish Catastrophe Insurance Pool (TCIP) and Compulsory Earthquake Insurance Scheme**  
by S. Yazici.



## PART III B

### *Chapter 15*

# **The French Experience in the Management and Compensation of Large Scale Disasters**

*by*

Suzanne Vallet\*

Caisse Centrale de Réassurance

Risks like natural perils and terrorism are unpredictable and can cause severe damage undermining the solvability of a company. The insurance marketplace avoids accepting to cover these risks, sticking to the safer territory of insurable risks. This leads to underinsurance for those exposed and to the adverse selection of risks. To make up for the lack of cover for uninsurable risks, France has implemented different solutions, in particular for natural catastrophes and recently (2002) for terrorism. This chapter examines how the different systems have acted in response to large scale disasters.

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## 1. Specific systems for uninsurable risks : natural catastrophes and terrorism

The National Fund for Agricultural Disasters (1964 law) created a Public Fund financed by an additional contribution to the premium corresponding to the insurance policies covering damage to property or vehicles of the agricultural operation, allowing to compensate for uninsurable damage on agricultural operations. The funds available in the pool are distributed amongst those who call upon the Fund, and no State guarantee will complete any missing amounts although in exceptional cases the State can decide to contribute extra funds. This type of compensation can be unjust, as certain people will receive too little and others too much compensation. The Public Fund is organized such that the size of the disaster does not influence the management of the Fund.

Those systems based on an insurance compensation mechanism are fundamentally different from the Public Fund alternative. France's solutions are a mixed insurance/reinsurance "1982 law natural catastrophe" scheme and GAREAT created in 2002 for terrorism insurance.

The GAREAT pool was set up in 2002 as an answer to the market's imminent withdrawal following the September 11<sup>th</sup> disaster. This pool covers large industrial risks, in general of value greater than EUR 6 million, in exchange for a limited contribution (12% on average for large risks) on property premiums. An estimated 43 000 risks are covered by the Pool thus benefit from the annual aggregate cover offered on a loss occurring basis for each underwriting year. The solvency of the Pool is guaranteed through the selection of a diversity reinsurers and the consideration of the financial ratings of these companies. The State guarantee, ultimate guarantee of solvency ruin, comes into play at the top layer of the program. The Pool has not yet been put to the test of a large scale disaster.

The mixed insurance/reinsurance "1982 law natural catastrophe" scheme covers – via an obligatory extended guarantee on the property damage insurance policy – property located in France and certain French overseas territories. The risk of adverse selection is checked by the obligatory nature of this extended guarantee. This scheme could be implemented thanks to France's moderate exposure to risk and to the well developed insurance industry. It benefits on the State guarantee which ultimately limits the aggregate annual loss to the market. The 1982 scheme gives an example of the management and compensation of large scale events for which the State guarantee came into play. This paper will thus focus on the experience of the 1982 law.

## 2. Focus on the 1982 scheme

This scheme was set up following the large storms which occurred in 1982. The objective of the scheme is to offer unlimited cover for those uninsurable risks at a moderate price, thanks to the State guarantee. This guarantee is constructed such that it only has to play in the case of an exceptional event or series of events, such as the 100 year return period flood in Paris or a strong earthquake in the south of France. The State imposed control on four essential factors in return for its guarantee of solvency :

- the declaration of the state of natural disaster : the mayors file for a decree, and their request is examined by an Interministerial Commission. This Commission uses technical reports to advise the Ministers who declare the state of natural disaster which is published in the Official Journal ;
- the definition of the perils covered : The legislators did not want to limit the 1982 law by creating a list of the natural phenomena included in the cover. Nor did they want to create a list of exclusions. They limited themselves, therefore, to the idea of “uninsurable damage” (this idea was then clarified by the laws of 25 June 1990 and 16 July 1992). The damage must be “direct”, in other words arising solely as a result of the action of a natural element of abnormal intensity to the property insured (for example, the loss of goods in a freezer will be included only if the machine itself was damaged, thus excluding a simple power cut) ;

**Table 15.1 Distribution of accepted files according to type of phenomenon (1982–2002)**

Floods	59.0%
Landslides (without subsidence)	20.1%
Subsidence	6.8%
Others	14.1%

- the deductibles : these depend on the type of risk – residential or commercial – and on the peril covered (the amount is the same for all perils except subsidence which has a higher specific deductible). Furthermore, since 1 January 2001, a sliding scale has been introduced to vary these deductibles so as to encourage loss prevention measures. This scale applies to those towns, which do not yet have a prevention plan for foreseeable natural risks (PPR). In practice, a coefficient from 1 to 4 is applied to the deductible based on the number of decrees already issued in respect of this same peril over the past five years.



- the price of the cover : the State fixes the amount of the additional premium corresponding to the natural catastrophe cover. It is now set to 12% of the fire premium for property and 6% of automobile fire premium (or 0.5% of automobile damage premium).

**Table 15.2 Deductibles and rating by line of business**

		Deductibles	Except subsidence	Rating
Non-professional	Property	€380	€1,520	12% of fire premium
Professional	Property	10% min €1,140	€3,050	
	Business interruption	3 working days min €1,140	€3,050	
Automobile		€380	–	6% of fire premium or 0.5% of damage

The organisation of the scheme forbids the insurer to calculate the price of the guarantee as a function of the real exposure, and imposes mutuality between property located in the high-risk zones and those in the low-risk zones.

Thanks to this solidarity, every insured benefits on a very complete guarantee at a moderate price (approximately €20 per year for the average homeowner). The 1982 law forced private insurers to cover nearly unlimited exposure. To counter this obligation, the state offers its guarantee through the state owned reinsurer Caisse Centrale de Réassurance (CCR). CCR offers the market a reinsurance program with no limit for those risks falling within the scope of the 1982 law. Insurers can choose to reinsure their natural catastrophe portfolios at CCR or with another reinsurer, or not to reinsure at all. However, CCR is the only alternative which offers the state guarantee.

The State guarantee is meant to be necessary only in exceptional cases. No exceptional event has occurred over the past 22 years ; however, a long list of major events set the oscillating rhythm of the loss cycle. The table below shows the estimated market losses for major events since 1982.

**Table 15.3 Estimated market loss for mains events (in m)**

Year of occurrence	Name	Market Loss Estimation
1982/83	Storm/floods(1)	534
1987	Storm October(1)	107
1988	Floods October (Nimes)	290
1990	Floods February	183
1989–2000	Subsidence(2)	3200
1992	Floods September (Vaison)	244
1993	Floods September/October	305
1993–1994	Floods December/January	259
1994	Floods November (Nice)	122
1995	Floods January/February	365
1995	Floods August/September (cyclones Antilles)(3)	110
1996	Earthquake July (Annecy)	61
1996	Floods December (Southwest)	76
1997	Floods June (Normandy)	30-40
1998	Floods June (North – Pas-de-Calais)	10-20
1999	Floods November (Grand Sud)	240-250
1999	Hurricanes José and Lenny (DOM)(3)	50-60
1999	Storm Lothar et Martin	220-230
2000	Floods December (Brittany)	60-70
2001	Floods January (Brittany – Normandy)	40-50
2001	Floods April (Somme)	60-80
2002	Cyclone Dina January (Reunion)	93
2002	Floods September (South)	650
2003	Arles	700

(1)“Nat Cat” or natural-disaster compensation was paid in addition to or in the absence of storm cover under the policies.

(2)This relates to damage caused to buildings by the dryness and rehydration of the subsoil.

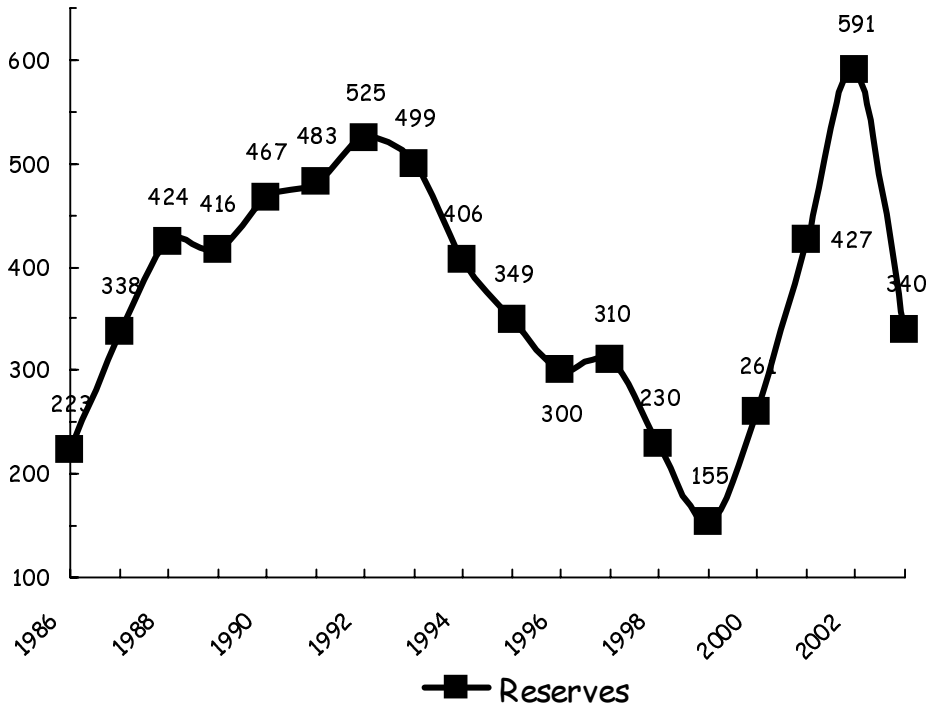
(3)This relates to water damage only. Indemnity for damage caused by wind is provided by the storm, tempest and hurricane cover under the policy.

### 3. 1999

In 1999 the State guarantee was called upon for the first time since the creation of the scheme. Although no exceptionally large event occurred in 1999, two major events hit France : the flooding in the Aude department in the south during November 1999 (insured loss 240M€) and the consequential flooding following the winter storms Lothar et Martin (insured loss 240M€). A significant hurricane also occurred in the French Antilles the same year (Lenny and Jose). At the same time, an unexpected peril new to the industry and to the scheme which appeared in 1989 had induced the erosion of CCR’s reserves over time. In 1999, the conjugation of two major events and the subsidence losses were too much, and the State guarantee was called into play for the very first time since the creation of the scheme.

The graphic below shows the evolution of the premium income and reserves per year. The reserves hit a low point in 1999.

**Figure 15.1 Evolution of CCR's equalisation reserve and premium income 1991–2003 (in m)**



At that time, the market accepted a reform with the objective of allowing the scheme to return to equilibrium. This market agreement was set for five years, concerning the underwriting years 2000 through 2004. The major points of the reform were :

- Check losses to subsidence ;
- Insure the equitable contribution of each insured to the scheme ;
- Financial measures to replenish reserves.

The **first set of measures** aimed to limit the subsidence loss. The interministeriel commission interrupted the treatment of subsidence dossiers and commissioned its expert Météo France to derive an objective method of measuring the abnormal intensity of the phenomenon. The presence of clay

subsoil was no longer sufficient to determine the state of natural disaster. A new method measuring the level of water in the subsoil was put into place, and allowed to measure if the soil was abnormally dry over a several month period of time. This new criteria reduced by half the number of accepted files. It was also decided at that time to introduce a specific deductible for subsidence, which would allow avoiding payment for minor damage such as micro cracks. The deductibles for subsidence were thus raised to 1 520 € for residential risks and the minimum deductible to 3 050 € for professional risks. Finally, it was decided that the Major Natural Perils Risk Prevention Fund would contribute to financing prevention plans specific for subsidence.

The **second agreement concerned the measures** aiming to insure the equitable contribution of each insured to the scheme, and concerned the updating of the deductibles with the introduction of a sliding scale, the homogenisation of the treaty premium base, and the extension of the cover to include wind damage for hurricanes in French overseas territories.

The changes initiated on the deductibles – in particular the sliding scale – contribute to the sustainability of the scheme through prevention. Since 1 January 2001, a sliding scale has been introduced to vary the deductibles applied to each town so as to encourage loss prevention measures. This scale applies to those towns, which do not yet have a prevention plan for foreseeable natural risks (PPR).

Specifically, when a state of natural disaster is declared in such a town, by means of an interministerial decree, as the result of a given peril (such as flood), a coefficient is applied to the deductible based on the number of decrees already issued in respect of this same peril over the past five years (a new decree defining the rules for counting the number of decrees for application of the sliding scale since 4 August 2003 was published in the Official Journal on 29 August 2003; originally, the law defined the rule for counting the number of decrees since 2 February 1995, the creation date of PPRs). The multiplicative coefficients are as follows :

- one to two decrees: normal application of the deductibles set out above;
- three decrees: doubling of these deductibles;
- four decrees: tripling of these deductibles; and
- five or more decrees: quadrupling of these deductibles.

The sliding scale ceases to apply as soon as a PPR is set up for the peril in question, but will be reapplied if the PPR has not been approved within four years.

These deductibles apply in respect of each and every occurrence and each and every policy. In the case of motor vehicles, they apply to each and

every vehicle, even if several vehicles are covered under the same policy. The deductibles are compulsory, that is to say they apply even when the basic policy does not include them. They are not index linked and cannot be “bought back”, even by means of another policy (encouraging risk prevention).

At the same time, the authorities inserted a better definition of the premium base upon which CCR’s reinsurance offer should be based, so that the difference in the set of guarantees offered by different companies in their basic policy would not induce inequality amongst the companies’ reinsurance costs. The strongest measures pushing toward the replenishment of reserves concerned the suppression of reinsurance commission on the quota share, and to a lesser extent the obligatory cession of automobile risks to the treaty.

The inclusion in the scheme of hurricane wind damage in overseas territories aimed to better the coverage available to insured on this market. The reinsurance of these risks would be covered on a separate treaty for a transitory period of five years. After this period, the insurer would reinsure these risks located overseas under the same reinsurance treaty, thus having one stop loss deductible based on the total premium applying to the total losses across both zones.

The **third set of measures** was financial, and touched both the insurance and reinsurance conditions of the scheme. On the insurance side, the rating of the extended guarantee was raised from 9% to 12%. It was said at the time that each of the three points in the rate augmentation corresponded to a specific need : one point for the cover of the subsidence risk, one point for the inclusion of wind damage due to hurricanes in the French overseas territories, and one point to help CCR replenish its reserves. The goal announced was that CCR obtain reserves such that the ratio reserve to premium reaches a factor between 2 and 3.

#### **4. A system in equilibrium: requires insuring its sustainability through reform and prevention**

Five years after the reform, the results are not as spectacular as expected. The years 2002 and 2003 experienced the most costly events recorded and led CCR to use 251 m€ of its reserves. The target ratio a reserve to premium has fallen to one half; however, we have seen that the system is functioning, even when faced with rather exceptional events two years in a row. The effects of the 1999 reform have proven their pertinence.

The deductible sliding scale has also proven to be an effective way of inciting the mayors of towns to pursue preventive measures. Very few

insureds actually pay the modulated deductible, as mayors prefer to file for a prevention plan and thus work towards the collective objective of sustainable development.

In conclusion, the scheme is able to find equilibrium after having suffered a set of major events without calling upon the state guarantee. The support of the insurance market through the 1999 reform and the contribution of society towards the prevention of major natural catastrophes are essential factors to the success. Finally, thanks to the State guarantee, the solvency of the insurance market is guaranteed in the case of a catastrophic event.



## PART III B

### *Chapter 16*

# **Disaster Risk Management in Japan\***

*by*

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and K. Kawachimaru\*\*, NIPPONKOA Insurance Company

Japan is a particularly exposed country in respect of earthquakes, tsunamis and volcanic eruptions. In order to address these potentially catastrophic risks, which often lead to disastrous human and economic losses in Japan, the government first established in 1966 the Earthquake Insurance System backed by the State Budget. This scheme was then deeply amended notably in 1980, inter alia to extend its coverage. The scheme was then successively revised in 1991, 1996 and 2001 in order to provide more tailored coverage and price rating to households. The note provides a detailed assessment of this revision process and of the organization and mechanisms established by the present scheme including the respective role of the insurance market and the government.

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\* The background note of Mr K. Kawachimaru's presentation (NIPPONKOA Insurance Company Ltd) is based on *Governmental Earthquake Insurance System in Japan*, from *Earthquake Insurance in Japan*, written and published in March 2003 by Non-Life Insurance Rating Organization of Japan.

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## **1. Establishment of the Earthquake Insurance Systems**

### ***1.1. Background of Establishment***

The Niigata Earthquake (M 7.5) occurred on June 16, 1964, around 1:00 pm, with a hypocenter off the shore of Niigata Prefecture. The damage from this earthquake spread nine prefectures from Yamagata to Akita, centering on Niigata Prefecture, with 26 dead, 447 injured. As for damage to residences, 1,960 were completely destroyed, 6,640 were partially destroyed, 15,297 were flooded and 67,825 were partially damaged. As for buildings other than residences, 16,283 suffered damage, and ships, roads, bridges, railways, banks, etc., suffered great damage. Additionally, the damage due to ground liquefaction inside Niigata City was also significant.

This earthquake disaster was focused on at the Diet and a resolution was passed that the establishment of an earthquake insurance system should be swiftly investigated.

In such a situation, Kakuei Tanaka, the Minister of Finance at that time, convened a general meeting of the Insurance Council and consulted with them concerning concrete measures in order to contribute to the stabilization of the livelihood of the nation at times of earthquake disasters without notice.

The Insurance Council performed deliberations concerning the coverage of earthquake disaster, insurable property and losses to be covered, prevention of adverse selection, ways for the nation to be involved, the amount to be insured, the limit of total payments, the sharing of liability between the Government and private insurance companies, etc. The Insurance Council discussed such with great deliberations and in 1965 made its report on an earthquake insurance system. In order to attempt the commencement of an actually achievable system, it was unavoidable that the specifics of the insurance system in the report contained various restrictions, due to various problems such as the financial burden of the Government.

### ***1.2. Implementation of the Earthquake Insurance System***

Specifics of the earthquake insurance established in 1966 were as follows:

*Losses to be covered*

Losses due to earthquakes, volcanic eruptions or tsunami due to said, and only in ease of total loss (including economically total loss) shall such be covered.

*Insurable property*

Buildings used for residential use and movables for living (household goods).

*Method of contract*

Contract shall be made incidental to householders' comprehensive insurance and storekeepers' comprehensive insurance (automatic attachment).

*Amount insured and limit amount to be paid*

Such shall be 30% of the amount insured of householders' comprehensive insurance and storekeepers' comprehensive insurance; however, 900,000 yen for buildings and 600,000 yen for households goods shall be the limit amount to be paid.

*Limit of total payment amount for insurance claims due to a single earthquake. etc., shall be 30 billion yen.*

***1.3. Enactment of Laws Concerning Earthquake Insurance***

Upon the implementation of an earthquake insurance system, the Government announced officially the "Law concerning Earthquake Insurance, Enforcement Order, Regulation for Enforcing Thereof" and "Earthquake Reinsurance Special Accounting Law, Enforcement Order, Regulation for Enforcing Thereof," and came into force in 1966.

The earthquake insurance system was subject to the backing of the nation, and because of the necessity to perform stable management of the system, and for contribution to the stabilization of the lives of the victims, the coverage details, payment standards, amounts of underwriting limit, reinsurance, accounting treatment, etc., were specifically stipulated in laws.

**2. Transition of Earthquake Insurance System**

The earthquake insurance system established in 1966 was quite restricted due to the uniqueness of the seismic risk. However, owing to

changes in the social and economic circumstances afterwards, along with the experiences from several great earthquake disasters, etc., policyholders expressed various needs.

In order to deal with these, many revisions were made, such as raising the limit of insurable amount, improving the coverage, raising the limit of the total amount of insurance claims to be paid, changes in premium rates, etc.

Major revisions concurrent with changes in the premium rates are as follows:

### ***2.1. 1980 Revision***

The Miyagiken-oki Earthquake (M 7.1) occurred on June 12, 1978, at about 5:00 pm. Huge damage was wreaked by this earthquake, centered on Miyagi Prefecture, with 1,183 houses completely destroyed, 5,574 partially destroyed, and 60,124 partial damage, etc. Since the damage of partial destruction and partial damage, which occurred massively in this earthquake, was not covered by the earthquake insurance, policyholders requested improvement of the coverage. There was even discussion in the Diet concerning the coverage of this earthquake insurance. Additionally, there was an investigation by the Insurance Council, and the report entitled "Concerning the Revision of the Earthquake Insurance System" was submitted in 1979. In accordance with this report, broad revision of the earthquake insurance system was expedited.

The specifics of the revisions are as follows:

#### *Introduction of half-loss coverage*

In addition to total loss coverage, half loss coverage was newly introduced into the coverage. As for buildings, in addition to total loss, half loss was covered, and as for household goods, in addition to total loss, losses which were not total, but rather were household goods contained in buildings that were themselves more than half loss, was to be covered as half loss.

It was determined that the payment method for half loss was 50% of the amount insured for buildings, and 10% of the amount insured for household goods to be paid respectively.

#### *Attachment method, change of attachment target contracts*

Out of consideration of policyholder convenience, the Attachment method was changed to "automatic attachment in principle," in which if the policyholder desired not to attach the earthquake insurance, they could do

without it, for all fire insurance types that were the targets of attachment of earthquake insurance.

### *Raising of proportion insured and limit amount insured*

The proportion insured, which had been uniformly 30% of the amount of fire insurance, was extended to be in the range of from 30% to 50%, and the amount of earthquake insurance was determined to be set within that range. Concurrent with this, the limit of amount insured was raised, from 2,400,000 yen to 10,000,000 yen for buildings, and from 1,500,000 yen to 5,000,000 yen for household goods.

### *Premium rates*

Since half loss coverage was introduced as an improvement of coverage, premium rates were reconsidered. Upon reconsideration, according to the outlines of the Insurance Council's Report ((1) concerning differences between areas, etc., as earthquake insurance had been an automatic attachment up to then, the public position had been not to make the difference so great; however, concurrent with the changes in the underwriting method, seismic risk needed to be reflected in the rates as fully as possible, (2) buildings and household goods were to be on separate systems), the class location was changed to a five-class system from three, and the rates for buildings and household goods were separated.

## **2.2. 1991 Revision**

The Chibaken Toho-oki Earthquake (M6.7) occurred on December 17, 1987 causing massive damage centering on Chiba Prefecture, bringing about complete destruction of 10 houses, and more than 60,000 with partial damage. Additionally, at the time of the Izuhanto-oki Earthquake swarm, which had occurred from July to August 1989, a large amount of partial damage occurred. However, since partial damage was not covered by the earthquake insurance, policyholders requested that partial damage should also be covered. Subject to said, an investigation was performed and revision was implemented in 1991.

The specifics of the revision are as follows:

### *Introduction of partial loss coverage*

In addition to total and half loss coverage, partial loss coverage was newly introduced for the coverage. As for buildings, total loss, half loss and partial loss were covered, and as for household goods, in addition to total loss, losses which were not total, but rather were household goods contained in buildings that were themselves more than half lost, were to be covered as

half, and household goods contained in buildings that were partially lost, were to be covered as partial loss.

It was determined that the payment method for partial loss was 5% of the amount insured both for the buildings and for the household goods, and it was to be paid respectively.

### *Reconsideration of premium rates*

Since partial loss coverage was introduced as an improvement for the coverage, premium rates for earthquake insurance were reconsidered.

## **3. Great Hanshin-Awaji Earthquake and Revision of Earthquake Insurance**

The Hyogoken-Nanbu Earthquake (M 7.3) occurred on 17 January 1995, at 5:46 a.m., centered on Hyogo Prefecture, and causing massive damage. According to the announcement by the Fire Defense Agency, damages reached as high as more than 6,000 dead and missing, more than 40,000 injured, more than 240,000 houses totally or half destroyed, more than 6,000 houses total or half burned down, and because of its scale, it was named as "Great Hanshin-Awaji Earthquake." This earthquake was a so-called city inland earthquake, which occurred on active faults close to a big city with highly developed urban functions, and dealt a severe shock to the society and the economy.

Interest in earthquakes in the Kansai area was very low at that time, but, stimulated by this earthquake, interest in earthquake insurance became higher and the number of the earthquake insurance policies increased vastly.

After the Great Hanshin-Awaji Earthquake, subject to requests by policyholders, improvement of coverage details, raising of the limit amount of participation and reconsideration of premium rates were performed and these revisions were made in 1996.

### **3.1. 1996 Revision**

In order to pay the insurance claims quickly to suffering policyholders, the method was employed in earthquake insurance of making loss assessment for household goods (cases of half or partial loss) and loss assessment of buildings the same. Therefore, even though they suffered serious damage to their household goods due to this earthquake, there were cases in which victims could not get sufficient amount for earthquake insurance claims paid because there was zero or only slight damage to their buildings, and this created confusion among policyholders. In order to avoid

such a situation, there was a request that loss assessment for household goods should be by the method of using the degree of damage to household goods themselves.

Additionally, there were many opinions that the limit of participation at that time of 10,000,000 yen for buildings and 5,000,000 yen for household goods, and that the configuration of payments for half loss of household goods being 10% of the amount insured were insufficient and such should be raised.

Subject to these requests, improvement of coverage details for household goods, raising of the limit amount of participation and reconsideration of premium rates were performed in January 1996.

Specifics of the revisions are as follows:

#### *Changes in loss assessment standards for household goods*

Concerning loss assessment for household goods, as for half and partial losses, the assessment method of using the degree of damage to buildings was changed to an assessment method of using the degree of damage to household goods themselves.

#### *Changes in payments for half loss of household goods*

The payment rate for half loss of household goods was raised from 10% to 50% of the amount insured.

#### *Raising of participation limit amount*

The participation limit amount was raised and as for buildings, such was changed to 50,000,000 yen from 10,000,000 yen, and for household goods, to 10,000,000yen from 5,000,000 yen.

#### *Reconsideration of premium rates*

Concurrent with the improvement in coverage details for household goods, reconsideration of premium rates was performed and rates for buildings and household goods were set as the same. Through this, the rates for buildings were lowered and the rates for household goods were raised. The class location was unchanged.

### **3.2. 2001 Revision**

Exceedingly many buildings suffered damage in the Great Hanshin-Awaji Earthquake. As a result of research and study by numerous scholars and experts concerning the damage situation, it was verified that the degree

of damage clearly differs depending on differences in earthquake resistance capacity of buildings.

Due to such facts, there was a request that earthquake resistance capacity of residences should be more fully reflected in premium rates or earthquake insurance from such groups as the "Association of Diet Members to Protect Japan from Earthquakes," formed after the Great Hanshin-Awaji Earthquake (later renamed the "Association of Diet Members to Protect the Nation from Natural Disasters," with about 140 members) and the "Investigation Committee concerning the System of Residence Rebuilding Support for Victims" in the National Land Agency, and from the Government's "Three Year Deregulation Promotion Plan (re-revised)".

On the other hand, in October 2000, the Ministry of Construction (present the Ministry of Land, Infrastructure and Transportation) began enforcing the Housing Performance Indication System under the Law Concerning Promotion of Quality Guarantee of Housing (hereinafter referred to as the "Quality Guarantee Law"). Through this, earthquake resistance capacity of residences began to be evaluated properly by the "earthquake resistance class" index.

On the basis on these situations, two kinds of discount systems in accordance with earthquake resistance capacity of residences were newly introduced and additionally, basic rates were lowered.

A summary of the revisions is as follows, and the details will be stated in the next section.

### *Basic rate*

Reconsideration of the basic rate was performed and rates for wooden structures were lowered. There was no change for the class location section.

### *Discount rate*

As a discount system for residences with high earthquake-resistance capacity, a construction age discount rate and earthquake resistance class discount rate were introduced. However, in case of the earthquake resistance class discount rate being applied, the application of the construction age discount rate could not be applied.

#### a. Construction age discount rate

The construction age discount rate was introduced, a discount on premium rates for houses newly constructed under the ongoing Building Standards Law, in other words, for houses newly constructed after June 1, 1981, in case the construction period of the

building is confirmed with documents such as building registration certificates. This discount rate was 10%.

#### b. Earthquake resistance class discount rate

The earthquake resistance performance of buildings is indicated as earthquake resistance class (three classes) in the building performance appraisals by the housing performance indication system of the Housing Quality Guarantee Law, or in earthquake-resistance performance appraisals by seismic evaluation. The earthquake resistance class discount rate, a discount on the premium rate on the basis of these, was introduced. The applicable discount rate was 30% for the earthquake resistance class of 3, the highest earthquake resistance performance, 20% for class 2, the second highest earthquake resistance-performance, and 10% for class 1.

### ***3.3. Victim Reconstruction Support and Earthquake Insurance***

Since exceedingly many houses suffered damage due to the Hyogoken-Nanbu Earthquake, at the peak 320,000 people had no other recourse but to live as evacuees in the more than 1,200 evacuation, areas such as schools; and, afterwards 48,300 first-aid temporary housings were constructed for the victims.

On the other hand, many monetary donations were sent from all across the nation, with the amount exceeding 17 billion yen. However, since the number of the victims was large, the amount distributed to each was low, and was insufficient as aid for them, and the rebuilding of houses did not progress rapidly. Against this such background, autonomous bodies, various types of organizations, political parties, etc., performed various investigations concerning the two support systems: house rebuilding support and life rebuilding support for victims of natural disasters.

Additionally, in relation to house rebuilding support, discussions were actively made concerning earthquake insurance, and revisions were performed in 1996 and 2001.

Discussion of life rebuilding support for victims progressed well and a ACT concerning Support for Rebuilding dwellings of Disaster Victims was established in 1998 and put into effect, becoming Japan's first publicly-supported individual compensation system.

#### *House rebuilding support system for victims*

Concerning a house rebuilding support system for victims of natural disasters, many suggestions and recommendations were made by various



types of organizations, autonomous bodies, political parties, and individuals, etc., after the Great Hanshin-Awaji Earthquake. Concerning these suggestions and recommendations, beginning with the various political parties, and also in administrative and citizen's groups, etc., various discussions and investigations were performed. In particular, discussion centering on the aforementioned Association of Diet Members to Protect the Nation from Natural Disasters has been ongoing. The discussion continues at present as well, differentiated from the ongoing earthquake insurance system, concerning the indemnity system from the establishment of a new foundation system for house rebuilding support, or mutual aid systems targeting the whole nation.

#### *Livelihood rebuilding support system for victims*

Various discussions were also performed about Livelihood recovery and rehabilitation support for victims of natural disasters, in parallel with the discussions of house rebuilding support. In particular, bills and suggestions, etc., concerning a publicly-supported individual compensation system were made.

Livelihood recovery and rehabilitation support is a matter of providing support for victims who are having difficulties rebuilding their Livelihood for economic reasons and discussions on said started about one year after the Great Hanshin-Awaji Earthquake, with bills being proposed by citizen's groups and Diet members. Thereafter, discussion moved forward rapidly, and a bill was established in 1998 and put into effect. Specifically, this system provides support money of a maximum of one million yen in accordance with the victim's annual income, in case of suffering damages exceeding a certain scale due to natural disaster, and, moreover, when the housing is completely destroyed.

This system will be operated employing a total of 60 billion yen as a fund, which is to be contributed by the prefectures in accordance with their share. Additionally, there is a system where in case support money is supplied from this fund, half the supplied amount will be subsidized by the nation.

## **4. Specifics of Earthquake Insurance**

Since the Government is undertaking the reinsurance for the earthquake insurance, necessary laws have been constituted, such as the "Laws Concerning Earthquake Insurance." Pursuant to these laws, coverage of insurance, losses to be covered, payment methods of insurance claims,

participation method, amounts insured, etc., are set forth. Specifics of earthquake insurance as of April 2002 are as follows.

#### ***4.1. Coverage of Insurance***

The coverage of earthquake insurance policies is limited to buildings for residential use and/or movables for living (households and personal properties) pursuant to the Earthquake Insurance Law. Specifically, the scope of the coverage of insurance is set forth as follows:

##### *Buildings for residential use*

This shall consist of buildings, all of or part of which are provided for residential use.

##### *Movables for living*

This shall consist of furniture, equipment and clothing used for living and other movables usually necessary for living; provided, however, that gemstones, semiprecious, noble metals, pearls and the products of said, products of tortoiseshell, coral, amber, ivory, cloisonne enamel, and calligraphic works and paintings, antiques and artworks and crafts, the value of one piece or one pair of which exceeds 300,000 yen, are excluded.

#### ***4.2. Losses to be covered***

Losses to be covered in earthquake insurance are losses arising concerning the object Insured due to fire, destruction, burial or flood directly or indirectly caused by earthquake, volcanic eruption or tsunami due to said (hereinafter referred to as the "Earthquake, etc."), and, moreover, the degree of loss is total loss, half loss or partial loss. Total loss, half loss or partial loss is defined in earthquake insurance as follows:

##### *Total loss*

- Buildings:

Cases in which the amount of loss of major structural parts of the building (framework (pillars, beams, etc.), foundations, roofs, outer walls, etc.) comes to no less than 50% of the market value of the relevant building, or cases in which floor space burned and lost or washed away comes to no less than 70% of the total floor space of the relevant building. The amount of loss includes minimum expenses considered to be directly necessary for the recovery of foundations, etc., for the restoration of the building

(land re-grading expenses, etc.) (same as half loss and partial loss).

Additionally, in case buildings for residential use become incapable of being lived in due to the occurrence of imminent dangers due to landslide or other disasters due to Earthquakes, etc., the buildings shall be deemed to be total loss.

– Movables:

Cases in which the amount of loss of movables a household and personal properties comes to no less than 80% of the market value of the movables.

### *Half loss*

– Building:

Cases in which the amount of loss of major structural parts of the building comes to no less than 20% and no more than 50% of the market value of the relevant building, or cases in which floor space burned and lost or washed away come to no less than 20% and no more than 70% of the total floor space of the relevant building

– Movables:

Cases in which the amount of loss of a movables come to no less than 30% and no more than 80% of the market value of the movables.

### *Partial loss*

– Building:

When the amount of loss of major structural parts of the building comes to no less than 3% and no more than 20% of the market value of the building, or when a building for residential use is flooded above the floor level or flooded in excess of 45 centimeters from the ground due to water damage due to floods, etc., caused by Earthquake, etc., shall also be deemed to be partial loss.

– Movables:

Cases in which the amount of loss of a movables come to no less than 10% and no more than 30% of the market value of the movables.

### ***4.3. Payment Method of Insurance Claims***

Payment methods of insurance claims shall be as follows, the same for both buildings for residential use and movables for living.

#### *Total loss*

*The entire amount insured of earthquake insurance (100%) shall be paid; provided, however, that such shall be limited to the insurable value.*

#### *Half loss*

An amount equivalent to 50% of the amount insured shall be paid; provided, however, that such shall be limited to an amount equivalent to 50% of insurable value.

#### *Partial loss*

Amount equivalent to 5% of the amount insured shall be paid; provided, however, that such shall be limited to an amount equivalent to 5% of insurable value

### ***4.4. Participation Method***

Earthquake insurance policies shall be participated in through policies incidental to fire insurance for residences covering buildings for residential use or movables for living.

Additionally, when a warning statement against earthquake disaster under the Large Scale Earthquake Countermeasures Act (Law No.73 of 1978) targeting the Tokai Earthquake (hereinafter referred to as the "Warning Statement") has been issued, concerning the object of insurance located in the area designated as the Area under Intensified Measures against Earthquake Disaster under the said Law, during the period from the time when the Warning Statement was issued till the day of issuance of the statement of withdrawal of the warning against the earthquake disaster, no new earthquake insurance policies may be entered into; provided, however, that earthquake insurance policies that had been entered into by the time the Warning Statement was issued and expired after the Warning Statement, can be renewal, if the insured and object insured are the same, and if the amount is the same or lower.

#### ***4.5. Amount Insured***

The amount insured for the earthquake insurance policies is set forth under the Earthquake Insurance Law as being equivalent to an amount no less than 30% and no more than 50% of the amount insured of the principal contract, and said amount is set forth in the enforcement ordinance as limited to 50 million yen for buildings for residential use and 10 million yen for movables for living.

#### ***4.6. Limit of Total Amount of Insurance Claims to be Paid***

Losses due to earthquakes differ greatly depending on the scale, place of occurrence, time of earthquake occurrence and meteorological conditions, etc., and sometimes the losses can be gigantic. Therefore, it is impossible to estimate correctly how gigantic a loss will occur due to a great earthquake in the future.

Thereupon, in order for the Government and the insurance companies to secure the payment of insurance claims due to earthquakes, a limit amount of total payments of insurance claims due to a single earthquake, etc., (hereinafter referred to as the "Insurance Claim Total Payment Limit"), with the shares of burden and burden amounts for the insurance companies and the Government is stipulated in the enforcement ordinances and regulation enforcing of the Earthquake Insurance Law. This Insurance Claim Total Payment Limit is 4.5 trillion yen as of April 2002. The share of burden of and burden amount of the insurance companies and the Government will be stated in Section 5 "Reinsurance."

It has been determined that in case the total amount of insurance claims to be paid due to a single Earthquake, etc., exceeds the Insurance Claim Total Payment Limit, the respective insurance claims can be reduced and paid in accordance with the proportion of the Insurance Claim Total Payment Limit to the total amount of insurance claims to be paid.

Two or more Earthquakes, etc., having occurred within 72 consecutive hours shall be deemed collectively to be a single Earthquake, etc., and whether or not the above reduction of insurance claims is to be performed shall be judged; provided, however, that this shall not apply to the situation where the areas affected do not overlap at all.

## 5. Reinsurance and Liability Reserves

### 5.1. Reinsurance

Normally, reinsurance contracts are made between private insurance companies; however, in the earthquake insurance systems of Japan, reinsurance contracts are performed not only with private insurance companies, but also with the Government.

The major reasons for such are the following two points:

1. Earthquakes have a possibility to cause extremely massive losses and it is difficult for private insurance companies to share the risk alone.
2. In order to standardize the risk for great earthquakes, which occur at a low frequency, the income and outgo of insurance in the extraordinarily long run must be considered, and it is difficult for private insurance companies alone, which consider the short-term balance of insurance, to manage stably.

In order for the Government to undertake reinsurance contracts for earthquake insurance, the Earthquake Insurance Law has been constituted. This Law sets forth that the reinsurance partners for the Government shall be reinsurance companies. Therefore, Japan Earthquake Reinsurance Company, Ltd. (hereinafter referred to as the "J.E.R."), which only handles reinsurance of earthquake insurance, was established in 1966 together with the establishment of earthquake insurance.

#### *Reinsurance structure*

The earthquake insurance systems in Japan are operated subject to the undertaking of reinsurance by the Government.

1. Reinsurance agreement between private insurance companies and the J.E.R.
 

Private insurance companies selling earthquake insurance inside Japan in accordance with the Earthquake Insurance Law execute the Earthquake Reinsurance Treaty (A) (hereinafter referred to as the "A Reinsurance Treaty") with the J.E.R. In accordance with this A Reinsurance Treaty, private insurance companies shall have the J.E.R. perform reinsurance of all the insurance liability of the undertaken earthquake insurance contracts and the J.E.R. shall undertake such.
2. Reinsurance agreement between the J.E.R and the private insurance companies

Of the reinsurance liability undertaken pursuant to the Special Contract A in above (1), the J.E.R. performs reinsurance for

respective private insurance companies of a part of the remainder of the liability after the Government performs reinsurance. This part is executed between J.E.R. and the various private insurance companies respectively (including The Toa Reinsurance Company Limited, hereinafter referred to as the "Private Insurance Companies, etc.") for the risk diversification of the J.E.R., and is called Earthquake Reinsurance Treaty (B) (hereinafter referred to as the "B Reinsurance Treaty").

### 3. Reinsurance agreement from the J.E.R. and the Japanese Government

The J.E.R., under the reinsurance agreement with the Government, performs reinsurance again with the Government of part of the reinsurance liability which was undertaken from the direct insurance company pursuant to the A Re insurance Treaty in above (1). This reinsurance agreement with the Government is called "Excess of Loss Reinsurance" (hereinafter referred to as the "C Reinsurance Treaty"), and is the method by which reinsurance claims are to be paid in case the total payment of insurance claims due to a single Earthquake, etc., exceeds a certain amount.

#### *Liability sharing of insurance companies and Japanese Government*

Burden sharing and the total maximum liability of insurance companies (the J.E.R. and the Private Insurance Companies, etc.) and the Government for insurance claims to be paid due to a single Earthquake, etc., are stipulated in the enforcement ordinances and enforcement ordinance regulations of the Earthquake Insurance Law. In "earthquake insurance reinsurance scheme", the horizontal axis is the amount of burden due to a single Earthquake, etc., and the vertical axis is the proportion of burden of insurance companies and the Government. That is, in accordance with this scheme, payment of up to 75 billion yen shall be borne 100% by the insurance companies and concerning the payment amount of 75 billion yen and up to 1.0774 trillion yen, insurance companies and the Government shall each bear 50% of the payment of insurance claims. Moreover, the Government shall bear 95% and insurance companies the remaining 5% of payments for amounts exceeding 1.0774 trillion yen.

The Insurance Claim Total Payment Limit due to a single Earthquake, etc., is stipulated to be 4.5 trillion yen as of April 2002. This payment limit is determined so that there should be no obstacle to payment of insurance claims even in case a huge earthquake of the Great Kanto Earthquake class should occur, and the burden of share of insurance companies for this amount is 747.33 billion yen, while the burden of share of the Government for this amount is 3.75267 trillion yen.

It is stipulated that in case the total amount of insurance claims to be paid due to a single Earthquake, etc., exceeds 4.5 trillion yen, the Aggregate Limit, the respective insurance claims can be reduced and paid in accordance with the proportion of the Aggregate Limit to the total amount of insurance claims to be paid.

## ***5.2. Liability Reserves***

The frequency of occurrence of earthquake disasters is low, and besides, although they sometimes cause massive losses, it is impossible to predict when they will occur. Therefore, as for insurance premiums paid by policyholders, both insurance companies and the Government are obligated by the law to accumulate the total amount of such, excluding the portion of necessary expenses for contracts, as liability reserve in preparation for future earthquake disasters.

Additionally, it is obligated that all the investment profits from the accumulated liability reserves also be accumulated as liability reserves.

Respective insurance companies are respectively accumulating the insurance premiums distributed in accordance with the respective burden of share as liability reserves, and are also accumulating all the investment profits from the accumulated liability reserves as liability reserves. The J.E.R. is managing and performing investment of these liability reserves in lump sum so as to pay insurance claims quickly to the victims of earthquake disasters. Investment of these liability reserves is limited to savings, national bonds, public bonds and corporate bonds, etc., since liquidity and safety of investment are required at the time of earthquake disasters.

The Government is accumulating the reinsurance premiums obtained and all the investment profits from the liability reserves as liability reserves. These liability reserves are accumulated separately from general accounting, under the Earthquake Insurance Special Accounting Law.





## PART III B

### *Chapter 17*

#### **Natural Disasters Fund (FONDEN)**

*by*

**Carlos Bayo Martinez\***  
FONDEN, Mexico

The Natural Disasters Fund (FONDEN) was created in 1996 at the national level in order to increase Mexican Federal Government's resources and means to better cover damages arising from natural disasters. The fund is also aimed at better setting and organizing the budget exercise providing reliable and sound financial capacity to compensate for losses caused by natural phenomena without altering public finance. In this respect, one of the primary purpose of this new program is to timely cover the non insurable damaged infrastructure (Federal and local) caused by natural disasters. Against this backdrop, this chapter provides a detailed overview of the FONDEN main features and challenges.

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\* General Director.

## 1. Introduction

Due to its geographical position, the Mexican territory finds itself under the threat of a great variety of natural phenomena which can cause disasters like earthquakes, volcanic eruptions, hurricanes, burning forest, floods, earth movement, aridity, etc.

In the event of disasters caused by nature, the Federal and Local Governments are required to orientate their budget exercise to allocate indispensable resources to cover the damages to the physical infrastructure and compensate the injured population.

As a consequence of these disasters, the regular programs of public construction, such as extending construction, ensuring maintenance, new construction, could not be implemented or suffered important decreases due to lack of money, since these resources were allocated to the reconstruction of the infrastructure destroyed by a natural phenomenon.

As a response to the Mexican Federal Government's concern to increase its capacity to attend the effects of natural disasters and with the purpose of giving an order to the budget exercise and be able to rely on enough resources to allow the government to attend the damages caused by natural phenomena without altering the results of public finances and their regular programs, the Natural Disasters Fund (FONDEN) was created in 1996 within the Federal Budget. The primary purpose of this new program was to timely cover the non insurable damaged infrastructure (Federal and local) caused by natural disasters.

Although with the creation of FONDEN the trouble related to avoiding a lead off on the Federal and local regular programs resources was in a way solved, since they were able to rely on fresh resources to attend emergencies and disasters, there was neither legal regulation providing correct control of the delivered resources nor appropriate transparency in the application of the money.

Therefore in 1999, the first FONDEN rules were issued. They encompassed the mechanisms, requirements, procedures, phases and terms that should be covered by the Federal Ministries and Mexican States to be able to access FONDEN resources to cover the damages caused by natural disasters.

With this new regulation, the government seeks for support to be delivered in a very transparent way, with no political conditions or favoritisms of any kind. In this respect, it was decided that the resources would be administrated by a trust fund.

Because of that, the idea of a Federal FONDEN trust shows up along with the 32 States FONDEN trusts, instruments that will be explained further on.

Although the procedure to deliver FONDEN resources through the trust fund has remained firm over the years, the FONDEN legal regulation has undergone many substantial modifications to ensure that the procedures to provide help and resources to the harmed population and damaged infrastructure in the event of natural disasters are carried out with the maximum efficiency and adequacy.

## 2. The purposes and genesis of the FONDEN

The FONDEN is a financial tool composed of many instruments and driven by various Federal Government Agencies. Its main purpose is to provide resources to the 32 Mexican States and to the Federal Agencies (in charge of federal infrastructure) to attend the harm and damages caused by a natural phenomenon, when the disaster's magnitude exceeds their capacity of response with their own budget.

**Table 17.1 FONDEN contribution to losses arising from natural catastrophes**

Type of Public Infrastructure	FONDEN resources percentage	State and Municipal resources percentage
1. Highways, bridges, ports, airports		
State	50	50
Municipal	30	70
2. Hydraulics (dam, infrastructure of drinking water and reorganizing, works of protection, etc.)		
State	50	50
Municipal	40	60
3. Educational and Health (schools, universities, health clinics, hospitals, etc.)		
State	50	50
Municipal	30	70
4. Primary Streets	20	80
5. Fishing, Basic Aquatic and of Breeding Grounds		
State	50	50
Municipal	30	70
6. Forest Resources	50	50
7. Natural Protected Areas	50	50
8. Coastal Zones, Rivers and Lagoons	70	30
9. Dwellings	70	30
10. Artistic and Historic Real State	30	70

The FONDEN is a federal program which provides support in a complementary and subsidiary way to the resources originally allocated to natural disasters. Therefore, to get the resources approved, it is necessary that the Mexican States and the Federal Agencies looking for complementary support justify that the disaster exceeds their financial standing (insufficient resources in their normal programs to cover the damages caused by the disaster).

In the case of damages to the infrastructure of a Federal Government Agency, the support will fully be charged to the resources of the FONDEN, with the condition that it has been fully justified that the Agency does not count with resources of its own to cope with the disaster.

In the event of damages to infrastructure of the Mexican States and their Municipalities, the support offered through the FONDEN is complementary and will be applied according to the following proportion:

### **3. Natural phenomena covered by the FONDEN**

The diverse types of natural phenomena that can cause natural disasters are listed below:

1. Geological
  - earthquake;
  - volcanic eruption;
  - seaquake;
  - wash out;
2. Hydro meteorological:
  - dryness;
  - cyclone (tropical depression, tropical storm and hurricane);
  - extreme rains;
  - snow and hailstorm;
  - flood;
  - tornado;
3. Others: forest burning

The damages caused by any other natural phenomenon could also be covered by the FONDEN.

## 4. The FONDEN instruments

The FONDEN integrates 3 instruments:

- **Revolvable Fund:** Its object is to provide resources for the acquisition of aid supplies before situations of emergency and of disaster with the purpose to cover in an immediate way the urgent needs of the population (life, health, alimentation, medical attention, dress, temporary shelter) after a natural phenomenon, as well as the rescue of people in risk zones.
- **FONDEN Program:** Its object is to provide economic support for the repair and reconstruction of the infrastructure of the three orders of government (Federal, State and Municipal) damaged by a natural disaster; as well as for the affected dwellings of low income population with no possibility to access any type of public or private insurance and for the restitution of forest resources, protected natural areas, coastal zones, rivers, lagoons, etc.
- **FONDEN Trust Fund:** Its purpose is to allocate resources from its patrimony to perform the actions foreseen in the FONDEN Program, as well as to contract insurance policies and risks transfer instruments (disastrous bonds).

## 5. Entities having access to FONDEN resources

- The States government that has been surpassed in their financial and operating capacity to cope with the damages generated by a natural disaster. The municipalities are not able to request directly supports from the FONDEN; they have to carry out the necessary actions in order for their requests to be dealt with through their State.
- The Federal Government Agencies in case of damage to federal infrastructure. In this case, they have to justify that the resources of their regular programs are not sufficient to cover the damages.

## 6. Procedure for access to FONDEN resources

Below we will explain the procedure required in order to have access to FONDEN resources, from the occurrence of the natural disaster to the granting of the resources.

### *6.1. First stage- procedure to evaluate and quantify the damages*

**Step 1.** Right after a natural phenomenon occurs, the State or the Federal Government Agency has to require one of the three specialized

federal departments to corroborate the existence of the disaster, depending on what kind of natural phenomenon has occurred (geological, hydro meteorological or forest burnings).

**Step 2.** In the next 4 days, the specialized federal department notifies the State about the existence of the disaster and the State proceeds immediately to the establishment of a Committee to evaluate and quantify the damages caused by the disaster to all kinds of infrastructure. This Committee integrates federal and State agencies which are responsible for the damaged infrastructure.

**Step 3.** In the next 10 days, a Committee meeting takes place, in which the federal and state agencies present their results about the evaluation on the damaged infrastructure from the diverse sectors affected and the amount of resources required for reconstruction. For damages affecting State infrastructure, the State can request in advance as much as 50% of the share's sum that correspond to the FONDEN, to immediately initiate the reconstruction works.

## ***6.2. Second stage – procedure to authorize the necessary resources to cover the damages***

**Step 4.** In the following 5 days, the Ministry of Interior receives the resources requests of the States and Federal Agencies and issues the natural disaster declaration in the Federal Official Newspaper. Simultaneously, the Ministry of Finances and Public Credit authorizes the FONDEN Trust to transfer the sum requested in advance by the State.

**Step 5.** Within the next 2 days, the Ministry of Interior should carry out the following tasks:

- Check that there is no duplication in the actions to be carry out between the federal and state agencies;
- Check that the requested resources are not for the reconstruction of damages that are not linked to the natural disaster;
- Check that the damaged infrastructure has not been the object of other previous support from the FONDEN; in this case, it should request and incorporate in the file the documents proving that the infrastructure was insured (the insurance situation will be explained with greater detail in part 11).
- Devise and present the global resources request (including its opinion about the file contents and its conformity to the legal norm) for approval by a collegial instance composed by 5 Ministers of State.

**Step 6.** Within the next 4 days, the collegial instance gathers to discuss the approval of the requested resources. If approved, they recommend that the resources be authorized by the Ministry of Finances and Public Credit and delivered by the FONDEN Trust, under the following procedure:

- In case of federal infrastructure, the authorized resources will be paid directly by the trustee of FONDEN Trust;
- In the event of State or municipal infrastructure, the authorized resources will be deposited by the trustee of FONDEN Trust in the according State FONDEN Trust, once the State Government deposits its correspondent part, in order for the reconstruction payments to be carried out.

The procedure described above has a time limit of 27 work days from the occurrence of the disaster to the authorization of the resources.

## 7. Execution of the authorized resources

- When the resources are meant to cover the cost of reconstruction of damaged State and municipal infrastructure, the Ministry of Interior informs the State about the total amount of resources approved by the FONDEN and for each sector affected, which will be deposited in the corresponding State FONDEN Trust, once the State Government deposits its correspondent part, according to the percentages indicated in the part 2 of this document and the calendar of contributions that the State presents before the State FONDEN Trust.

In that sense, all matters related to the works and actions required for the reconstruction and the use of the resources approved, is dealt with directly by the Technical Committee of the State FONDEN Trust, until full completion.

- When the resources are for the reconstruction of federal infrastructure, the trustee of the Federal FONDEN Trust is in charge of delivering the approved resources to the Federal Agencies at the moment that they present him the progress of the works and actions of reconstruction.

## 8. Federal FONDEN Trust and States' FONDEN Trusts

**Federal FONDEN Trust** - It was established in 1999 and its patrimony comes from each tax year remnants of the budgetary resources of the FONDEN Program and the remnants of the concluded programs of reconstruction.



Its main purposes are to:

- Provide the approved resources to the Federal Agencies for the reconstruction of federal infrastructure affected by a natural disaster;
- Deposit in the States' FONDEN Trusts the authorized resources for the works and actions linked to the reconstruction of the State and municipal damaged infrastructure;
- Provide to the Federal Agencies and deposit in the States' FONDEN Trusts resources with a temporary character until they obtain the reimbursement of the insurance policies, which should be deposited in the Federal FONDEN Trust once recovered;

**States' FONDEN Trust** - As the Federal FONDEN Trust, they were established in 1999, one for each Mexican State. Their constituents are the Local Government of each State and they have the same trustee in all of them as well as in the Federal Trust, which is a Development National Bank.

Their patrimony is constituted with the contributions provided by the Federal FONDEN Trust and the contributions made by the States and their Municipalities.

Their main purposes are to:

- Manage the resources received by the Federal FONDEN Trust and by the Governments of the States and their Municipalities;
- Finance the works and actions for the reconstruction of the affected State and municipal infrastructure, according to the percentages of payment indicated in part 2 of this document;
- Return to the Federal FONDEN Trust within the first 5 days of each month, the financial interests generated from the federal resources deposited in the State FONDEN Trust for the reconstruction of infrastructure damaged by a disaster;
- Receive donations to be used only for the purposes of the trust.

If at the end of a particular natural disaster reconstruction program, some remnants are left due to the cancellation of works and actions or to the incompleteness of the program, these should be returned to the Federal FONDEN trust and to the State Government, in the proportions that they have contributed and according to the percentages established for each type of infrastructure.

On the other hand, if the natural disaster reconstruction program is completely finished and some remnants are left due to the obtention of better prices (compared to the ones foreseen), on the acquisition of the materials

and in the labor costs, those resources could be used for the constitution of a State Natural Disasters Fund.

## 9. Statistics

Since the beginning of human written history, there have been many tales about large-scale natural disasters, some going back to prehistoric times and that were transmitted through myths and legends, which frequently have found verification in physical evidence discovered in recent archaeological studies.

Even in the most advanced countries, it is very difficult to gather trustful and reliable information about the losses produced by disasters and even more difficult in developing countries like México, where there is no practice to carry out a quantification of goods and losses. For these reasons, the available statistics imply high margins of error, above all in data referring to economic losses and losses of human lives.

Therefore, only some general statistics of large natural disasters that have occurred in Mexico from the 1980's to date are included in table 17.2, and only those considered relevant to appreciate the importance of certain basic factors.

**Table 17.2 Main Natural Catastrophes that have occurred in Mexico since 1980**

YEAR	PHENOMENON	STATE	POPULATION AFFECTED	LOSSES USD
1980	Hurricane	Tamaulipas	25,000 victims	10 million
1982	Hurricane	Sinaloa	257,000 victims	450 million
1985	Earthquake	D.F.	4,287 deceased and 37,300 victims	4,000 million
1985	Rains	Nayarit	48,000 victims	420 million
1988	Hurricane Gilbert	Yucatán, Q. Roo, Campeche, Tamaulipas, Coahuila, Nuevo León	250 deceased and 15,000 victims	750 million
1990-1991	Floods	Sonora, Baja California Sur, Sinaloa y Chihuahua	40,000 victims	53 million
1993	Floods	Baja California Sur	10,000 victims	63 million
1995	Earthquake	Colima y Jalisco	34 deceased and 1,000 victims	7 million
1997	Hurricane Pauline	Guerrero y Oaxaca	228 deceased and 50,000 victims	800 million
1998	Rains	Chiapas	407 deceased and 28,753 victims	N.D.
1999	Rains	Puebla, Hidalgo, Veracruz, Tabasco y Oaxaca	329 deceased and 295,000 victims	1,000 million
2002	Hurricane Isidore	Campeche, Chiapas, Yucatán y Quintana Roo	448,000 victims	250 million
2002	Hurricane Kenna	Jalisco y Nayarit	319,000 victims	48 millions
2003	Hurricanes Ignacio y Marty	Baja California Sur	20,000 victims	43 million

Considering only the direct economic losses, the annual cost of disasters in Mexico during the last years, according to statistics, has been close to 500 million dollars, which is a very significant amount for Mexico, given the size and capacity of its economy.

From 1999 to August 2004, more than 400,000 dwellings have been reconstructed because of the damages caused by natural disasters, with an estimated cost of 500 million dollars, for actions concerning only the low income population.

The increase in the number of disasters in recent years is attributed mainly to the population increase and the human settlements in areas particularly exposed to natural phenomena, which turn into disasters, but also to the environmental deterioration of Mexican soil, particularly due to deforestation.

## **10. FONDEN main strengths and weaknesses**

### ***10.1. The FONDEN's main strengths are:***

- Offering an exclusive federal program for natural disasters, including aid to the population before emergency situations that could be generated by a natural phenomenon;
- Transparency in the delivery of resources, whether for reconstruction or for the life and health of the population in case of emergencies;
- Money availability at any time of the year; since the resources are placed in a Trust Fund, they do not have to be returned to the Federal Treasury at the end of the year;
- Guarantee that the resources will not be exhausted, as by law disposition, the Ministry of Finances and Public Credit has the obligation to carry out the necessary budgetary procedures to ensure resources sufficiency at any time and before any natural disaster, no matter the amount required;
- Possibility to include additions and technical improvements in the infrastructure that will be reconstructed, in order to reduce its vulnerability to a new natural phenomenon.

### ***10.2. The FONDEN's weaknesses are:***

- The extreme poverty in some regions of the country, which causes a natural phenomenon, even of low or medium magnitude, to become a natural disaster of large proportions due to the weak and badly

structured infrastructure, and to the fact that a great number of dwellings are built in very risk-prone zones (up the hills, on the edge of rivers, etc.);

- Delay in the reconstruction of the damaged infrastructure and the dwellings affected, because of the necessity to comply with a great number of legal dispositions;
- The FONDEN does not foresee resources for domestic household goods of very low income population that lost its patrimony due to a natural disaster;
- The lack of required regular maintenances of local and federal infrastructure, due to insufficient budgetary resources in the State and Federal Agencies, which causes that in the presence of a natural phenomenon, the damages turn out to be a lot greater than they should.

## 11. Challenges and perspectives of the FONDEN

### *11.1. Evolution from a reactive system to a preventive system.*

One of the main targets of the “Mexican National Developing Plan 2001-2006” is precisely to transit from a natural disaster reactive system to a natural disaster preventive system.

The prevention system strategy sets three primary steps:

- Knowing the dangers and threats to which we are exposed, through study and knowledge of natural phenomena;
- Identify and establish at the three levels of government (national, State and municipal) the characteristics and the actual grades of risk; understood as the product of the danger by the exposition and by the vulnerability;
- Design actions and programs to mitigate and reduce the risks before the occurrence of natural phenomena, through the reinforcement and adjustment of the infrastructure and the training of the population to learn what to do before, during and after a disaster.

To implement the above-mentioned tasks, more resources are required to invest in the prevention of disasters. This is why every year we try to get sufficient resources assigned in the Federal Budgetary of Expenses to achieve those purposes and be able to avoid large disbursements of resources to cover the damages caused by a natural disaster of large magnitude.

Today, the Federal Government already has two natural disasters prevention programs: i) the Fund for the Prevention of Natural Disasters; and ii) the Preventive Trust, which can be used by the Federal Agencies as well as by the States requiring resources for the execution of works or actions or for the acquisition of specialized equipment for the prevention of disasters.

### ***11.2. Natural Disasters State Funds.***

In an eminently federalist spirit, we are taking action so that in the medium term, all the States have their own natural disaster fund, which would allow the decentralization of this function from the federal government and avoid that all natural disasters occurring in the country continue to be covered by federal resources.

### ***11.3. Eradicate the extreme poverty in some regions of the country and the vulnerability of a considerable part of the dwellings and infrastructure.***

It is considered a main target in the Mexican National Developing Plan 2001-2006 to decrease substantially the marginalization index and to eradicate the extreme poverty of the country.

In this view, we are considering ways to dedicate more resources to the extremely poor population, living in the regions where most of the damages caused by natural disasters occur due to the extreme vulnerability of structures and foundations.

### ***11.4. Electronic FONDEN (E-FONDEN)***

The Mexican Government is working day by day to look for innovations and be at the vanguard in matter of prevention and attention of natural disasters.

The E-FONDEN project aims at increasing transparency and reducing the time needed for the approval of resources to cover the losses stemming from natural disasters, by making it possible to fulfill the requirements and process in an electronic way, allowing its fast analysis and monitoring.

The main aspects of the project are:

- The system will have the capacity to provide information on the progress of the process in an executive form through warnings, which will allow the user to identify failures in the process;
- Electronic formats will allow to avoid errors in the integration of manual files;

- The security system will allow the user to define policies of level access;
- The procedure to access FONDEN resources could be electronically monitored at any time by any Federal or State Agency;

The main advantages of the project are: increase in productivity; reduction of times; simplification of processes; improvement of service quality; efficiency increase; reduction of costs and errors; promotion of transparency; increase in security and decrease in work.

### ***11.5. Insurance***

Another Federal Government goal is to achieve that all Federal agencies and States have their infrastructure properly insured, in order for them to avoid, when a natural disaster of large magnitude occurs, the enormous disbursements that those kinds of disasters bring along. The idea is that the resources delivered from the FONDEN for the attention of natural disasters can gradually decrease and the insurances and other risks transfer instruments take charge of the amounts to pay the damages.

This is the reason why the FONDEN legal regulation aims to promote an insurance culture, compelling the Federal Agencies and State Governments to commit to incorporate in their next budgets and annual programs sufficient resources to insure the infrastructure damaged by a disaster that is going to be reconstructed with FONDEN resources, before receiving support for the reconstruction. Should the infrastructure be damaged again by another natural phenomenon, this would allow, to avoid the FONDEN having to provide resources again.

In parallel to this, the Mexican Government has been working actively in the insurance of the FONDEN Trust patrimony, through the transfer of risks by contracting an insurance policy or a “catastrophic bond” in those cases of large-scale natural disasters.

## **12. Catastrophe insurances or bonds: a financial instrument to solve an economic issue**

- The requirement of resources in case of a catastrophic disaster is enormous and volatile; it is therefore neither possible nor recommendable to use direct budgetary resources. A common solution is “self-insurance” through the creation of trusts.
- Nevertheless, in years with low fiscal revenues, there are negative incentives to stop contributing resources to the trusts, causing their depletion.

- The spending linked to natural disasters of large magnitude are highly unpredictable, fiscal resources are not enough to cover it.
- The new scheme is based on policy insurance or catastrophe bonds and has two great advantages:
  - **Magnify the resources of the trust**, the payment of the insurance premium is covered with resources of the trust. When the catastrophe happens, the trust receives a great amount of resources. It would be much more complicated to cover the full cost of the disaster with fiscal resources only.
  - **It solves the economic issue**, since it creates a frame of incentives that stimulates renewing periodically the cover.

Therefore, this scheme focuses on contracting catastrophic covers first able to transfer the risk of earthquake and to protect the existing resources in the trust.

This kind of scheme provides incentives for the State to fund a possible disaster in a permanent way, since the responsibility of not renewing a catastrophic insurance is enormous, whereas stopping contribution to the trust during a year is a relatively smaller responsibility.

### 13. Objectives of the project

The first risk that should be transferred from the FONDEN trust to the financial markets is the earthquake risk, since:

- Although it is the less recurrent risk, it is the one that can cause the biggest disasters.
- In México, we have enough data about this risk as we have top specialists on the topic.

Other risks could then possibly be transferred.

It is necessary to develop a system that evaluates the weather and topographic risks and that determines the probability of maximum loss (PML) by type of risk and geographic location.

## 14. Proposal of earthquake risk cover

There are two main financial instruments to transfer the earthquake risk:

- Traditional Reinsurance
- Catastrophe Bond.

The Mexican government is working very hard to have the earthquake risk cover proposal contracted before the end of the year.

Once the earthquake risk cover has been issued, we will be able to advance in others risks coverage (hurricane, flood, agrarian risks, volcanic eruption, etc.).

For now the budget of the FONDEN will be dedicated to paying the catastrophic insurance premiums and will retain a small sum for recurrent, less destructive, events. In doing this, the FONDEN will dispose of a sound and large capacity to face catastrophic events of great magnitude without affecting public budget.





## PART III B

### *Chapter 18*

# **The Spanish Experience in the Management of Extraordinary Risks, Including Terrorism**

*by*

Ignacio Machetti\*

Consorcio de Compensación de Seguros

In December 1954, the ‘Consorcio’ became the masterpiece in one of the oldest State backed systems dealing with Extraordinary Risk Cover, terms that in this system include perils of nature (flood, earthquake, volcanic eruption, storms) and socio-political risks, essentially terrorism. This chapter provides an overview of the Consorcio and its main reforms.

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\* General Manager

## 1. Short sight to history: the origins

The objective of this note is to put forward what the ‘Consortio de Compensación de Seguros’ has represented in the past and what it represents nowadays in Spain. It has been, from a historical overview, a successful experience, with a high projection to the future.

In this perspective, this year is the commemoration of the fiftieth anniversary of the Law that gave permanent regulation to the ‘Consortio’ in its shape as a stable mechanism for the compensation of damages from extraordinary events, after a provisional period which begun in 1941, constituting the remote background of the ‘Consortio’.

Actually, that year 1941, counting on State and private market participation, an instrument allowing to face the compensation of the enormous damage produced on people and goods along the Civil War (1936-1939) was established, as those damages were far above the low capacity of the insurance undertakings of the period. An instrument that was later used to compensate for several big losses, not related to the war, produced at that time: 1941: Santander fire; 1944: Canfranc and Ferrol fires; 1947: mines explosion in Marina, Cádiz; and 1948: gunpowder arsenal explosion in Alcalá de Henares.

It was just the good results raised along that provisional period, that induced to give permanent status and continuity to the ‘Consortio’ in order to be able to face up in the future risks with a large loss potential, as the Extraordinary Risks, that private market was unable to assume.

## 2. Stabilisation and development: adaptation capacity

That definite step took place in December 1954. The ‘Consortio’ became the masterpiece in one of the oldest State backed systems dealing with Extraordinary Risk Cover, terms that in this system include perils of nature (flood, earthquake, volcanic eruption, storms) and socio-political risks, essentially terrorism. With respect to the latter, Spanish insurance industry has paid special attention to it through this institution as, unfortunately, terrorism is not a new subject in Spain.

One of the keys for the survival and good health of the ‘Consortio’ is its flexibility, its capacity to adapt to the requirements of the insurance sector at every time. It constitutes a dynamic instrument, that has not focused just the cover of extraordinary risks, but also, and with an essentially subsidiary nature, it has received new tasks in other lines of insurance, following

market needs; lines such as Export Credit Insurance, Compulsory Travellers Insurance, Hunting Compulsory Insurance, Motor Car Third Party Liability Insurance, Multiperil Crop Insurance, etc.; as well as different non-insurance activities as the winding-up of insurance undertakings, the management of the so-called FIVA (Insured Vehicles File), prevention, etc. This is the origin of the character and vocation of the 'Consortio' as an instrument at the service of Spanish insurance industry, acting always in full collaboration with the sector.

As a result of those developments, the legal nature of the 'Consortio' has also been modified for a better adaptation to the new circumstances. After 1954, certainly the most important modification took place in December 1991, as a result of the adaptation requirements to Community regulations, following Spain accession to the European Community, in 1986. As a result of that the 'Consortio', apart from losing the monopoly that it had from the start in the cover of Extraordinary Risks, stopped being a State institution and became a public business institution, attached to the Ministry of Economy and Finance. An institution with its own legal personality and full capacity to act, its own assets independent from the State's, and whose activity is subject, as any other insurance undertaking, to laws ruling private companies.

From that time, the 'Consortio' is managed by an Administration Board, chaired by the Director General of Insurance and Pension Funds and with a mixed composition, including equal numbers of representatives from State Administration and from private insurance market, all of them appointed by the Minister of Economy and Finance. This Board applies the same management criteria as any private company, therefore looking for maximum efficiency. In particular, claims are dealt with by a decentralised management through 18 regional offices.

A last feature worth mentioning is that the 'Consortio' employs 365 people and counts on some 350 external professionals, particularly adjusters and lawyers.

### **3. Natural disasters and terrorism: reaction capacity**

In the last two decades, from an international perspective, natural disaster losses have substantively increased, and we can observe a tendency towards higher losses as a result of a higher vulnerability provoked by factors essentially anthropic in origin: higher concentration of people and values in risk areas; higher value of goods insured; lack or deficiency in mitigation and prevention policies; increase of catastrophic climatic events as a result of global warming.

This loss behaviour has caused serious troubles to the insurance and reinsurance markets, and has given way to various approaches on the suitability, relevance, need and even demand of public intervention in order to provide an insurance cover economically and socially sustainable. On top of that, and in a period of time much shorter than the catastrophic dynamics concerning natural events, terrorism is not any more an irrelevant risk, has become very difficult to delimit, and insurance and reinsurance markets are not always able to assume it. September 11 attacks marked a sudden change, without any transition, and March 11 attacks in Madrid have tragically deepened this wound. Of course, the effects of September 11, so negative on international insurance and reinsurance markets, finally affected a part of Spanish insurance supply, and were felt in the 'Consortio', essentially in aviation and business interruption related to the risk of terrorism.

In the first case, the hard cut in cover for non-passenger third party liability concerning the risk of terrorism and war led Spanish Government to ask to the 'Consortio', for a transition period and in the framework of the decisions taken within the ECOFIN, to cover that risk on behalf of the State. Our institution fulfilled those tasks up to October the 31st 2002, when there was a chance to find that cover in the market. Regarding business interruption related to terrorist acts, it is worth pointing out that the Association of Insurance Undertakings, UNESPA, signed up an agreement with the 'Consortio' by which our institution covered, as reinsurer, companies freely joining the agreement. This agreement has been in force until the moment that business interruption has been actually integrated in extraordinary risks cover system (previously only direct damage was covered). That means that now it is a direct cover, not reinsurance, and that the 'Consortio' assumes it not just for terrorist acts but for any natural or socio-political event included in the system.

Until recently only extraordinary losses consequence of events taking place in Spain were covered. Certainly we can also attribute to the tragic legacy of September 11 the inclusion in Extraordinary Risks cover of damage to people (covered by accident policies) for events being included in the system, happening abroad, and provided that the policyholder has his residence in Spain. Obviously the afterthought was mainly events of terrorism.

The March 11 attacks, a human disaster that, with 192 deaths and about 1,500 wounded, have left in the conscience of Spanish people an inextinguishable track of pain, as well as the pride of a model civic reaction. For insurance, however, the scope of damages and compensations that the 'Consortio' had to face, was more limited than expected. Claims were mainly on personal damage (branch of accidents), since the goods having suffered the highest material damage, i.e. the wagons, were not insured.

The 'Consorcio' has focused specially and as a priority in the personalised attention to those harmed in this terrorist event, trying to reduce to the essential minimum the period of procedure for the claims.

Related to this attack, more than 1000 files of claim for compensation, 952 for personal damage (192 for death) and 58 for material damage, have been opened. Half this number has already been terminated, for a total amount of compensations slightly above EUR 20 million. 442 files are not yet terminated, essentially because for many injured people sequels have not yet been definitely established. For those files a provision of funds for an amount of EUR 15 million has been constituted. Therefore, and according to those data, we can expect that compensations for damages produced by the attack will represent for the 'Consorcio' payments for an amount close to EUR 35 million.

## **4. Characteristics of the cover system for extraordinary risks**

### ***4.1. Wide-sense Compensation.***

The system is based on the principles of solidarity, compensation, cooperation and subsidiarity.

- Solidarity among the insured through mutualisation.
- Temporary compensation, between accounting years.
- Territorial compensation, among different geographic areas.
- Compensation of risks, among the different hazards covered.
- Cooperation between the private market and a public institution as the 'Consorcio'.
- Subsidiarity, as the 'Consorcio' behaves only when and where the market does not assume the cover.

### ***4.2. Compulsory character***

Extraordinary risks cover must be compulsorily included in the policies of certain lines of damage on goods (fire and natural events, land vehicles, other damage to goods, business interruption, and so on) and in personal accident policies, even though underwriting of those policies is, however, free. The compulsory character guarantees the possibility of the abovementioned mutualisation and allows to provide a feasible, and no burdensome, solution to the problem of adverse selection. This is a cover compulsorily joined to a master policy, to be underwritten by private

insurance undertakings, and in no case by the ‘Consortio de Compensación de Seguros’. This procedure obviously benefits the promotion of insurance in lines where the inclusion of extraordinary risks cover is compulsory.

#### ***4.3. Subsidiarity and guarantee fund***

If the underwriting company does not cover explicitly those risks, they are covered by the ‘Consortio’. It would contact the insured just in case of loss, respecting capitals insured and conditions of compensation established in the ordinary policy. Therefore, the company deals with the policy and the ‘Consortio’ deals with loss and compensation. It would also assume compensation in the event that the underwriting company covering the extraordinary risk were unable to assume its commitments, due to bankruptcy or to winding-up by the ‘Consortio’. Thus the ‘Consortio’ acts as guarantee fund.

#### ***4.4. Price of the cover: the surcharge***

The price of the cover is a **surcharge** that, with different rates according to the kind of good covered, is applied compulsorily on the capital insured in the policy, and is collected, together with the corresponding premium, by the company, which credit it monthly to the ‘Consortio’. The companies deduct a collection charge for this service.

#### ***4.5. Risks and damage covered by the system***

Risks covered by the system are:

- **Perils of nature:** flood (direct rain and overflow of artificial channels is excluded), volcanic eruption, earthquake, seaquake, sea-breaking on land, fall of meteorites, and storms (it includes, among other, tornadoes and gusts of wind above 135 km/h.).
- **Socio-political events:** terrorism, riot, rebellion, civil commotion and sedition, as well as acts of law enforcers (Army, Police) during peacetime.

Up to recent times only direct damage on people and goods, including mud extraction, demolition and debris removal expenditure, for losses taking place in Spain affecting risks located in the country were covered. Recently, as already said, business interruption as result from direct damage was included, as well as damage to people suffered abroad due to extraordinary events when the policyholder is a resident in Spain.

#### ***4.6. Qualitative cover***

As a characteristic it must be emphasised that it is a qualitative and not a quantitative cover, as the reference is neither a minimum accumulation of loss nor a minimum geographical extension and of affected people that ought to be reached, but the damage potential of an extraordinary event, independently from the actual scope of the latter in a particular loss. That means that compensation does not depend on the amount of losses, on its geographical extension, on the number of affected insured people nor on the official declaration as disaster area, but on affected people (it might be only one) having a policy of the lines mentioned covering damaged goods, having paid the corresponding surcharge and on the cause of loss being under the legal definition of any of the events included in the system. It is a way of guaranteeing legal safety of people suffering losses and of making claim proceedings and the management of compensation independent from politics, as they do not depend neither on the valuation nor on the decision of any authority that had previously to pronounce itself about the character of the loss.

#### ***4.7. Resources and equalisation reserve***

Resources of the ‘Consorcio’ to face its corresponding losses come essentially from surcharges abovementioned. As a financial safety mechanism, and besides the provisions and margins of solvency required to any insurance company, the ‘Consorcio’ has an Equalisation Reserve, that counts on a soft tax treatment and whose resources come from each financial year profits. This provision acts as a special and big fund for losses allowing compensation between years with high and with low loss-ratio. At this moment it has reached the amount of EUR 2,425 million.

Apart from that, the ‘Consorcio’ benefits from the guarantee of the State. Nevertheless, up to the present it has never needed it to pay compensations, despite the fact that it has faced important losses in the past.

### **5. Loss data**

Total amount of compensations paid by the ‘Consorcio’ between 1987 and 2003, as a result of damage on goods for extraordinary events is EUR 1,631 million, 85.0 per 100 corresponding to flooding losses, 8.9 per 100 to damage for terrorism, 2.6 per 100 to civil commotion, and 2.5 per 100 to atypical cyclonic storm.

For the period 1971-2003, and also with regard to damage on goods, income for surcharges reached a total of EUR 6,139 million (updated).



Compensations reached a total amount of EUR 4,171 million (updated), which represents a loss-ratio of 67.95 per 100. It means that, in accordance with the erratic behaviour of the type of risks concerned, with respect to frequency and intensity, besides reduced or moderated losses for years, there appear some picks of losses increasing that loss-ratio to the following levels: 655.27 in 1983; 283.01 in 1982; or 240.89 in 1987.

The distribution of Consorcio's payments per type of goods affected during the period 1987-2003 is the following: 34.81 per 100 of the compensations correspond to "Business and other simple risks"; 30.99 per 100 to "Industrial risks"; 22.57 per 100 to "Housing and offices"; 7.46 per 100 to "Motor vehicles"; and 4.17 per 100 to "Civil works".

In the section damage to people, for the period abovementioned (1987 to 2003), compensations paid by the 'Consorcio' reached a total of EUR 21 million. From this amount, 87 per 100 corresponded to events of terrorism and 12 per 100 to flood.

**Table 18.1 Extraordinary risks - Property and personal accidents  
Total payments distribution per causes (in Euros) – Period 1987-2003**

<b>Cause</b>	<b>Property</b>	<b>%</b>	<b>Personal Accidents</b>	<b>%</b>
<b>Flood</b>	<b>1,385,383,648</b>	<b>85.0</b>	<b>2,496,211</b>	<b>11.9</b>
Earthquake	16,725,642	1.0	0	0.0
Atypical cyclonic storm	40,235,666	2.5	0	0.0
Falling astral bodies and meteorites	41,470	0.0	0	0.0
<b>Terrorism</b>	<b>144,837,337</b>	<b>8.9</b>	<b>18,328,196</b>	<b>87.1</b>
Riots	681,768	0.0	0	0.0
Civil commotion	41,633,661	2.6	90,812	0.4
Acts of the Armed Forces	1,161,258	0.1	125,611	0.6
<b>TOTAL</b>	<b>1,630,700,450</b>	<b>100</b>	<b>21,040,830</b>	<b>100</b>

**Table 18.2 Extraordinary risks - Property**  
**Total payments distribution per type of risk (in Euros) - Period 1987-2003**

Type of risk	Property	%
Housing and Offices	367,986,707	22.6
Businesses and shopping centres	567,677,1412	34.8
Industrial risks	505,395,386	31.0
Civil works	68,040,203	4.2
Motor Vehicles	121,601,013	7.5
<b>TOTAL</b>	<b>1,630,700,450</b>	<b>100</b>

**Table 18.3 Extraordinary risks - Property**  
**Premiums and total payments distribution (in Euros) - Period 1971-2003**

Years	Premiums updated	Total payments updated	Loss ratio (%)
1971-1980	895,179,115	741,813,652	82.87
1981-1990	1,337,527,336	1,944,085,583	145.35
1991-2000	2,737,361,338	1,101,063,120	40.22
2001	373,373,688	165,617,611	44.36
2002	379,226,400	132,694,030	34.99
2003	416,043,733	86,041,073	20.68
<b>TOTAL</b>	<b>6,138,711,609</b>	<b>4,171,315,069</b>	<b>67.95</b>

**Table 18.4 Extraordinary risks - Property**  
**Premiums and total payments distribution (in Euros) – Years with special payments**

Years	Premiums updated	Total payments updated	Loss ratio (%)
1982	114,143,112	323,039,657	283.01
1983	114,061,407	747,407,907	655.27
1987	121,779,438	293,356,125	240.89
1989	183,603,203	238,493,284	129.90

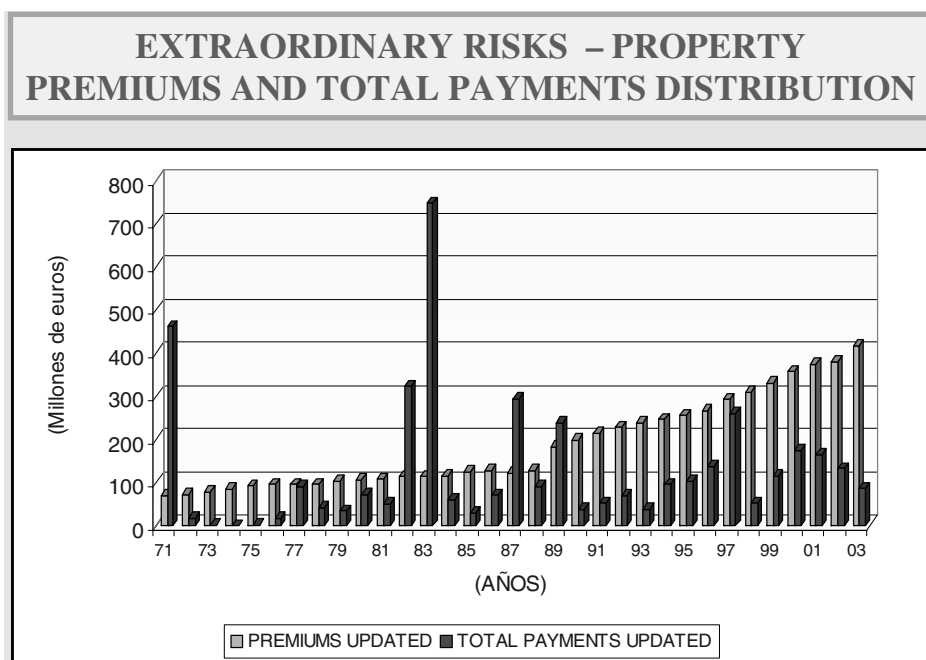
Table 18.5

**EXTRAORDINARY RISKS – PROPERTY  
PREMIUMS AND TOTAL PAYMENTS DISTRIBUTION**

<b>YEARS</b>	<b>PREMIUMS UPDATED</b>	<b>TOTAL PAYMENTS UPDATED</b>	<b>LOSS RATIO (%)</b>
1971	69,108,093	461,147,951	667.29
1972	72,459,076	18,351,200	25.33
1973	79,337,912	2,250,331	2.84
1974	83,931,339	435,979	0.52
1975	92,878,803	2,622,690	2.82
1976	95,686,062	16,668,884	17.42
1977	96,012,889	91,837,675	95.65
1978	95,552,364	41,057,518	42.97
1979	102,922,321	34,248,933	33.28
1980	107,290,256	73,192,492	68.22
1981	108,409,056	50,573,172	46.65
1982	114,143,112	323,039,657	283.01
1983	114,061,407	747,407,907	655.27
1984	116,650,445	59,818,853	51.28
1985	124,185,624	30,396,892	24.48
1986	128,226,575	71,177,143	55.51
1987	121,779,438	293,356,125	240.89
1988	128,036,019	90,020,319	70.31
1989	183,603,203	238,493,284	129.90
1990	198,432,457	39,802,231	20.06
1991	213,637,986	52,533,624	24.59
1992	228,223,075	69,764,543	30.57
1993	238,841,990	39,649,416	16.60
1994	245,913,175	96,101,626	39.08
1995	255,121,194	104,191,273	40.84
1996	267,150,107	136,256,684	51.00
1997	291,963,732	261,126,147	89.44
1998	309,306,666	52,380,387	16.93
1999	329,993,202	114,920,346	34.83
2000	357,210,210	174,139,073	48.75
2001	373,373,688	165,617,611	44.36
2002	379,226,400	132,694,030	34.99
2003	416,043,733	86,041,073	20.68
<b>TOTAL</b>	<b>6,138,711,609</b>	<b>4,171,315,069</b>	<b>67.95</b>

EUROS

Figure 18.1



## 6. Challenges of the future.

The whole accumulated experience and the mechanisms and processes enabled to assume the insurance treatment of natural disasters and risks like terrorism place the 'Consortio' in a favourable initial position to face challenges of the future, which will demand adjustment efforts and imaginative solutions in co-operation with the market. At least two of those challenges will have an uncertain, but surely impressive, development: climate change and mega-terrorism.

Even from a non pessimistic point of view, one must admit that global warming might provoke an increase in extreme climatic events, as much in frequency as in intensity. Although insurance industry has not the exclusivity in the search for preventive solutions, which will be essential, it will have to offer insurance alternatives according to each climatic reality. Certainly, a field of close collaboration will have to be opened among the insurance industry, the public authorities and the insured themselves.

With respect to mega-terrorism, the variety of possible aims eventually threatened and the full range of methods usable in the attacks offer, for the near future, an uncertain perspective with respect to the scope of the risk to be faced. But when considering chemical, biological, nuclear and even informatics attacks, with large geographical areas potentially affected and their corresponding damage on lives and goods, the risk to be faced is almost similar to a war and, therefore, non-insurable.

Far from alarmist predictions, the 'Consortio' will celebrate this year 2004 its fiftieth birthday with the satisfaction of having developed, with proved effectiveness, a task of service to insurance industry and to Spanish society as a whole, and so hopes to do in the future.

## PART III B

### *Chapter 19*

# **The Turkish Catastrophe Insurance Pool (TCIP) and Compulsory Earthquake Insurance Scheme\***

*by*

S. Yazici\*\*

Permanent Delegation of Turkey to the OECD

The introduction of the Turkish Catastrophe Insurance Pool (TCIP), in 2000, provides a reliable method for compensation to homeowners in Turkey without reverting to government budget, social solidarity and risk sharing are effectively maintained through payments of affordable insurance premiums. Meanwhile, a large amount of the risk is being ceded to international reinsurance markets until sufficient financial resources are accumulated within TCIP. This chapter provides an overview of the rationale for the establishment of TCIP and of its specificities.

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\* This note was not presented during the Conference. It is included in the publication to complement the information provided by other reports on the TCIP.

\*\* Economic Counsellor.

## 1. Background

Turkey is one of the countries that have long been affected by many natural disasters, particularly earthquakes and floods. The existing earthquake map of Turkey demonstrates that 96% of the land is susceptible to earthquake risk with varying degrees, and a considerable part of the population is living in the first and second degree earthquake zones where most of the damaging earthquakes occur. The two major earthquakes in 1999 in the Marmara region (the August event was magnitude 7.4, and the November event was 7.2) caused loss of thousands of lives and enormous financial burden on the economy and government.

Historically, earthquake insurance has existed in Turkey for a long time. Earthquake coverage has been traditionally provided as an allied peril to the fire policy and engineering policy. However, the penetration for such insurance has been quite low, especially for residential buildings (5% on average) and in rural areas.

Studies to create a special earthquake insurance scheme first started after the Erzincan earthquake in March 1992. These studies have envisaged promoting private insurance on the one hand and creating a public fund on the other hand to support insurance market, as there was lack of capacity in the market to cover more risks, and the market was relying on foreign reinsurance which has been very expensive during the hard market of that time. However, as there has been no clear determination, no scheme has come into existence.

After the Adana earthquake of June 1998, the discussion has received fresh attention. Economic impacts of such continuing disasters and low insurance penetration led the authorities to initiate a new study to promote disaster insurance and establish a widespread and effective earthquake insurance scheme. This new study has been initiated by the Undersecretariat of the Treasury, which is also responsible for regulating and supervising the insurance industry, in collaboration with the local insurance market and the World Bank, which has engaged in a lending program with the government after the Adana earthquake. During this study, various disaster insurance schemes, including the California's CEA and New Zealand's EQC, have been examined.

This study and visits to CEA and EQC have helped the Treasury to shape a new insurance scheme. With the help of political momentum emerged following the Marmara disasters in August and November 1999, as well as public and insurance industry recognition of the need for action, this

scheme has received immediate acceptance, and the government decided to introduce it in 2000.

The legal framework of the new scheme was established by a decree with power of law. With this decree law, starting from 27 September 2000, taking out insurance was made compulsory for all residential buildings that fall within municipality boundaries, and The Turkish Catastrophe Insurance Pool (TCIP) was created to offer this insurance. Moreover, the obligation of the government to extend credit and construct buildings for the victims in case of an earthquake disaster (a requirement of the Disaster Law) was abolished (starting from 27 March 2001). The new insurance scheme has effectively replaced a big part of government obligations under the Disaster Law.

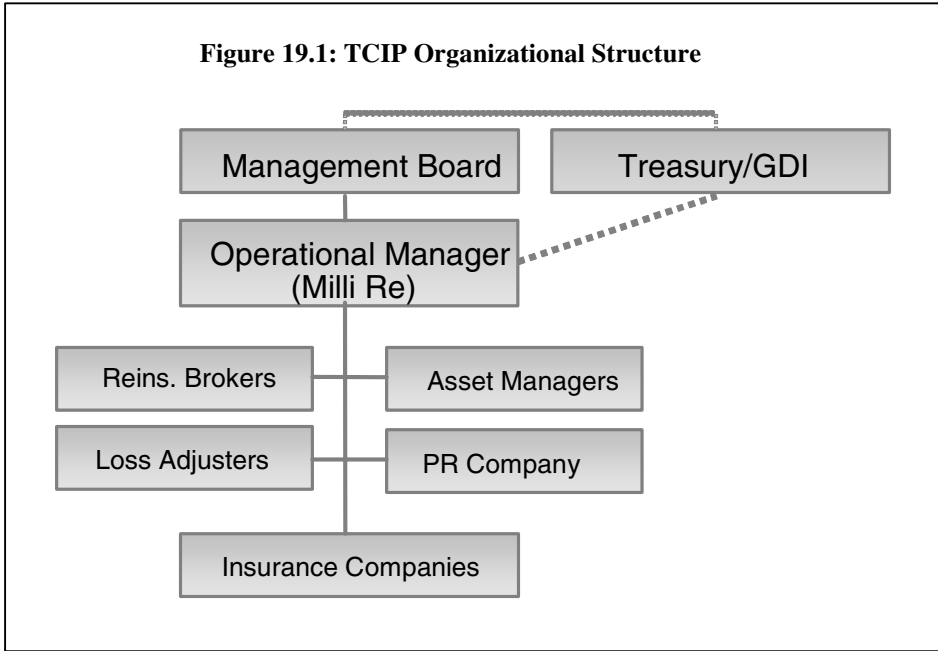
TCIP has been established under the supervision of the Treasury within the 9 months specified by the above mentioned decree law, and the first insurance policy was written on 27<sup>th</sup> of September 2000, as envisaged. The compulsory earthquake insurance scheme has aimed to offer such insurance coverage at affordable premiums, to alleviate the financial burden of earthquakes on the government budget (particularly relating to the construction of post disaster housing), to ensure risk sharing by residents, to encourage standard building practices, and to establish long term reserves in financing future earthquake losses.

With the introduction of the Turkish Catastrophe Insurance Tool (TCIP), a reliable method for compensation is provided to homeowners without reverting to government budget, social solidarity and risk sharing are effectively maintained through payments of affordable insurance premiums. Meanwhile, a large amount of the risk is being ceded to international reinsurance markets until sufficient financial resources are accumulated within TCIP.

## 2. Structure of TCIP

TCIP is a legal public entity managed through the TCIP Management Board consisting of representatives of the Prime Ministry, the Treasury, Ministry of Public Works and Settlement, the Capital Market Board, the Association of Insurers, the Operational Manager, and an earthquake scientist. Four members of the Board are public sector executives specialized in different areas, while two members represent insurance sector and one is from the academic community. The formation of the board and portraying of all key parties is very important in the success of TCIP. This has helped TCIP to better coordinate works, and increased ownership of the scheme.





Besides the Management Board, the Treasury is also a primary owner of the scheme. It is responsible for overseeing the whole program and auditing all operations and accounts of TCIP. The administrative and technical support of the Treasury has been a key factor for TCIP in achieving its goals. Other than the Treasury's audit, annual accounts are also audited by an independent auditing firm.

Operational management has been contracted out to Milli Re, the leading reinsurance company of Turkey, for five years. This contract is extendible for following terms. Milli Re has allocated part of its expert personnel to TCIP, and is ready to dedicate more human resources if needed. The operational manager receives payment depending on the overall volume of premiums received.

Aiming to minimize administrative costs and create an efficient operational structure, TCIP relies on external service providers for most of its operations. Insurance companies and their agencies are carrying out the distribution and marketing of policies. Almost all non-life insurance companies are participants of the scheme. The reliance on the ability of private insurers to sell policies and collect premiums has been very efficient in terms of reducing administrative costs. Participating insurers receive commission payments depending on the volume of premiums they have collected.

Public information campaigns are carried out with the help of a PR company and other subcontractors. TCIP has been carrying out massive information campaigns to increase insurance awareness and maintain and increase insurance takeout. Likewise, independent insurance loss adjusters commissioned by the operational manager are carrying out loss assessments when there is a reported loss.

TCIP and its revenues are exempt from all kinds of taxes, levies and charges to allow rapid accumulation of resources. Accumulated funds are kept in segregated accounts. Funds were being managed by the operational manager in the earlier years. However, with the increase in accumulated funds, two asset management companies have been retained in 2004 to manage funds. Funds are invested in diversified financial instruments following TCIP Board's investment guidelines.

### **3. Covered buildings**

The compulsory scheme covers only residential buildings that fall within municipality boundaries. Eligible policyholders are owners or usufructuaries of such buildings or flats.

Dwellings in small villages (with no municipality established) have been excluded from the scheme. The main reasons for this are as follows: First, homeowners in such areas have lower income level which makes it difficult for them to pay for insurance premiums. Second, the insurers' distribution network is not well established in such areas, which makes it expensive to distribute insurance. Thirdly, as the dwellings in those areas are more vulnerable, an actuarially fair price or even a subsidized price would not be affordable for homeowners at all. Therefore, state compensation under the Disaster Law for such small villages (constituting approximately 30% of the population) still prevails. On the other hand, such dwellings can be insured on a voluntary basis in the private insurance market.

### **4. Covered risks**

Compulsory earthquake insurance is a stand-alone product and is sold separately from fire or homeowner's insurance. It covers all material damages caused directly by an earthquake (including fire, explosion and landslide following an earthquake) to the insured building.

TCIP does not provide coverage for contents, movable goods, debris removal, loss of profit, liability, human injury and death. Coverage for such

losses can be purchased voluntarily under fire or homeowner's insurance from private insurance companies.

Although the original design of TCIP is a multi-peril natural hazard insurer, products for other natural hazards are not available yet. New products such as flood insurance are planned to be provided in the medium term.

## 5. Coverage and payment limits

TCIP aims to provide an adequate level of protection at affordable premiums. Therefore, the compulsory earthquake insurance has a ceiling in terms of coverage. This ceiling is approximately US\$ 50,000 as of December 2004 (in current exchange rate), which appropriately reflects the cost for reconstruction of a quality typical dwelling in Turkey. This limit is reviewed semi-annually according to changes in the construction price index. Policyholders are free to buy additional coverage in excess of this limit from insurance companies if the value of their dwelling is more than this amount. In such cases, TCIP policy works on "first loss" basis. In other words, there is no "average clause" applicable.

TCIP does not compensate for the land or any loss in market value of an insured dwelling. When assessing claims, TCIP takes into account market reconstruction prices at the date of event occurrence for each type of building, and any loss payment is limited to the sum insured. In the case of masonry type of buildings or small dwellings, the sum insured is usually below the maximum coverage limit as the reconstruction costs of such buildings are lower.

There is a 2% deductible applied over the sum insured. TCIP is responsible for the loss exceeding such an amount. However, there is no co-insurance condition.

The sum insured is calculated by multiplying the gross square meter of dwelling by the relevant unit reconstruction cost.

## 6. Insurance rates

Insurance rates account for seismicity and construction type. The earthquake map used by TCIP divides the country into five different categories of land according to the vulnerability factors whereas the tariff divides buildings into three categories according to their construction types. As the result of two groupings, fifteen different rates are applicable for buildings according to location and the type of construction. The rates range from 0.44 per mille at the lowest to 5.50 per mille at the highest (Table 19.1).

**Table 19.1 TCIP insurance rates**

Type of Construction	Risk Regions				
	I	II	III	IV	V
	Insurance Rates (‰)				
Steel, concrete	2.20	1.55	0.83	0.55	0.44
Masonry	3.85	2.75	1.43	0.60	0.50
Other	5.50	3.53	1.76	0.78	0.58

Although the rates have been adjusted, a similar tariff was being used by insurance companies before the new scheme was introduced. The aim in adopting a similar tariff and keeping the rate matrix simple is to avoid creating complexities which would confuse potential policy holders.

A flat rate pricing option was also discussed at the design stage. However, this has not received much acceptance because risk based approach was well established in the insurance market, and recognized as a fair approach. On the other hand, one might argue that the current rates are not well representing the actual risk. This is true especially in the case of the more vulnerable types of buildings, and this implies that some homeowners are subsidizing others. Therefore, the solidarity approach is not totally missing in the scheme. Although the rates have been readjusted in 2004 by 10% on average, this argument still prevails.

## 7. Financial resources and claim paying capacity

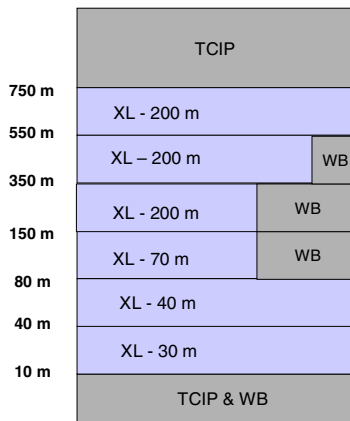
TCIP is a privately funded entity, and its funding has been primarily dependant upon premium contributions made by homeowners under the insurance scheme. TCIP has not faced any major disaster since the beginning of the program. Therefore, it could have accumulated some financial resources through retained insurance premiums and investment income in the last four years. However, since these resources are not sufficient, TCIP has to heavily rely on reinsurance to be able to indemnify policyholders if a major disaster occurs.

TCIP has been very successful in transferring its risks to international reinsurance markets up to now. The annual risk management and risk transfer program is prepared by the operational manager and discussed and approved by the Management Board. TCIP purchased reinsurance in the amounts of US\$ 540 million, US\$ 840 million and US\$ 740 million in 2001, 2002 and 2003 respectively. The 2004 reinsurance program is also in the amount of US\$ 740 million, and has 6 excess layers where the lowest

attachment point is US\$ 10 million (Figure 19.2). A similar program has been prepared for the year 2005 with the lowest attachment point being US\$ 15 million. TCIP also has an access to a contingent credit facility in the amount of US\$ 100 million from the World Bank, and a borrowing option from government in case of a major earthquake. All of these create a claims paying capacity of US\$ 1 billion for TCIP in 2005, which is, given the current portfolio, estimated to be adequate against a major disaster.

TCIP has been criticized in the past for paying too much for reinsurance. However, given the lack of adequate financial resources, there is no other viable solution than relying on foreign reinsurance. In fact, TCIP has been very diligent in keeping a balance between accumulating more resources and having adequate protection for probable losses. This policy has been very well managed until now despite the fact that the premium levels are low and the overall penetration has been lower than expected.

**Figure 19.2 TCIP 2004 risk management program (US\$)**



### 8. Claims payment

TCIP has had quite an experience regarding claims payment despite the fact that there has been no major disaster since the inception of the scheme. Table 19.2 below summarizes the claims paid by TCIP. The high frequency of small and medium size earthquakes occurring every year (21 events on average) is immediately evident from Table 19.2. This picture alone might indicate the importance of introducing the compulsory earthquake insurance scheme in Turkey. It is obvious also that the amount of payments would have been much higher if the insurance takeout by homeowners was higher.

**Table 19.2 TCIP claims payments (as of November 2004)**

Year	Number of Earthquakes	Number of Claims Paid	Total Payment (US\$)
2000	1	6	34,117
2001	17	338	89,554
2002	21	1,558	1,668,650
2003	20	2,503	3,529,277
2004	26	515	443,541
Total	85	4,920	5,765,139

TCIP has created a well functioning claims management system, and is continuously improving it in anticipation of a probable major event. Some features of this system are as follows:

- Claims filing: Claims can be filled through various channels, i.e.;
  - TCIP call center,
  - Internet (through TCIP website),
  - SMS messaging (established in cooperation with GSM operators),
  - Insurance companies and their agents.
- Claims assessment: Claims assessments are performed by independent loss adjusters commissioned by TCIP, following TCIP loss assessment guidelines.
- Local authorities are contacted immediately for exchange of information and to facilitate the assessment process.
- Loss adjusters have been previously retrained by TCIP for proper and consistent loss assessment.
- Training sessions are periodically repeated to keep loss adjusters up-to-date.
- Additional training programs are being held to create reserve loss assessment teams in case of a major disaster.
- IT system: IT system enables instant transfer of loss assessment data from the field, and quick payment of claims.
- Call center receives claims and notify policyholders about assessed damages.
- IT system also has capabilities of using bulk SMS messaging and e-mail messaging to notify policyholders about assessed claims and payments.

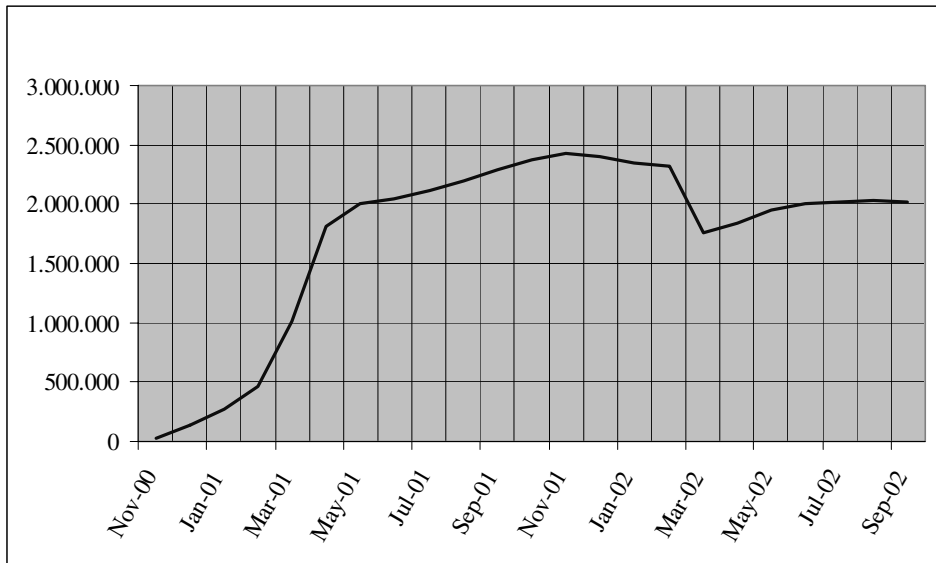
- Payment: After loss assessments are finalized and reports are approved, payments to policy holders are usually made through bank offices at the location of the occurrence directly by TCIP.
- Claims are paid within one month. In the case that loss adjustment extends to a longer period for any reason, policyholders are provided with advance payments.

## 9. Market penetration

Compulsory insurance scheme has been in force since 27 September 2000. After the inception of the scheme, there has been a gradual growth for 5 months, and the number of policies has reached 460,000. However, due to increasing awareness among homeowners and the fact that obligation of the government for post disaster housing arising from the Disaster Law was to disappear at the end of March 2001, there has been a boom in policy numbers in the next 3 months. Following this boom, the number has reached over 2 million by the end of May 2001 despite the severe economic crisis that the country was experiencing at that time (Figure 19.3).

Keeping the trend, insurance policy numbers have reached to their highest with 2,430,000 dwellings insured as of end November 2001. This number represents approximately 20% of the total dwellings that fall within the compulsory scheme. However, after this peak point, there has been stagnation for 4 months, and a major drop by April 2002 because of non renewal of insurance policies. The main reasons of such a dramatic drop have been the decreasing income level of homeowners due to continuing economic crises, and the changing attitude of the government in favor of providing disaster housing to the victims of the Afyon earthquake of February 3, 2002, which occurred in a relatively poor province with low insurance penetration (7.1%). Thousands of homeowners have refused to renew their policies with an expectation that the government will compensate for the damages regardless of the insurance program.

TCIP has led intensive public information campaigns to boost insurance sales. As a result of these campaigns and TCIP's fast payment performance, the decrease has been ceased, and a lot of the policies have been gained back. Even, the take-up rate in Afyon has increased from 7 to 12% in a few months. Afterwards, total policies have been maintained at around 2 million for the last two years.

**Figure 19.3: TCIP Policy Numbers in the First 2 Years**

TCIP public information campaigns basically involve commercials and documentaries broadcasted on national and local TV channels, TV and radio programs, newspaper ads, and various printed materials to be distributed to homeowners and elementary school students. Moreover, aiming to increase awareness and exchange views, a series of local campaigns have been pursued in a dozen of cities since March 2002, where TCIP officials meet with the local authorities, homeowners, insurance agencies and local media. These campaigns have proved to be very helpful in maintaining the current level of insurance penetration.

Among the main reasons for low penetration are relatively low insurance culture, the traditional role of the state in compensating for disaster damages and the continuing expectation of the public in this direction, low level of enforcement and difficult economic conditions experienced in recent years.

Despite disincentives for insurance through additional government compensation, it seems that there has been also some change in the behaviors of homeowners in the affected areas after a damaging earthquake. Table 19.3 below indicates that insurance take-up rates have noticeably increased in such areas. This result can be attributable to good public relations, high service quality and rapid settlement of claims of TCIP.



**Table 19.3 Insurance penetration after some earthquakes**

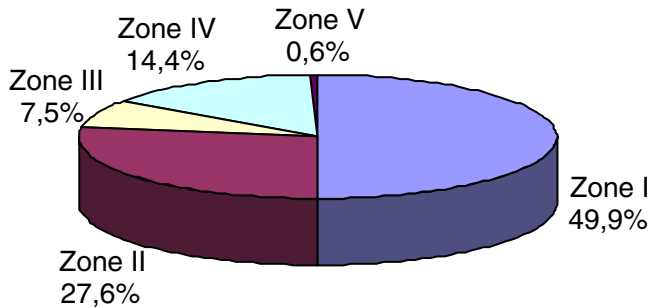
Place of Earthquake	Date of Earthquake	Penetration at the Date of Earthquake (%)	Penetration in November 2004 (%)
Afyon	February 3, 2002	7.1	11.3
Tunceli	January 27, 2003	6.4	11.2
Izmir	April 10, 2003	14.3	16.4
Bingol	May 1, 2003	1.7	9.7

As of November 30, 2004, the total policy number is 2,058,222, and the penetration ratio is 16%. This is a moderate level of penetration for a mandatory scheme, and is definitely not the desired level yet. However, it is well above the penetration of homeowner's insurance prior to the start of the new scheme, and is therefore promising.

On the other hand, insurance penetration varies across various geographic regions and risk regions. The take-up rate is obviously higher in the economically more developed parts of the country (Table 19.4), especially if it is a high risk area (Figure 19.4). This implies that different regions should be treated differently in terms of marketing and public relations.

**Table 19.4 Penetration across geographic regions (30 November 2004)**

Geographic Region	Number of Policies	Penetration %
Marmara	1,059,807	25.6
Central	353,969	15.9
Aegean	339,143	14.6
Mediterranean	132,227	8.0
Black Sea	102,485	8.0
East	40,994	6.7
South East	29,597	4.0
Overall	2,058,222	15.9

**Figure 19.4 TCIP Portfolio Across Risk Regions****Table 19.5 Some figures of TCIP**

	2001	2002	2003	2004*
Number of Policies (end of year)	2,427,000	2,128,000	2,022,000	2,058,000
Insurance penetration	18.7	16.4	15.6	15.9
Annual Premium Income (YTL)	54,240,600	66,605,100	86,305,345	122,371,800
Average Sum Insured (YTL)	14,760	19,970	27,165	35,078
Average Premium (YTL)	23	31	42	59
Claim Payment Capacity (US\$)	600 ml	900 ml	1,000 ml	1,000 ml

\*As of November 30, 2004

## 10. Enforcement of compliance

Although it is called “compulsory”, under the current legislation, there is no penalty or fine imposed for not buying insurance. For the enforcement of insurance, there are two main sanctions currently applicable:

- The government’s obligations to extend housing credit and to have buildings constructed, which arise from the Disaster Law, are abrogated as of March 27, 2001. Those who are required to carry earthquake insurance and fail to do so will not be eligible to receive any compensation from the government in the form of housing credit or

reconstruction of damaged buildings in case of an earthquake. However, this provision has been waived twice in four years since the beginning of the scheme. The first event was Afyon Earthquake of February 2002 (a magnitude 6.0 earthquake), and the second event was Bingol Earthquake of May 2003 (a magnitude 6.4 earthquake).

- Homeowners have to present their insurance policy documents in order for the real estate registration offices to affect any procedures related to the buildings subject to the compulsory insurance. This has been a well functioning checkpoint. However, the database of such offices is not updated in some provinces. There is an ongoing IT project to establish a more reliable real estate database. This may help to increase compliance to some extent in the future.

A recent draft law envisages extending such a requirement to other public services and creating some new checkpoints for compliance. If these new checkpoints are applicable, homeowners will be obliged to present their insurance policy documents when opening accounts for such services as gas, water, electricity and telephone. In fact, a pilot application has already been started in 5 cities regarding water and gas services. The enactment of the draft law will extend this application and provide the necessary regulation backing. Moreover, managers of apartment buildings will be given an auxiliary role in taking out insurance and renewal. Again, the current application of TCIP has already envisaged such a new role for managers as 10 percent premium discount is granted for such policies covering at least 8 individual units in the same apartment building. These new measures to improve compliance are expected to bring in a large number of new policies every year. However the draft law has not been sent to the Parliament yet.

## 11. Conclusions

Within a short period of time, the performance of TCIP scheme has proved to be a well designed public-private partnership program. Moreover, many continuing initiatives in various areas such as claims management, IT systems, risk management, fund management and public relations aim to further improve service quality, minimize costs, increase penetration, and make TCIP a better business entity.

One of the key initiatives worth mentioning is the development of a unique and comprehensive IT system which puts TCIP technologically ahead of most of the insurance companies. The installation of this IT system allowed TCIP to sell almost half of the policies through authorized users (insurance companies and their agencies) over the Internet. In addition, the system allows the insurance companies to issue policies using their own

infrastructure and make real-time transfer of data to the TCIP's central database. This enables TCIP to have real-time records about the sale of each policy. The system also provides for the instant transfer of all loss assessment data in case of an earthquake, and supports mobile communication devices. The IT system has a call center, and the capabilities of using SMS messaging and Internet technologies to notify policyholders about assessed damages. A Disaster Recovery Center is also established in another city. The next planned effort related to the IT system is to create a real time data exchange capability with the related agencies to improve compliance.

There may be several lessons that can be drawn from the Turkish experience of TCIP, especially for the countries facing similar conditions. It is not an easy task to make a big shift from conventional policies, and it may take several years to implement a real change in policies and behaviors. Such reforms are usually introduced in the aftermath of a major event. Although this is helpful in receiving support from various parties, working under intense conditions may lead to some errors in design, and lack of communication with all parties. The support may also diminish with the passing of time as people tend to forget the effects of such disasters.

Reform may be difficult to accomplish if there is a strong traditional role of the state in compensating the disaster losses. Things may even get more complicated when there is a sharp change of policy like abolishing all state support and replacing it with insurance. Low insurance penetration is the essential argument used by the government to step in when a disaster occurs. However, this tends to hinder insurance penetration in return. Instead of abolishing state compensation totally, which has not worked very well in the Turkish case, limiting state compensation and having a clear determination to promote insurance might serve both ways.

When measuring the success of TCIP, it is obvious that TCIP has been very efficient in providing compensation to its policyholders and the insurance take-up ratio has been improved a lot. Moreover, on the homeowners' side, when compared to the previous system of state compensation which used to replace houses in one year at the earliest, TCIP pays in cash within one month and provides a higher satisfaction in exchange of a small premium paid.

It can be said that a self-funding system against earthquake disasters would be created in the years to come when much of the building inventory can be taken into the TCIP portfolio. The current market penetration is promising for the future. However, there are still many challenges ahead for TCIP to be truly successful, especially in terms of compliance.



## PART III. C.

### **Role of Government and Public-Private Partnerships for Catastrophic Risks Management**

#### **C - Country Surveys – Emerging economies**

- Chapter 20*    **Natural disasters and Disaster Relief Policy in China**  
by Y. Zheng.
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by R. Flores.



## PART III C

### *Chapter 20*

## **Natural Disasters and Disaster Relief Policy in China**

*by*

Y. Zheng\*

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Ministry of Civil Affairs

China's disaster prevention, disaster resistance and disaster relief system as well as its social mobilizing system have generally played a crucial role to cope with the losses arising from natural disasters. These systems have effectively eased the damage caused by natural disasters, guaranteed the basic living of people in disaster areas and also maintained the social stability together with the economic development. The frequency and severity of natural disasters in China is however worrying and improving the disaster control system as well as disaster monitoring, early warning, emergency response and recovery management level is not an easy task. In this respect, this chapter provides an overview of the current scheme and policies in place in China and of challenges still to be faced.

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\* Deputy Division-General.



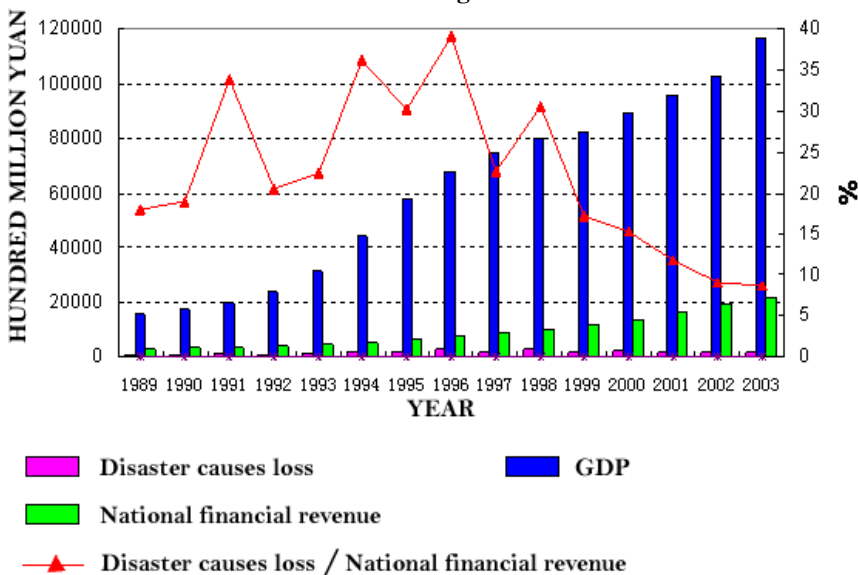
# 1. The Main Characteristics of Natural Disasters and Its Development Tendency

## 1.1. The hazardous consequence of natural disasters

Based on their cause, natural disasters can be classified in 5 categories: meteorological disasters, including droughts, floods, tropical cyclones, hails, great rainfalls, rainstorms, sandstorms; geological disasters including earthquakes, landslides, mudflows; oceanic disasters, such as windstorms, hazardous sea-waves; forest and grassland diseases and pests as well as forest and grassland fires.

Frequent occurrence of disasters has caused great losses in the Chinese history. Natural disasters, especially floods, droughts, typhoons, earthquakes, fires and landslides, as well as mudflows, have occurred more frequently since the 1990s and the economic losses have increased greatly. Annually, the population struck by disasters amounts to 370 million, affected agricultural areas to about 50 million hectares and 4.18 million houses are destroyed. The annual population evacuated in emergency amounts to 4 million. and the direct economic losses are more than 100 billion Chinese Yuan, which is 40% more than that in 1980s.

Figure 20.1



Overall, flood, drought and earthquakes are the main natural disasters affecting China and the economic losses caused by them represent 80%-90% of losses caused by all kinds of disasters.

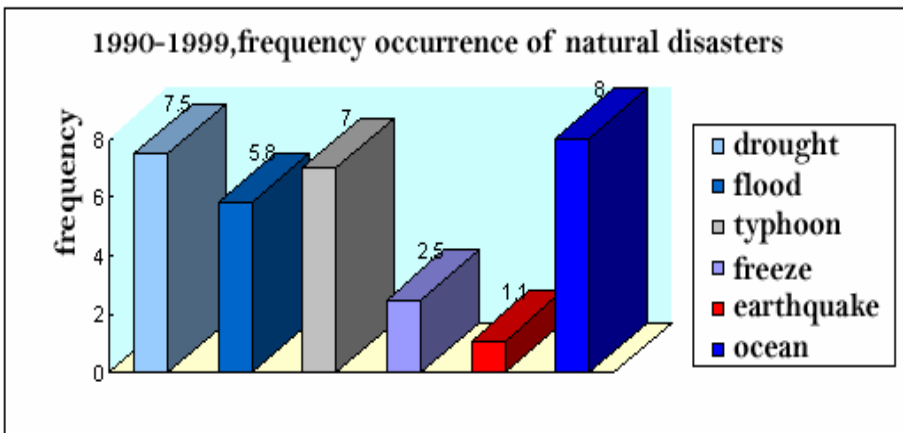
To the world, the disaster situation is in the same picture and the disaster losses have clearly increased from the 1970s to the 80s and the 90s. Although the total number of deaths has decreased from 1.96 million to 0.8 million and 0.79 million, the affected population has increased from 740 million to 1450 million and 1960 million. and the direct economic losses (in the price of 2000) have increased from \$131 billion to \$204 billion and \$629 billion.

According to the analysis of the disaster development tendency, the global climatic change and human activity are the main elements influencing the causes of the disasters.

### *1.2. The main characteristics of natural disasters in China*

Because of the specific geographic and climatic background as well as the social and economic situation in China, there are typical temporal and regional characteristics.

**Figure 20.2**



### *1.3. The frequent occurrence of meteorological disasters due to the monsoon climatic situation*

The monsoon climate causes considerable temperature and precipitation changes throughout the year, causing frequent floods and droughts in large areas. Snowstorms and low temperatures have also caused great losses in winter. Along the coast areas, the 7-8

typhoons landing annually have caused much loss due to strong winds and rainfall.

#### ***1.4. The frequent occurrence of earthquakes due to the location among the three geological areas***

China is located at the junction of Eurasia, Pacific and Indian Oceanic areas. This area is also often struck by earthquakes and lines in the Eurasian Earthquake Belt, Himalaya Earthquake Belt and Pacific Ocean Earthquake Ring. In China, Bohai Sea Bay area, Southwestern and Northwestern areas are the most exposed to earthquakes. About one third of all destructive earthquakes in the world during the 20<sup>th</sup> century happened in China. Since 1949, 477 destructive earthquakes have occurred in China, causing the death of 278 thousand people and injuring 760 thousand. Moreover, the earthquakes have also totally destroyed 6 million houses and caused 42 billion Chinese Yuan of the direct economic losses.

#### ***Joint belt of three major plates with frequent earthquakes***

China is located at the joint belt of three major plates, namely, the Euro-Asian, the Pacific and the Indian plates, where tectonic movement is quite active. It is also an important distribution range of Euro-Asian, Pacific and Indian seismic belt. Earthquakes frequently affect the circumference of Bohai Gulf, Southwest regions and several provinces in Northwest regions. In the 20<sup>th</sup> century, destructive earthquakes that occurred in China accounted for one third of all earthquakes in the world. Since 1949, China has been struck by 477 destructive earthquakes, which killed 278,000 people, injured 760,000, and caused damage to 11 million buildings (of which more than 6 million were toppled down). The direct economic losses have reached 42 billion RMB.

#### ***Many geological disasters are directly due to the complex topographical condition of China***

China, where hilly and plateau areas occupy 69% of all the land areas, is frequently affected by geological disasters: landslides, mudflows etc. According to statistics, geological disasters cause about 1000 deaths every year and the annual economic losses are more than ten billion Chinese Yuan.

*The under-development in the high risk areas hinders the improvement of the capacity of disaster mitigation.*

The high risk areas are mostly poor areas, especially in the west and middle regions, when disasters make the poor victims poorer and take away the wealth of the others.

*Weakness in resisting natural disasters causes even bigger loss*

Large population, economic underdevelopment, imbalance in regional economic development and weakness in enduring and resisting natural disasters in rural areas, especially in middle and west regions, are among the main reasons why some regions of China are relatively underdeveloped and some rural residents are still living in poverty or are brought back to poverty. The East part of China and the coastal areas are advanced in development. These areas are however very exposed to and frequently affected by different kinds of natural disasters. Once cataclysmic disasters happen, economic losses are tragic.

## **2. China's Basic System on Natural Disaster control**

On the one hand, China's disaster prevention, disaster resistance and disaster relief system as well as its social mobilizing system have generally played a very crucial role. These systems have effectively eased the damage caused by disasters, guaranteed the basic living of people in disaster areas and also maintained the social stability together with the economic development. On the other hand, the current situation is still serious and sometimes even worse due to unreasonable human activities and environmental degradation. Therefore, it is an arduous task to improve the disaster control system as well as its capability on disaster monitoring, early warning, emergency response and recovery management level.

### ***2.1. Leadership and coordination system regarding disaster control***

The basic leadership systems of China's disaster control are: a unified leadership of authorities of all levels, division of work among different sections, classified disaster control, making full use of the armed forces' pioneering function. With regard to China's integrated coordination system for disaster control, at present, under the unified leadership of the state council, the central government has set up many sections in charge of coordinative and organizational work for disaster control. For example: China International Committee for Disaster Reduction, National

Commanding Headquarter for Flood Prevention and Drought Resistance, National Headquarter for Earthquake Resistance and Relief, National Comprehensive Coordination Office for Disaster Resistance and Relief. These sections not only provide decision-making service for the central government but also ensure the timely implementation of decision from central authorities to local levels.

In parallel with the regulated coordination and operation system established from central to local, governments of all levels have their own sections responsible for disaster control. Each section does its own work, cooperates closely with the others and forms a network for disaster control. Personnel, fund and facilities of corresponding sections provide a firm guarantee for starting disaster control work.

## ***2.2. Public Policy on Disaster Emergency Relief***

In order to enhance disaster emergency relief capability aiming at all kinds of major natural disasters, the Ministry of Civil Affairs (MCA) has in recent years pushed the implementation of a national emergency pre-planning system for disaster relief. Currently, 17 provinces have already promulgated emergency pre-plans for disaster relief, 80% of the cities and counties have also stipulated such emergency plans. A national emergency preplanning and responding system for disaster relief was fundamentally formulated.

In 2003, the MCA promulgated “Working Procedures In Case of Unexpected Natural Disaster” right in time. This document classifies the responses to unexpected natural disasters into 3 levels according to the scale and severity of each disaster (see table 20.1). It also clarifies detailed working measures for each level and carries out emergency relief works in line with regulated management procedures. Classification measures are as follows:

If a natural disaster occurs in one province (Autonomous Region or municipality directly under the Central Government), and one of the followings appears in a single disaster, the corresponding emergency response will be activated.

**Table 20.1 Working procedures in case of unexpected natural disaster**

Levels	Mortality (Unit)	People transferred (Ten thousand)	Buildings Destroyed (Ten thousand)	For Destructive earthquakes
3 <sup>rd</sup>	30—50	10—30	1—10	1. Mortality:20—50 2. People transferred and arranged in urgency: 100,000—300,000 3. Buildings toppled down and damaged: 10,000—100,000
2 <sup>nd</sup>	50—100	30—80	10—15	1. Mortality:30—100 2. People transferred and arranged in urgency: 300,000—800,000 3. Buildings toppled down and damaged:30,00—150,000
1 <sup>st</sup>	Above 100	Above 80	Above 15	1. Mortality:50 above 2. People transferred and arranged in urgency: Above 800,000 3. Buildings toppled down and damaged: Above 100,000

Meanwhile, in case of accidents, public health events, social security events or other public emergency events causing casualties and requiring emergency personnel evacuation or relief, the response plan described hereafter shall also be activated.

After activation, the main measures taken by MCA include:

- Gather, assess and understand the disaster situation in time, and provide the population with the necessary information on the disaster and relief works;
- Report to the corresponding agencies on the disaster situation as well as the progress of disaster relief works in time, and coordinate assistance measures to local areas from the central government;
- Dispatch special work groups in time to disaster areas to guide the relief works, supervise local authorities for better implementation of the public policy on disaster relief and to liaise between the MCA and the afflicted local office;
- Distribute emergency relief fund and allocate relief supplies in time to support the local relief activities;
- Adequately organize public donation activities for disaster relief; if needed, mobilize the population to participate in relief works;

- Properly evacuate the victims and ensure their basic living, and guide local authorities to start reconstruction work in time.

The establishment of the above-mentioned response system ensures that emergency relief plans can be activated at any time and that disaster relief personnel, fund and supplies can be in position in the shortest time in case of a disaster. It is initially guaranteed that afflicted people in disaster-struck areas can receive necessary assistance (mainly food, drinking water, shelter, clothes and medical care) within 24 hours. In 2003, about 7.07 million people were urgently transferred and resettled because of a disaster, among which 3 million were temporarily accommodated for more than one month. In 2004, 62 work groups were sent out by the MCA, an amount of 330 million RMB of emergency relief funds was distributed in 22 times and 1.4 billion RMB reconstruction fund was distributed. 2.11 million houses were rebuilt and more than 80 million afflicted people were settled adequately. The basic rights and interests of afflicted people were safeguarded and social stability in disaster-struck areas was guaranteed. During this term, in order to prevent the flood in Huai River and Wei River drainage areas, the MCA timely activated the 1<sup>st</sup> level of the disaster relief response procedure on July 21<sup>st</sup>. Throughout the year, the 3<sup>rd</sup> response was activated 14 times and the duration of response added up to more than 4 months.

### ***2.3. Expenditure of Disaster relief***

In recent years, central institutions have further improved the financial subsidy mechanism for disaster-struck areas, in with the fields of agriculture, irrigation, education, transportation, communication, people's life and restoration. At present, central subsidies to local disaster relief work include mainly: living relief fund, sanitation relief fund, flood prevention and drought resistance fund, pre-flood emergency fund, fund for roads damaged by flood, educational and administrative relief fund, agricultural relief fund and reconstruction fund. In 2003, China in all devoted 8.03 billion RMB to disaster relief, of which 4.05 billion came from the MCA and the MOF (Ministry of Finance).

For the living relief fund, the MCA and the MOF arrange relief and subsidy funds for large-scale natural disaster through 3 instruments: the emergency relief fund, the reconstruction fund and the desolation relief fund. The emergency relief fund is used for afflicted people emergency rescuing, transferring and accommodation in case of unexpected disaster. Its focus is to provide afflicted people with temporary but urgent boarding, clothing, lodging and medical care, which afflicted people cannot obtain by themselves. The amount of funds to be provided shall conform to specific standard, for instance the number of afflicted people to be transferred and accommodated. The reconstruction fund is meant to ease the living

difficulty of afflicted people during reconstruction period. Its focus is to repair or restore the buildings damaged during the disaster. The amount of funds to be provided shall be determined according to the number of afflicted people and demolished buildings. The desolation relief fund is divided into spring and winter reliefs. Spring sector lasts from March to May, winter sector lasts from December to February the following year. Spring and winter reliefs are used to solve the problem of ration, cloth, quilt and health. The amount of funds to be provided shall depend on the number of afflicted people, the duration of the relief need and the size of the area damaged directly by disaster.

To ensure the implementation of emergency relief work, the MCA and the MOF have established a contingency relief fund system, verifying the time requirement for funds distribution. On the lay of central government, it is stipulated that contingency relief funds must be distributed 2 or 3 days later after the occurrence of a disaster. For example, in 2003, an earthquake took place in Shandan, in the Gansu Province. Contingency relief funds were distributed by the central government after only 6 hours. On the lay of local government, it is stipulated that contingency relief funds must go from province level to county level in 10 days and from county level to afflicted people in 5 days. Spring and winter desolation relief funds distributed by the central government must go from province level to county level in 30 days and from county level to afflicted people in 15 days.

While the central government allocates relief funds, the MCA actively promotes the classified system on diversion of the commitment on relief funds burden among the different level governments in order to mobilize relief funds efficiently. This mechanism has been put in use since 1994 by the MCA and the MOF. Local relief funds allocated increased from 840 million RMB in 1995 to 2.44 billion RMB in 2003. Funds devoted by local authorities of all levels account for one half of the central budget. The establishment of a disaster control system further accentuates the responsibility of authorities of all levels; helps increase the input of relief funds and effectively guarantee afflicted people's basic living.

#### ***2.4. System of Relief Supplies Reserve***

The MCA and the MOF started to build up a central system for relief supplies reserve. Currently, reserve sites of relief supplies of central level have been set up in more than 10 cities, among which Harbin, Tianjin, Zhengzhou, Wuhan, Changsha, Nanning, Chengdu and Xi'an. Local reserve sites have also been set up in areas that are easily and frequently exposed to natural disasters. A relief supplies reserve network based on relief storage has also been established. Until the end of 2003, the central storage has stored and distributed 271,000 tents. In the year 2003, 130,000 tents were



urgently transported and allocated in 52 batches. It was a record since the establishment of the central relief supplies reserve system in 1998. Those tents were mainly used in the relief operations following the earthquakes of Bachu-Jishi of Xinjiang, Zhangye of Gansu, Dayao of Yunnan, Chifeng of Inner Mogolian as well as the floods alongside Huai River, Wei River and Yellow River. They played an important role in resettling the evacuated people.

Besides, China successively promulgated and implemented more than 30 laws and regulations regarding the reduction of disasters: the Water and Soil Conservation Law, the Earthquake Prevention and Disaster Relief Law, the Flood Prevention Law, the Meteorological Law, etc. Disaster control work has been greatly improved and legalized.

In recent years, scientific and technological applications in the field of disaster control were further enhanced. People understand more and more the formation and development factors, such as meteorology and earthquakes, of major disasters. The technique of disaster monitoring and evaluation has been much further developed. Such advancement provides concrete scientific basis for the government to shape integrated measures for disaster prevention and relief as well as to conduct positive disaster control.

The Chinese government gives great importance to international communication and co-operation in the field of disaster relief. In the recent years, our co-operation with other countries or international institutions in this field has focussed on the following 3 aspects: 1) International aid after the occurrence of a disaster; 2) Bilateral and multilateral co-operation among countries located in disaster-struck areas; 3) Communication and co-operation among corresponding international organizations and non-governmental organizations in the field of disaster control.

### **3. Challenges in Disaster Control and Relevant Measures**

Although great achievements have been made in our disaster control system, there is still inefficiency in current work. We still cannot meet the economic and social development need properly. It mainly appears that:

#### ***3.1. Awareness of disaster risk is quite weak.***

The obvious contrast between the increasing risk of disasters and the lack of knowledge on disaster prevention & reduction keeps us far away from the real need. In many cases, some casualties should have been avoided. For example: on July 12<sup>th</sup> 2003, a mud-rock flow broke out in Danba County, in the Sichuan Province, and took away 51 lives. There had

been some signs and warnings before the tragedy but, unfortunately, people got drown in mud, because of their negligent behaviour.

***3.2. The administrative system coping with natural disasters is not comprehensive. The capability of emergency response and quick handle of disaster control needs improvement.***

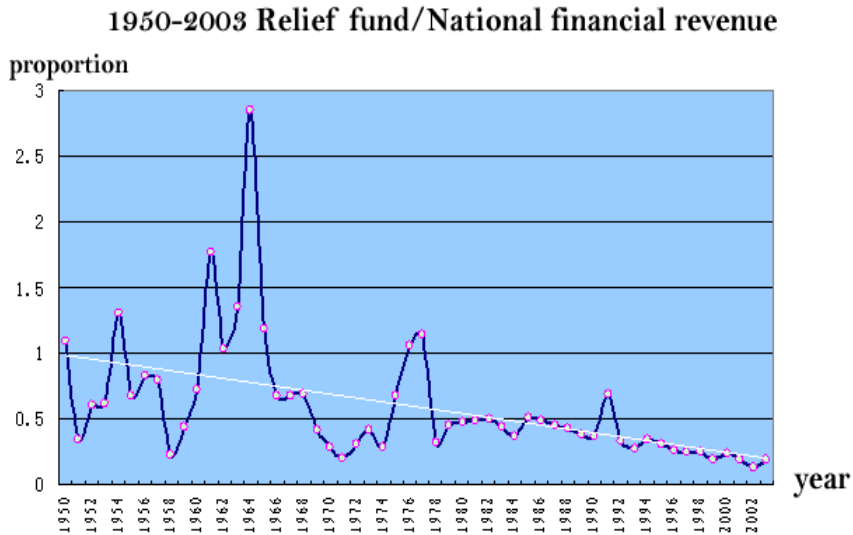
Detailed and practical standards, procedures and regulations in guiding rescue are needed. Due to the lack of appropriate materials, of effective measures after relief works start and of comprehensive response plans, people make plans but without rehearsal, making it very difficult for such plans to be fully executed. Many phenomena also appear unregulated due to the lack of comprehensive laws, regulations and other administrative regulations.

***3.3. A gap still exists between the need for relief and actual inputs for disaster control, especially as regards to aid for afflicted people.***

On the one hand, after reform and opening up, China's economy has thrived tremendously. The national financial revenue bounced from 6.2 billion RMB in 1950 to more than 2,000 billion RMB in 2003. In the meantime, the input from the central government for disaster relief increased from 60 million RMB in 1950 to 4.05 billion RMB in 2003, which clearly indicates the central government's great attention to disaster relief work.

On the other hand, natural disasters nowadays always take place in those economically underdeveloped areas inhabited by ethnic minority groups. Financial difficulty is very obvious and people's self-relief ability is rather weak in these areas. Moreover, the funds allocated by the government are still insufficient to fully meet the actual relief needs.

Figure 20.3



In order to improve the work in the field of disaster relief and ensure that the afflicted people get effective aid on time, emphasis needs to be put on the following points:

- **Conduct a nationwide education program on people's awareness of disaster reduction.** Emphasis should be put on enhancing consciousness of reducing natural disaster in the whole society, and enhancing the disaster control level of the governmental staff.
- Further enhance the division of tasks between different departments under the unified leadership of the government, and strengthen the mechanism of disaster control. Emphasis should be put on further improving the emergency mechanism, the coordination mechanism, the social mobilizing mechanism, the information sharing mechanism and the supervision mechanism of disaster control, forming concerted efforts of disaster control by bringing the comprehensive coordinating function of disaster resistance and relief into full play and strengthening the communication and coordination of information among the different disaster control departments.
- **Further strengthen and improve the emergency plan system for natural disasters.** We need to speed up the formulation of a department plan for disaster control, efficiently link up the different department plans and establish a plan system for disaster control for China as soon as possible.

- Fully strengthen the development of a disaster information system and bring disaster monitoring, forewarning and forecasting onto a higher level. We should continue to strengthen the information system of disaster control, tighten up the development of an information sharing system of disaster control among different departments. Besides, we need to make full use of modern methods of observation and measurement to forewarn and forecast possible disasters. We need to make sure that after the occurrence of a major natural disaster, reports by local governments in disaster-struck areas on the situation and the efforts of disaster relief can reach the central government within 24 hours as to provide information guarantee for disaster resistance and relief.
- **Further enhance the capability to respond to major natural disasters.** According to relevant regulation of disaster relief, after the occurrence of a major disaster, it is a basic responsibility of the county-level governments in disaster-struck areas to provide basic living aid, especially food and drinking water within 24 hours, to urgently transferred people. This shall be a basic function of authorities at county level in disaster areas.
- **Set up a standard work system to recover and rebuild disaster-struck areas.** Under the unified leadership of government in disaster-struck areas, on the basis of careful planning, scientific guidance and full respect of the wishes of the farmers, we need to efficiently fulfil the task of recovering and rebuilding disaster-struck areas, as well as settling the afflicted people, as to provide assurance for the recovery of a normal production, living and social order.
- **Further clarify the responsibility at each level and guarantee the input of disaster relief.** We need to analyse and clarify in detail the responsibility of government on each level, and carry out in full scale the government responsibility system of disaster control.
- **Perfect the legal system of disaster control as soon as possible.** To perfect the legal system of disaster combat and relief, emphasis should be put on constituting the Law of Disaster Relief as soon as possible to standardize the work of natural disaster relief.

Moreover, it is an urgent task for the government and business society to form jointly an insurance mechanism to cope with disaster relief and recovery processes. Since the 1990s, there have been several pilot studies and trials for insurance tools to use in China. However, this mechanism is still not efficient and has not been widely applied after the occurrence of disasters. It would be beneficial for the victims and government if the experiences and expertise from the international community could be integrated to improve the disaster relief system in China in the future.



## PART III C

### *Chapter 21*

## **Disaster Management in India**

*by*

D. Madan \*

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India is highly vulnerable to natural disasters. About 60% of the landmass is prone to earthquakes; over 40 million hectares is prone to floods; about 8% of the total area is prone to cyclones and 68% of the area is susceptible to drought. In addition, man-made disasters due to terrorist activities using conventional weapons or nuclear, biological and chemical materials may also be a potential threat to national security. The basic responsibility for undertaking rescue, relief and rehabilitation measures in the event of a disaster is that of the concerned State Government. The Central Government supplements the efforts of the State Governments by providing financial and logistic support in case of major calamities. Against this backdrop, this chapter provides an overview of the mechanisms in place in India to compensate and mitigate its large exposure to natural and man-made disasters.

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\* Under Secretary.

## **Introduction**

India has been vulnerable to natural disasters on account of its geo-climatic conditions. About 60% of the landmass is prone to earthquakes; over 40 million hectares is prone to floods; about 8% of the total area is prone to cyclones and 68% of the area is susceptible to drought. In addition, man-made disasters due to terrorist activities using conventional weapons or nuclear, biological and chemical materials may also be a potential threat to national security.

### **1. Role of Central and State Governments**

The basic responsibility for undertaking rescue, relief and rehabilitation measures in the event of a disaster is that of the concerned State Government. The Central Government supplements the efforts of the State Governments by providing financial and logistic support in case of major calamities.

#### ***Transfer of Subject***

The subject of Disaster Management (excluding drought) was transferred from the Ministry of Agriculture to the Ministry of Home Affairs in February, 2002.

#### ***Change in Orientation***

There has been a shift in focus from post disaster relief and rehabilitation to encompass the entire cycle of disaster management including mitigation, preparedness, response, relief and rehabilitation.

### **2. National Disaster Management Framework**

In line with the change in orientation, a strategic framework has been drawn up covering institutional mechanisms; early warning systems; disaster prevention and mitigation; legal and policy framework; network of emergency operation centres; preparedness, response and human resource development. The framework has been shared with all the State and UT Governments.

### 3. Institutional and Policy Framework

The institutional and policy mechanisms for carrying out response, relief and rehabilitation have been well established since Independence. These mechanisms have proved to be robust and effective. The changed approach, however, mandates a priority to pre-disaster aspects of mitigation, prevention, and preparedness. New institutional mechanisms are being put in place to address this change in approach.

### 4. National Emergency Management Authority

Disaster Management involves multi-disciplinary functions encompassing a number of Ministries/Departments. Institutional mechanisms which would facilitate this inter-disciplinary approach are being put in place. A National Emergency Management Authority is proposed to be constituted, headed by Secretary/Special Secretary in the Ministry of Home Affairs and with representatives from various relevant Ministries/Departments as members.

The State Governments have also been requested to set up Disaster Management Authorities in States on similar lines.

### 5. National Policy on Disaster Management

A National Policy on Disaster Management is in the process of being finalized. The broad features of the Policy on Disaster Management are as follows:

- Adoption of a holistic and pro-active approach towards prevention, mitigation and preparedness.
- Incorporation of mitigation measures in the on-going schemes/programmes.
- Prioritisation of projects addressing mitigation, where there is a shelf of projects.
- Community involvement and awareness generation, particularly that of vulnerable segments of population.
- Interaction with the corporate sector, non-governmental organizations and media in the national effort for disaster prevention/vulnerability reduction.



- Formulation of Standard Operating Procedures and Disaster Management Plans at state and district levels as well as by relevant Central Government Departments.
- Compliance with construction designs laid down in the relevant Indian Standards.
- Evaluation and, where necessary, retrofitting of lifeline buildings such as hospitals, railway stations, airports, airport control towers, fire station buildings, communication network, major administrative buildings, etc. in high seismic risk zones.
- Conversion of relief codes into disaster management codes for institutionalising the planning process.

## **6. Disaster Management Act**

The States have been advised to enact Disaster Management Acts to provide for adequate powers for authorities coordinating mitigation, preparedness and response as well as for various mitigation/preparedness measures required to be undertaken.

## **7. Disaster Mitigation**

### ***7.1. National Core Group for Earthquake Risk Mitigation***

A Core Group for Earthquake Risk Mitigation has been set up with eminent experts in earthquake engineering and administrators as members. The Core Group has mainly been assigned the responsibility of drawing up a strategy and plan of action for mitigating the impact of earthquakes; and providing advice and guidance on various aspects of mitigation.

### ***7.2. Review of building bye-laws and their adoption***

An Expert Committee appointed by the Core Group on Earthquake Risk Mitigation has prepared a report covering appropriate amendments to the existing Town and Country Planning Acts; Land Use Zoning Regulations; Development Control Regulations and Building Byelaws which could be used by the State Governments and the local bodies to upgrade their existing legal instruments. These have been shared with the State Governments.

### ***7.3. National Programme for Capacity Building for Engineers & Architects in Earthquake Risk Mitigation***

National Programmes for Capacity Building in Earthquake Risk Mitigation for engineers and architects have been launched to assist the State Governments in building up capacities for earthquake risk mitigation. Under these programmes, 10,000 engineers and 10,000 architects in States will be imparted training in seismically safe building designs and related techno-legal requirements, over a period of three years.

### ***7.4. Inclusion of Earthquake Engineering at Undergraduate level in Engineering/Architecture curricula***

Earthquake engineering aspects are expected to be included at the undergraduate level in engineering colleges/Institutes of Planning and Architecture from the academic year 2005-06.

### ***7.5. Emergency Health Management for Medical Education***

Emergency Health Management for dealing with disaster situations is proposed to be made a part of the course curricula of medical colleges at undergraduate level. Committees with representatives from several resource institutes have been constituted for the development of curriculum for Emergency Health Management for medical students at undergraduate level and training module for in-service Health Managers.

### ***7.6. National Earthquake Risk Mitigation Project***

An Earthquake Mitigation Project has been developed for detailed evaluation and retrofitting of lifeline buildings. The programme also includes training of masons in earthquake resistant constructions as well as providing assistance to the State Governments to put in place appropriate techno legal regime.

### ***7.7. Accelerated Urban Earthquake Vulnerability Reduction Programme***

An accelerated urban earthquake vulnerability reduction programme has been taken up in 38 cities in seismic zones III, IV & V with a population of over half a million. A large number of orientation Programmes have been organized for senior officers and representatives of the local planning and development bodies to sensitize them about the earthquake preparedness and mitigation measures. Training programmes have been organized for engineers and architects on seismic safe construction and implementation of BIS codes. Education programmes are being organized in schools, colleges

and other educational institutions. Awareness generation programmes for the community are also being undertaken in these cities. The cities are also being assisted to review and monitor their building byelaws to incorporate multi-hazard safety provisions and develop disaster management plans.

### ***7.8. National Core Group on Cyclone Monitoring and Mitigation***

A National Core Group on Cyclone Monitoring and Mitigation has been constituted with experts from Indian Meteorological Department, National Centre for Medium Range Weather Forecasting, Central Water Commission, National Remote Sensing Agency and Indian Space Research Organisation, besides administrators from relevant Ministries/Departments and State Governments. The Group has been assigned the responsibility of looking at warning protocols for cyclones; technology upgradation; coordination mechanism between Central and State Ministries/Departments/Organizations; mechanism for dissemination of warnings to local people and cyclone mitigation measures required to be taken for the coastal states. The cyclone warning formats have been revised to make them more meaningful and user friendly to the community at risk. A project has been taken up for upgradation of models for cyclone track prediction.

### ***7.9. National Cyclone Mitigation Project***

A project for cyclone mitigation has been drawn up in consultation with cyclone prone States. The project envisages construction of cyclone shelters, coastal shelter belt plantation in areas which are prone to storm surges, strengthening of warning systems, training and education, etc. The project is likely to be supported by the World Bank.

### ***7.10. Landslide Hazard Mitigation***

A National Core Group on Landslide Hazard Mitigation has been constituted with representatives from Departments of Science & Technology, Road Transport and Highways, Geological Survey of India and National Remote Sensing Agency as members. The Core Group has been assigned the responsibility of drawing up a strategy and plan of action for mitigating the impact of landslides; to provide advice and guidance to the State Governments on various aspects of landslide mitigation and landslide hazard zonation and to evolve early warning systems and protocols for landslide risk reduction. The Geological Survey of India (GSI) has been designated as the nodal agency. The States have been requested to share the list of habitations close to landslide prone areas in order to supplement GSI's on-going assessment of such areas.

## **8. Disaster Risk Management Programme**

A disaster risk management programme has been taken up in 169 districts in 17 multi-hazard prone States with assistance from UNDP, USAID, European Union and few other international agencies. The programme states are being assisted to draw up State, District and Block level disaster management plans; village disaster management plans are being developed in conjunction with the Panchayati Raj Institutions and disaster management teams consisting of village volunteers are being trained in preparedness and response functions such as search and rescue, first-aid, relief coordination, shelter management plans etc., The State and District level multi-hazard resistant Emergency Operation Centres (EOCs) are also being set up under this programme including provision of equipments for EOCs. Orientation training of engineers, architects and masons in disaster resistant technologies has been initiated.

### ***8.1. National Institute of Disaster Management***

National Institute of Disaster Management (NIDM) undertakes training of trainers and organizes training programmes for planners, administrators and command functionaries. The Institute has also been entrusted with the responsibility of development of National level information base on disaster management policies, prevention mechanisms, mitigation measures and providing consultancy to various States in strengthening their disaster management systems and capacities and development of strategies for hazard mitigation and disaster response.

### ***8.2. Disaster Management Faculties in Administrative Training Institutes in States***

Disaster Management Faculties have been created in 29 State level Training Institutes. These faculties are being financially supported by the Central Government. The State Training Institutions take up focused training programmes on disaster management for different target groups within the State.

### ***8.3. All India Services***

Training curricula have been drawn up and integrated in the syllabus of All India Services (IAS, IPS and Indian Forest Services). Training modules are being developed for other Civil Services at National and State levels.

### ***8.4. Awareness Generation***

A National programme for awareness generation as a part of overall disaster risk management strategy is being undertaken.

### ***8.5. Disaster Management in School Education***

Disaster Management as a subject in Social Sciences has been introduced in the school curricula for Class VIII and IX through Central Board of Secondary Education. The curricula for Class X are under preparation and will be introduced from the academic year 2005-06. Training of teachers for teaching the curricula has been undertaken. State Governments have also been advised to take similar steps through their school education boards.

### ***8.6. Information, Education and Communication***

In order to assist the State Governments in capacity building and awareness generation activities, the Ministry has compiled a set of resource materials developed by various organizations/institutions. This has been shared with State Governments for further dissemination down to the village level, in local languages.

## **9. Preparedness**

### ***9.1. Specialist Response Teams***

Eight battalions of Central Para-Military Forces are being converted into Specialist Response Teams. Four of these will also be trained and equipped for responding to nuclear, biological and chemical emergencies. There will be a total of 144 Specialist Response Teams. Each team consists of 45 personnel. 18 Specialist Response Teams have already been trained to respond to natural calamities.

### ***9.2. State Specialist Response Teams***

The States have also been advised to set up their own Specialist Response Teams for responding to disasters. The Central Government will provide assistance for training of trainers. Since resources are an important constraint for the States, the State Governments have been advised that they may utilize 10% of the annual in-flow into the Calamity Relief Fund (CRF) for the procurement of search and rescue equipment and communication equipment.

### ***9.3. Regional Response Centres***

Fourteen Regional Response Centres have been identified and are being developed for storing a cache of essential search and rescue equipment to facilitate movement of such equipments quickly to the site of a disaster.

### ***9.4. Incident Command System***

In order to professionalize emergency response management, it is proposed to introduce an Incident Command System in the country. This system provides for specialist incident command teams with an Incident Commander and officers trained in different aspects of incident management – logistics, operations, planning, safety, media management etc. Training of trainers is being undertaken in different modules of the Incident Command System.

### ***9.5. Emergency Support Function Plans***

It has been observed that the relevant departments start constituting teams/mobilizing resources only after a disaster has struck which leads to delay. The relevant departments/agencies have been advised to draw up Emergency Support Function (ESF) Plans and constitute response teams and designate resources in advance for rapid response.

### ***9.6. India Disaster Resource Network***

A web-enabled centralised data base on disaster response resources has been operationalised. The India Disaster Resource Network (IDRN) is a nation-wide electronic inventory of essential and specialist resources for disaster response including specialist equipment and manpower resources. The IDRN lists out the equipments and resources by type and by the functions it performs and gives the contact address and telephone numbers of the controlling officers of the said resources. It has already been made use of during the flood situations last year and this year.

### ***9.7. National Emergency Operation Centre***

The control room at the national level has been upgraded as National Emergency Operations Centre (EOC) to coordinate the disaster/emergency operations.

### ***9.8. State/District level Emergency Operation Centres***

The States are being assisted to set up control rooms/emergency operation centres (EOCs) at the State and district level. Hazard zone-wise standard layout/structural and construction designs have been developed for

State and District EOCs and shared with all the States. Construction work has commenced in 6 States and 64 districts.

### ***9.9. National Emergency Communication Network***

The Communication network between the national and the state EOCs and the site of the disaster is currently based on conventional Department of Telecommunication network. It has generally been observed that in a calamity, communication is the first casualty. It has, therefore, been decided to put in place multi-mode multi-channel communication systems with enough redundancy. A National Emergency Communication Plan has been drawn up and Phase-I of the plan is currently under implementation. It will provide satellite based mobile voice/data/video communication between National EOC/State EOCs/mobile EOCs and remote disaster sites.

### ***9.10. Development of GIS-based National Database***

The GIS data base currently available with different agencies of the Government is being upgraded. The data base will provide multi-layered maps on district wise basis. These maps taken in conjunction with the satellite images available for a particular area enable the district administration/State Governments to carry out hazard zonation and vulnerability assessment as well as coordinate response after a disaster. It is proposed to establish a GIS database in the Ministry which will assist in hazard zonation, risk management, preparedness and emergency response management.

### ***9.11. Strengthening of Fire Services***

In order to further strengthen the capacity for response, the fire services in the country are proposed to be developed into multi-hazard response units. A project has been drawn up for this purpose.

### ***9.12. Handling of Hazardous Materials***

Guidelines have been sent to States for industries handling hazardous materials. It has been prescribed that on-site and off-site disaster response plans in the industries dealing with hazardous materials be updated in consultation with District Administration and rehearsed once every year. It has also been prescribed that these industries will carry out awareness campaign for the population in the vicinity regarding the dos/don'ts to be observed in case of any accident involving hazardous materials.

## 10. Response Mechanism

In case of any major calamity, the Ministry of Home Affairs as the nodal Ministry coordinates response and provides necessary relief materials in conjunction with the relevant Ministries/Departments. Airlift facility is organized through the Ministry of Defence, medicines through the Ministry of Health, food supplies through the Ministry of Food & Public Distribution, etc. The developments are monitored on day to day and in major calamities on hour to hour basis.

## 11. Cabinet Committees

At the apex level there are two Cabinet Committees i.e. the Cabinet Committee on Natural Calamities and the Cabinet Committee on Security. Major issues relating to natural disasters are placed before the Cabinet Committee on Natural Calamities for decisions. In case of calamities which impinge on internal security or which may be due to the use of nuclear, biological and chemical weapons/materials, the matter is required to be placed before the Cabinet Committee on Security.

## 12. National Crisis Management Committee

There is a National Crisis Management Committee (NCMC) under the Chairmanship of Cabinet Secretary with Secretaries of all the relevant Ministries/Departments/organizations as members. The NCMC gives directions to the Crisis Management Group as deemed necessary. Home Secretary is responsible for ensuring that all developments are brought to the notice of the NCMC. The NCMC can give directions to any Ministry / Department/ organisation for specific action needed for meeting the crisis situation.

## 13. Crisis Management Group

The Central Relief Commissioner in the Ministry of Home Affairs is the Chairperson of the Crisis Management Group (CMG), consisting of senior officers (called Nodal Officers) from various concerned Ministries/Departments/Organisations. The CMG's functions are to review every year contingency plans formulated by various Ministries/Departments/Organisations in their respective sectors; measures required for dealing with natural disasters; coordinate activities of the Central Ministries and the State Governments for response and relief. The CMG, in the event of natural disasters, meets frequently to review the relief operations and extend all possible assistance required by the affected States to overcome



the situations effectively. The Resident Commissioner of the affected State is also associated with such meetings.

## **14. Funding Mechanism**

The present scheme of financing response and relief is based on the recommendations of the 11<sup>th</sup> Finance Commission for the period up to 2004-2005. On the recommendation of the 11<sup>th</sup> Finance Commission, a Calamity Relief Fund (CRF) for each State for meeting the expenditure on relief operations has been created. CRF consists of 75% central contribution released in two half yearly installments every year (1<sup>st</sup> May and 1<sup>st</sup> November). The remaining 25% contribution is to be provided by the State Governments. The State Governments are required to meet the expenditure for providing immediate relief to the victims of natural calamities as per the approved norms prescribed under CRF. A Committee under the Chairmanship of Chief Secretary of the State has been authorized under the scheme of CRF to decide on all matters connected with the financing of relief expenditure. Where funds available in the CRF are not considered sufficient for meeting the expenditure on relief, in case of a calamity of severe nature, financial assistance is also provided to the States from the National Calamity Contingency Fund (NCCF). The State Governments are required to submit a detailed memorandum indicating the sector-wise details of damage and requirement of funds for the relief operations. On receipt of memorandum from the State Government, an Inter-Ministerial Central Team is deputed for an on-the-spot assessment of situation and requirement of funds. The Report of the Inter-Ministerial Central Team is considered by the Inter-Ministerial Group (IMG) headed by the Home Secretary. A High Level Committee (HLC) of Ministers, presently chaired by the Agriculture Minister, considers the request of the State Government and decides the quantum of assistance from the NCCF, based on the report of the inter-ministerial central team, recommendations of the IMG thereon, approved items/ norms of assistance and funds available in CRF with the State Governments.

## **Conclusion**

While mitigation measures, which are the lasting solutions to ensure that hazards do not get converted into disasters, constitute the long-term strategy to be implemented over the next two decades, preparedness measures and professionalization of response mechanism is expected to yield fruitful results in the next three years. The objective is to build a safer and secure India through sustained collective efforts, synergy of national capacities, people's participation and knowledge/experience sharing in improved disaster management practices.

PART III C

*Chapter 22*

**Management of Extraordinary Risks  
Including Terrorism, in India  
Achievements and Perspectives**

*BY*

C.S. Rao\*

Indian Insurance Regulatory and Development Authority

This chapter provides an analysis of the respective role of the government, at both local and national levels, of the insurance and reinsurance markets particularly through the establishment of pools and of other financing alternatives to cover natural and man-made disasters in India.

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\* Chairman.

## 1. Introduction

India has been traditionally vulnerable to natural catastrophes on account of its unique geo-climatic conditions. Floods, droughts, cyclones, earthquakes and landslides have been recurrent phenomena. About 60% of the landmass is prone to earthquakes of various intensities; over 40 million hectares is prone to floods; about 8% of the total area is prone to cyclones and 68% of the area is susceptible to drought. Risk of loss by terrorism is very uncertain with a constant threat of loss.

## 2. Role of Government

The provision of relief to the victims of natural calamities in India has always been considered to be the responsibility of the State Government. The States have found that the management of natural disasters causes a great financial strain on their limited resources. They have to necessarily rely on Central assistance and their access to Central resources depended on their bargaining strength. The concern of the governments, both in the Centre and the States, is to ensure that the developmental efforts are not diluted in the year in which it is affected by natural calamities.

Over the past few years, there has been a paradigm shift in the approach to catastrophe and extraordinary risk management. A Calamity Relief Fund (CRF) for each State to be contributed by the Centre and the State in the ratio of 75:25 is in place. The size of the Fund for each State is determined based on an average of the ceilings of expenditure for natural calamity approved by the Centre in the previous 10 years. In addition a National Centre for Calamity Management has been established which recommends to the Central government release of funds beyond the CRF limits when a calamity of rare severity occurs in a State. Expenditure approved on this account by the Centre is met by levying a special surcharge on Central taxes. This is a very novel method which places the onus on the Executive to explain to the Parliament and justify the levy with reference to the magnitude of the calamity.

In addition to supplementing the efforts of the States by providing assistance in the event of a natural calamity the Central Government has laid emphasis on the States earmarking adequate resources for disaster mitigation in their Annual Plans. The new approach proceeds from the conviction that development cannot be sustainable unless disaster mitigation is built into the development process. Another corner stone of the approach is that mitigation has to be multi-disciplinary spanning across all sectors of

development. The new policy also emanates from the belief that investments in mitigation are much more cost effective than expenditure on relief and rehabilitation.

### **3. Alternative Risk Financing and Insurance Pooling Mechanisms**

It is also true that Government alone cannot mitigate disasters and we need to explore alternate methods of funding the direct costs of natural disasters outside the national budget. A major challenge to the insurance industry is to help manage the natural catastrophe risks in India. An integral part of any risk solution lies in providing sufficient capacity for the transfer of risk from households and corporates to the insurance and reinsurance sector. However, it is yet to be extensively used in India. Both risk pooling structures and alternative catastrophe coverage mechanisms (long-maturity risk financing facilities, weather-indexed contracts, and capital market instruments) can achieve better risk protection and financing terms—enough to allow the expansion of insurance coverage of public assets and private property. The problem is that, unlike in the West, where insurance is sold as a product that offers protection and security, in India it is sold more as a saving instrument. Risk coverage is only a secondary objective. That's also one of the reasons for the poor insurance coverage in this country.

Till recently, both insurers and reinsurers have been rather unconcerned about the exposures in covering catastrophic perils. Premium rates were fixed on some historic basis and cover provided for the asking. Reinsurance was not a problem because reinsurers were as relaxed in their acceptance of risk as the direct insurers. The dramatic losses of the recent past, especially the loss by destruction of the twin towers highlighted the dangers of the present method of insuring and reinsuring catastrophe perils. An immediate fall-out of the 9/11 incidents was the disappearance of cover for the risk of terrorism from the commercial market. Only limited cover was available and that too at punitive terms. Indian insurers had a choice of either echoing the non-availability of cover for terrorism risk, or refusing cover to the insuring public, or organizing the cover internally with minimum resort to the international market. The long history and maturity of the Indian market guided it to the latter solution.

#### ***3.1. Terrorism Risk Insurance Pool***

It was obvious that at the level of individual insurers, meaningful limits of cover could not be provided to the clients. So, the insurers in the market decided to pool their resources through a Terrorism Risk Insurance Pool. This Pool acted as the one hundred percent reinsurer of every direct

insurance policy on the risk of terrorism. The reinsurance accepted by the Pool was based on the collective underwriting capacity of all the insurers in the market. As a matter of prudence, reinsurance cover to some extent on excess of loss basis was secured from the international reinsurance market. The Pool was able to offer cover up to Rs.200 crores (US\$ 40 million) per location from day one. As the initial period was loss free and a fund had got built up, the cover limit was raised to Rs. 300 crores (US\$ 60 million) from January, 2004. There is now a proposal to raise it further to Rs. 500 crores (US\$ 100 million) from January, 2005.

The reinsurance market is driven by sentiments rather than facts and the memory of the September 11 losses seem to have been overtaken by the concern for loss of premium. As a result, we are now witnessing considerable softening of premium rates and raising of cover limits for Indian risks seeking insurance for terrorism risk in the international market. However, one should always remember the international market provides no assurance of stability in terms of availability of cover and self-reliance to the extent possible is the right solution.

Reinsurers have also expressed concern about the exposure to catastrophe perils through surplus reinsurance treaties. Although there have been some efforts to place event limits on proportional treaties, the move has not yet gathered the momentum where insurers are unable to use these treaties in the normal manner. However, it is unwise to wait until the international market cuts off cover. So, there is need to explore alternate channels for effective reinsurance of the catastrophe exposures that insurers underwrite.

### ***3.2. Earthquake Pool***

Policymakers face a daunting task in addressing the issue of earthquake risk. Major earthquakes seldom occur, but when they do, catastrophic consequences follow. Since earthquakes are geographically focused events losses from a single event can be tremendous. Insurers are hesitant to offer many policies in an area facing the same hazard. Earthquake risk, with very long return periods is ill-suited to annual underwriting and determination of profits. While reinsurers will have the benefit of the entire premia as profit, in the years when earthquakes do not occur, they pay the losses without the benefit of continuity of the premia over the long term in the year when an earthquake occurs. Besides, with the concept of “pay back” very commonly applied by reinsurers on excess of loss covers, the insurers are forced to pay back the losses they recover through highly increased excess of loss premia. Even the income tax laws do not recognize the long term nature of such risks since they look at profits emerging on an annual basis.

Although earthquake insurance by itself does not mitigate losses from seismic hazards, it is one of many policy options that can help reduce losses from earthquakes. Other options include such things as structural and non-structural mitigation, building codes, and land-use planning. Insurance, when coupled in this manner, can be used as a financial incentive for action. Unless proper incentives are put into place, a fully insured individual has a disincentive to mitigate since the insurer will cover any loss.

The logical solution therefore is to underwrite earthquake insurance business on a long term basis and recognize profits only after a relatively longer period. This solution is not available to insurers at their individual company level. Several countries have already put in place earthquake insurance pools at the market level and in many cases, the government also has a role to play. The efforts in India in this matter are as yet at a preliminary stage. Progress has been slow because the insurers have not yet felt the pressure from the reinsurers.

The preliminary thinking on the Pool is to underwrite earthquake insurance as at present but reinsure into the national pool up to the capacity of the pool with whatever excess of loss protections it is able to arrange, and reinsuring the balance exposure into the conventional commercial market. It is expected that progressively, the capacity of the pool will expand and reduce the need for conventional reinsurance in the commercial markets.

### ***3.3. Regional Pools***

Countries that have natural catastrophe exposures need to examine the feasibility of establishing a regional catastrophe pool where national reinsurers of those countries without catastrophe hazard can join as capacity providers. A regional pooling mechanism among the countries of the region can be one of the solutions to cope with unpredictable natural and man made catastrophes. International diversification can significantly reduce the fluctuation in the loss burden from year to year and capital cost for multi national reinsurance portfolio is much lower than single country reinsurance solutions.

## **4. Conclusion**

This is a very crucial time for the insurance and reinsurance industry to explore new opportunities for dealing with catastrophic risks. While a comprehensive solution to the problems of insurance of extraordinary risks may not be readily available, manageable remedies can be implemented by facilitating public-private partnership combined with individual

responsibility. Insurance needs to be used as a catalyst in helping both the industry and society to deal with the critical issue of reducing losses and providing protection against damage from earthquakes, floods, hurricanes, and other natural and man made disasters.

## PART III C

### *Chapter 23*

# **Earthquake Risk Management Policy in Indonesia**

*by*  
Werner G. Bugl\*  
Asuransi Maipark Indonesia

Indonesia is located at the convergence of three major tectonic plates, namely the Eurasian, the Indo-Australian and the Pacific plates. This situation generates thousands of earthquakes every year, most of which are potentially destructive. The Government has established a National Coordinating Board for Natural Disaster and Refugee Management (BAKORNAS PBP) in 1979. This chapter provides an overview of the main features and purposes of this scheme.

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\* President Director and CEO.



## 1. Earthquake Risk in Indonesia

Indonesia is located at the convergence of three major tectonic plates, namely the Eurasian, the Indo-Australian and the Pacific plates. This tectonic cocktail generates thousands of earthquakes every year, most of which are potentially destructive.

Whilst much of Western Indonesia is located on a relatively stable part of the Eurasian plate, the Sumatera trench or fault zone spans the entire length of Sumatera and is similar to the San Andreas fault in California. The greatest seismic hazard in Indonesia comes from this fault zone.

Sumatera alone has suffered more than 15 big earthquakes in the past 100 years.

Besides Sumatera, other areas most prone to earthquakes are Java, Bali, Nusa Tenggara, Maluku, Sulawesi and Irian Jaya.

The earthquake hazard in Jakarta and Surabaya is considered as low to average.

Historical records suggest that earthquakes and volcanoes top the list of significant perils. Suggestions are that there is some co-relation between regions with a large earthquake potential and with numerous volcanoes.

Volcanic eruptions are an ever present risk in Indonesia.

Indonesia is home to 13% of the world's active volcanoes and is therefore referred to as the "ring of fire."

Over the last 200 years an estimated 175.000 people have died as a result of volcanic activities.

The most singularly spectacular volcanic eruptions have been Tombora, the creation of Lake Toba, North Sumatera, the famous Krakatau eruption in 1883 and Mt. Agung in Bali in 1963.

There are about 104 different types of volcanoes.

This paper does not particularly deal with tsunamis, yet tsunamis are earthquake triggered. Tsunami is a major exposure in many coastal regions; it has mainly occurred in the Eastern part of Indonesia.

The 15 larger earthquakes of magnitude 4 or stronger that occurred in the period 1990 – 2001 resulted in approx. 3000 casualties. The most devastating was the one in Flores due to a tsunami.

Details of cost caused by earthquakes are difficult to come by. Most records refer to the loss of lives, not property.

But the thing that is most striking about those records is that property damage and the effect on people was considerably less in earlier decades, i.e. In the 60's, 70's and 80's. The last decade, i.e. the 90's, accounts for 97.5% of the damage and 41% of the people affected. Of the 137 natural disasters recorded from 1980 – 1999, 26% were earthquakes and tsunamis. 43% of all fatalities were due to earthquakes and tsunamis.

The lesson here is not necessarily that we have more natural disasters – this theory would open the floor to discussion on climatic changes or the El Nino phenomenon – but an increase of population and concentration in disaster exposed areas and property value concentrations.

Damage data available are largely based on loss of life and due to sparse level of information on damage, it is not clear which peril presents the greatest threat in terms of loss potential to the insurance industry. Any evaluation of natural perils should not merely focus on earthquake hazards alone. However, very likely, earthquakes have the greatest potential to produce insured losses.

## 2. Role of Government

The Government has established a National Coordinating Board for Natural Disaster and Refugee Management (BAKORNAS PBP) in 1979. Its tasks assigned by presidential decree are:

- Formulate policy for disaster alleviation
- Coordinate activities on disaster alleviation
- Provide guidance and direction, including disaster prevention, safety, rehabilitation, reconstruction etc.

Members of BAKORNAS PBP are: practically all ministries, including Army and Police Commander; the Chairman is the Vice President of the RI. National, province and regency level interests are represented on the Board. The level of Government involvement depends on the severity of a disaster (e.g. the number of victims or the impact on economy) and the effectiveness of any disaster plans in place is dictated by the availability of funds.

The Government's efforts focus on educational work on disaster understanding, preparedness, safety, improvement of building code, improvement of forecast and monitoring through extension and up-grading of seismological network and Meteorological and Geophysical Agency

(MGA) seismic stations. Due to its complexity and sheer size this National Coordinating Board may not be able to respond adequately in times of emergency and crisis.

Indonesia has a seismological network operated by the Meteorological and Geophysical Agency (MGA) of Indonesia under the Department of Communication. Its task is to monitor seismic activity. The seismic network has been developed after successful periods of cooperation with the US, UN, UNESCO and French Government. MGA now operates 58 stations, both digital and analog.

The network is divided into five regional seismological centers (RSC) and one national seismological center (NSC) located in Jakarta. MGA is responsible to announce to the public the hypocenter and impact of large earthquakes.

A tsunami warning system known as TREMORS (Tsunami Risk Evaluation through seismic Moment from Real-time) has been installed at the Tretes geophysical station located in East Java in 1996. The system is no longer connected to the national seismological center (NSC) since the telephone line from the station to the new location of NSC in Jakarta is no longer available.

The current networks lack density and do not cover all of Indonesia.

The funds that the Central Government has earmarked for disaster mitigation are minimal. The autonomous Provincial Governments do not budget for disaster relief investments. The current emphasis is only on disaster relief. More needs to be done in terms of pre-disaster and post-disaster planning and initiatives, such as heightening natural disaster awareness through seminars, training, brochures, co-operation between national and local Governments, engaging scientists and development of resources at Government bodies like MGA. The knowledge sources available should serve to improve urban planning, building code and enforce other short and long-term initiatives.

The vital aspect for the insurance industry of all engagements of Government in disaster management is to improve the framework for insurability of natural disasters.

Without minimum public standards of disaster awareness, education, information, monitoring, prediction, early warning, safety, prevention, alleviation, the insurance industry will not be encouraged to relieve the Government and share the potential financial drain on fiscal resources.

However, insurance protection saves people and businesses from financial bankruptcy and allows quick recovery from major catastrophes through inflow of money.

The insurance industry is a vital, indispensable sector of the economy, transferring risk from state to the individual and a capital provider.

Therefore the Government and Insurance Industry should become partners and intensify their cooperation on disaster management.

### **3. Role of Insurance**

According to the latest annual report of the Directorate of Insurance, a total of 106 companies were licensed as of 31.12.2003, namely 3 State-owned companies, 78 private domestic direct insurer, 4 domestic reinsurers and 21 joint venture insurance companies.

Despite legislation introduced in 1999, with the aim to strengthen the industry and reduce the number of insurers, not much progress has been made. Capitalization for existing domestic companies remains low.

Deregulation in 1989 led to the abolishment of tariffs, free competition and the inevitable consequence of drastic deterioration of premium rates.

An unstable economic and political environment since the Asian economic crisis in 1997 has seen most of Indonesia's economic sectors going through a torrid period.

The reason for the relatively small size of the Indonesian insurance market is due, in part, to the economic situation, public lack of understanding and awareness of insurance, the absence of compulsory insurance, religious beliefs and also a mistrust towards financial institutions including insurance.

As compared to some of its Asian neighbors, Indonesia's insurance market penetration and density of 0.60% of GDP and US\$ 4,1 per capita respectively is considerably smaller.

When it comes to natural catastrophe insurance, in particular earthquake, the density is even less. Prevailing cultural attitudes even resist a demand surge after catastrophe events.

There are no reliable industry records regarding earthquake insurance before the establishment of the Indonesian Earthquake Pool (PRGBI) effective from 01.01.2003.

But what we know is that many insurance companies were finding it difficult to finance their reinsurance protection from the very low premium

base that they produced for the high earthquake exposures they were writing. The average rate for earthquake in Indonesia was minimal, less than 0.01%.

The insurance industry plays an important role in supporting economic growth by diversifying risks and absorbing volatility.

The objective is to form a community of insureds who pays enough premium to cover the cost of damage caused by a natural catastrophe.

An individual insurer and even an entire insurance market has capacity limitations for the underwriting of earthquake insurance covers and can not retain the huge aggregate liabilities that accumulate in their books.

There is a strong dependence on international reinsurance markets for risk transfer or other alternative financial schemes.

After experiencing horrific underwriting losses in the wake of a number of natural catastrophes and major loss events, coinciding with massive loss of assets due to stock market meltdowns, reinsurers have gone back to basics.

Proportional reinsurance of natural perils for individual insurers is unsustainable, mostly for lack of balance in geographical spread and lack of volume of portfolios and insufficient technical pricing in the absence of tariff rates.

The almost unanimously and universally accepted view among reinsurers is that global best practice to manage catastrophe loss potentials is by means of national pools or national or regional specialist companies.

The Indonesian insurance regulators were increasingly concerned with the dramatic decrease of the average rate applied for earthquake insurance, the high reinsurance protection cost (i.e. outflow of foreign currency) and the capability of insurers to meet assumed liabilities.

A long-term solution was called for.

#### **4. Establishment of Indonesian Earthquake Pool (PRGBI)**

By a further Joint Decree of the Directorate General of Financial Institutions, Department of Finance, and the General Insurance Association of Indonesia (AAUI) dated 30.11.2000, a Working Committee on Natural Disaster Insurance was set up.

Its mandate was to:

- Promote public awareness of earthquake risks

- Collect information related to earthquake
- Review the current practices of covering earthquake risks
- Make proposals for better handling

The Working Committee came up with the recommendation to set up an Earthquake Pool. It took another two years to get the support and co-operation of the market and two more directives of the Directorate of Insurance in December 2001 and April 2002, making participation in the Earthquake Pool compulsory for all general insurance and reinsurance companies.

The vehicle for this undertaking was the Indonesian Earthquake Pool or Pool Reasuransi Gempa Bumi Indonesia (PRGBI).

The PRGBI began operation from 1<sup>st</sup> January 2003.

### *Objectives*

The Indonesian Earthquake Pool (PRGBI) aims to:

- promote discipline and proper handling of earthquake insurance in Indonesia for all type of fire property risks, i.e. agricultural, private, industrial & commercial (separate policy, technical terms)
- set a benchmark for earthquake insurance pricing in Indonesia (compulsory cession at specified tariff)
- collate statistics and data bases to justify the appropriateness of premium rates on earthquake insurance (detailed bordereaux)
- build strong local capacity for earthquake insurance in Indonesia (indirect effect).

## **5. Transformation of PRGBI into a Special Risk Company**

Parallel to this development the Directorate of Insurance, Directorate General of Financial Institutions, Department of Finance R.I., and the Indonesian Insurance Association (AAUI) set up a Natural Disaster Insurance Committee (PPPARSK), which was given the mandate to transform the PRGBI into a legal entity of a Special Risk Insurance Company.

On 23.12.2003, PT. Asuransi MAIPARK Indonesia was established.

***Several pool models were considered:***

A Pool can either be organized as

- an association of participating Pool members; this was the model for the PRGBI
- a Government-run company or
- a separate company with Pool participants as shareholders; this was the model for MAIPARK.

If we look into the course taken by other countries, we will find that

- Pool solutions for natural perils insurance become more and more common; it is considered “global best practice”.
- Reinsurers support Pools as an effective way to enable sustained natural hazard insurance.
- Governments have to play a key role through their regulatory authorities in setting up the framework for schemes and bring in a certain degree of compulsion.

The key message here is that cooperation among all market participants is an indispensable mechanism for an adult, mature and well functioning insurance industry when it comes to protection against natural catastrophes. There should be no room for competition on these lines of insurance for wrongly perceived shortsighted commercial gains and advantages.

- Some of the main synergies derived from a separate public liability company instead of a pool:
  - dedicated management and staff
  - clients are shareholders and have a vested interest in the fortune of the company
  - level playing field for everybody, i.e. standard policy type and tariff, with competition focussed on service rather than coverage and price
  - provide earthquake insurance cover at affordable premium rates to policy holders over time
  - lower administrative expense
  - through concerted advertisement and PR by MAIPARK, increasing awareness and demand of the public for catastrophe insurance

- joint purchase of reinsurance protection at lower cost
- gradual decrease of dependency or over-dependency on international reinsurance to eventually achieve a certain degree of self-reliance
- Some Facts and Figures about MAIPARK:
  - Capitalization and shareholders
  - The regulator decreed a minimum shareholding of each general insurer and reinsurer operating in Indonesia of 0,5% of its invested funds. The total paid up capital of MAIPARK based on this formulae came to approx. Rp 50 billion or US\$ 5.000.000. There are 32 founding members and 65 non-founding members
  - Market cession
  - As with the PRGBI, there is currently a variable quota share cession in place. The cessions vary between 5% and 25%, depending on the location of the insured property and there is an acceptance limit of US\$ 2.500.000 any one risk.
  - Scope of cover
  - The scope of cover for earthquake is defined by the Indonesian Standard Earthquake Policy
  - Earthquake tariff
  - Just a brief comment on the earthquake tariff. It is based on the three main CRESTA zones for (1) low, (2) medium and (3) high risks. Besides the U/W criteria of zones, rates are further dependent on construction classification and occupancy
  - Compliance
  - Compliance is an important criterion for the functioning of MAIPARK. The Directorate of Insurance, Ministry of Finance, is carrying out company inspections jointly with MAIPARK to verify compliance of insurers with the compulsory nature of the operations of MAIPARK.



## 6. Conclusion

The journey for MAIPARK has just begun.

For a start-up, MAIPARKS's development in the first year of its operations is exceeding observers' expectations.

The average earthquake premium rate has increased tenfold from 0.01% to 0.11%.

The dramatic fall in the take-up rate for earthquake insurance, estimated between 35% to 70% of existing business, has probably not happened, though it is difficult to exactly assess this effect of the introduction of a compulsory earthquake tariff. But it is probably closer to 20% - 30% only.

The other success has been the increased transparency that has come from a separate earthquake policy and the valuable database that will be available for the marketplace as a whole and that will serve the objective to review the existing earthquake pricing and eventually formulate a technically proper earthquake tariff.

MAIPARK's commitment aims to

- promote awareness for natural disaster related problems and expertise among the insuring public, clients and shareholders
- promote a policy of "Government in partnership with industry" for constructive initiatives in disaster prevention management and risk diversification to
- build a National Catastrophe Reinsurance Company capable of providing the domestic market with a meaningful capacity and strong support from top class international reinsurers to the extent required
- evolve into the National Specialist Reinsurer for all natural peril insurances.

## 7. Vision

It is highly commendable that the market and the Government united to opt for ex-ante funding of disasters rather than ex-post.

However, much more needs to be done.

The actual demand on and social responsibility of the Government is to protect people's livelihood.

The calling of the private insurance industry, MAIPARK and the Government is to enter into a risk partnership to provide earthquake insurance for residential risks in Indonesia.

This is the very “raison d’être” of most of the pools established in other countries. The ambitious realization of this scheme in particular (because of the autonomy of Provincial Governments in Indonesia) and the greater earthquake insurance penetration of the market in general hinges, among other things, on the important issue of the state’s tasks to ensure the preconditions for “insurability”. Key to insurability are land use regulations and building codes, enforcement of regulations, measures to protect the infrastructure and favorable tax treatment of technical reserves for natural perils established by insurers and reinsurers.

Affordability is an extremely imperative issue too, to gain widespread acceptance of such an undertaking in an environment where people are not accustomed to mandatory insurance.

MAIPARK’s mission is a pioneering challenge that may require and would be worth of the involvement of international organizations like the IMF or the World Bank.



PART III C

*Chapter 24*

**Disaster Risk Management Policy  
in the Philippines**

*by*

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This chapter first highlights the particular risk-exposure of the Philippines to disasters and calamities. It then provides an overview of the Philippine Disaster Management System, of the comprehensive emergency management framework and of the funding mechanism of these disaster management programs. It also presents a project for a risk transfer scheme to cope with natural disasters.

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\* Civil Defense Executive Officer.

## **1. Geographical location of the Philippines and the disasters /calamities**

The republic of the Philippines is located in East Asia, comprising over 7 100 islands in the West Pacific Ocean. It occupies the western ring of the Pacific Ocean, a most active part of the Earth characterized by an ocean encircling belt of active volcanoes and earthquake generators. The geographical location of the Philippines makes it prone to natural disasters like typhoons or tropical cyclones (with an average of 22 tropical cyclones a year, out of which 5 are destructive), floods, earthquakes (of which about 5 quakes a day or 1 825 quakes a year), volcanic eruptions (as the Philippines is a host for 22 active volcanoes), tsunamis, and extreme climate events, i.e. el Niño and la Niña.

Over the years, natural and man-made calamities have brought misery to our people and devastated public and private infrastructures. Rehabilitation of affected areas has considerably depleted the government treasury and prevented government from making yearly investments in development projects like farm-to-market roads, highways, bridges, ports, etc., as well as investments in human capital (education, health care, and safe drinking water). Resources that could otherwise be spent for these are funnelled to affected areas and displaced population to enable them to lead normal lives again as soon as possible.

## **2. An overview of the Philippine Disaster Management System (PDMS) - Presidential Decree (PD) 1566**

Given this backdrop of a harsh environment, the Philippine government has set in place a Disaster Management System which encompasses a comprehensive disaster risk management framework and an all hazards, multi-sectoral and community-based approach.

The Philippine Disaster Management System (PDMS) is governed by a set of decrees, orders and laws that enunciates the policies, doctrines, organizations and procedures in addressing disaster management concerns in the country. Under Presidential Decree (PD) 1566, S-1978, the following policies are affirmed:

- self-reliance shall be developed by promoting and encouraging the spirit of self-help and mutual assistance among local officials and their constituents;

- responsibility for leadership rests on the provincial governor, city/municipal mayor, and Barangay chairman, each according to his area of responsibility;
- each political and administrative subdivision of the country shall utilize all available resources in the area before asking assistance from neighboring entities or higher authority;
- the primary responsibility rests on the government agencies in the affected areas, in coordination with the people themselves;
- it is the responsibility of all government Departments, Bureaus, Agencies and instrumentalities to have documented plans of their emergency functions and activities; and
- the national government is there to support local governments. In times of emergencies and according to their level of assignment, all national government offices in the field shall support the operations of local governments.

### **3. Comprehensive Emergency Management Framework**

Pursuant to PD 1566, the National Disaster Coordinating Council (NDCC), the highest policy making, coordinating, and supervising body at the national level for disaster management in the country, is tasked to oversee the implementation of the following:

- Mitigation - refers to the measures aimed at minimizing the impact of a natural or man-made disaster on a nation or a community in terms of casualties and damages. Further refers to measures designed to prevent natural phenomena from causing or resulting in disasters or other similar emergency situations.
- Preparedness - refers to pre-disaster actions and measures being undertaken to avert or minimize loss of life and property, such as but not limited to community organizing, training, planning, equipping, stockpiling, hazard mapping, and public information and education initiative.
- Rehabilitation – refers to the process by which the affected communities/areas or damaged public infrastructures are restored to their proper or normal level of functioning or their actual condition prior to the occurrence of the disaster or calamity.
- Response – refers to any concerted effort by two or more agencies, public or private, to provide emergency assistance or relief to persons

who are victims of disasters or calamities, and in the restoration of essential public activities and facilities.

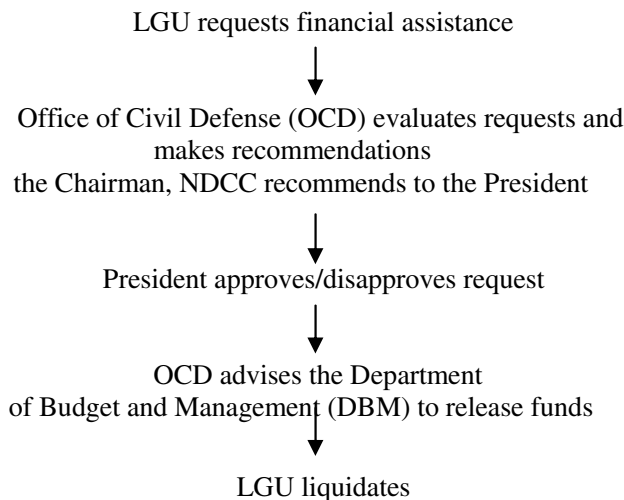
#### 4. Funding of disaster management programs/projects/activities

The ever-increasing threat of disasters on the lives and properties of the Filipinos has prompted the government to allocate funds at the national and local government levels, through the **National Calamity Fund (NCF)** and **the Local Calamity Fund (LCF)**. These funds shall be made available exclusively for disaster-related activities or services such as relief, rehabilitation, reconstruction, and other works or services in connection with calamities which may occur during the budget year or those that occurred in prior years including pre-disaster activities such as acquisition of supplies, rescue equipment, and training of personnel engaged in direct disaster management, including disaster risk reduction activities.

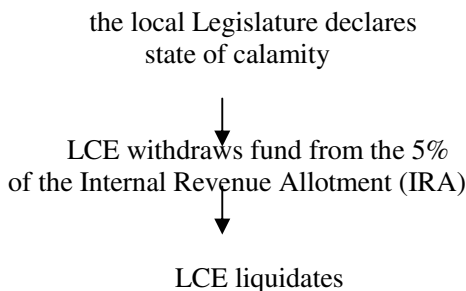
The NCF is proposed by the office of the President and is appropriated by the Philippine Congress. Currently and for next year, our NCF stands at US\$ 12.466 million.

When a disaster strikes and the resources of the Local Government Unit (LGU) are not sufficient to cover the relief, rehabilitation, and reconstruction efforts needed, the LGU makes a request to the national government for funding assistance from the National Calamity Funds.

##### *National Calamity Fund*



If the destruction and need for resources are minimal, the LGU uses its LCF to address the effects of disaster. The procedure for the utilization of the LCF is as follows:



The annual average cost of damage due to disasters from 2001 to 2003 alone, run to about US\$301 Million or PHP17 Billion. On the other hand, the National Calamity Fund appropriations for said years is US\$12.466 Million or PHP700 Million per annum, or roughly ten percent (10%) of the annual cost of damage. In spite of the government's desire to fully address the numerous requests from Local Government Units (LGUs) for financial assistance for the rehabilitation and restoration efforts, still a sizeable amount of the rehabilitation and reconstruction requirements remains unmet due to fund constraints.

Aside from the NCF and LCF funds, addressing the effects of disasters may also come from the following:

- donations from local and international sources ;
- insurance both from private and government financial institutions;
- special appropriation from congress; and
- realigned funds from the national coffers

## 5. Risk transfer scheme: a proposal

To date, the Philippine government is working through the OCD-NDCC for a risk transfer scheme, like a calamity insurance. A proposed resolution entitled "Mandatory property insurance, coverage of Local Government Units properties" is currently being evaluated by a technical committee of the NDCC. Once adopted, the proposed resolution shall be included in the bill to be filed by some members of the House of Representatives, entitled "an act streamlining and strengthening the Philippine disaster management capability, appropriating funds thereof and other programs".



The substantial/significant points to be included in the proposal are the following:

- **funding of disaster management activities** at the **local** level – five percent (5%) of the estimated revenues from regular sources shall be set aside as a Local Disaster Management Fund for preparedness, mitigation and prevention activities for potential occurrence of disasters as well as for disaster response, rehabilitation, reconstruction, and other works or services in connection with disasters or calamities, whether natural or man-made, occurring within the LGU or other areas, and for the **payment of premiums for property insurance**, provided, however, that such fund shall be used for the following:
  - payment of GSIs premiums for insurance policy coverage against loss or damage due to fire, typhoon, flood, earthquake, to insure rehabilitation and reconstruction of damaged public buildings, roads, and bridges.
  - provided that the appropriation and flexibility on the utilization of the Local Disaster Management Fund by the LGUs shall be based on the local Sanggunian in consultation with the respective Local Disaster Management Councils (LDMCs). Provided finally, that the unexpended calamity fund balances shall be treated as a continuing appropriation to support disaster management activities, **including payment of insurance premiums**.
  - the funds necessary to pay for the premiums shall be from the President’s Calamity Fund and the LGU’s authorized 5% expenditure for calamity-related situations.
- **Compensatory benefits** – any Accredited Disaster Volunteer (ACDV) who incurs death or injury while engaged in any of the civil defense/disaster management activities as defined under this act shall be entitled to the following compensatory benefits to be paid out of the initial amount of **US\$177,000,00** or **PHP10 million** to be appropriated to OCD for this purpose. **Portions of the said amount shall be used to pay for the insurance premiums for the individual personnel accident insurance of each Accredited Disaster Unit (ACDU)**.

Any ACDV who is injured or becomes disabled in carrying out disaster response activities shall be entitled to free medical care in any government hospital or institution.
- Rationale of the proposed project

- The scheme shall address the pressing concerns of non-rehabilitation and restoration of damaged properties. All government properties, infrastructure and buildings shall be covered by property insurance.
- Insurance coverage would include among others, protection of losses against fire, lightning and earthquake. Additional insurance coverage can be negotiated on a case to case basis.
- The following agencies will take part in the realization of the scheme:
  - the Government Service Insurance System (GSIS), the government Agency mandated to cover all government properties against losses caused by natural and man-made calamities, shall be requested to prepare a proposal with the premium rates most beneficial to the government.
  - the NDCC shall take the lead role in negotiating with the GSIS for the rates, guidelines and mechanics of the property insurance coverage.

The scheme if implemented will certainly reduce the burden of cost for the government.



## Annex 1

### List of Speakers and Presentations at the Conference\*

#### Session 1 - Insurability of catastrophic risks

- Economics of catastrophe risk insurance, *Christian Gollier (University of Toulouse)*.
- Insurability of terrorism risk: challenges and perspectives, *Howard Kunreuther and Erwann Michel-Kerjan (Wharton School, University of Pennsylvania)*.
- Industrial, technological and other catastrophes, *Christian Lahnstein (Munich Re)*.
- Recent trends in the catastrophe risk insurance/reinsurance market, *Patrick Murphy O'Connor (Benfield)*.
- Role of the reinsurance industry in the management of weather related risks, *Peter Zimmerli (Swiss Re)*.
- Issues and options in the management of terrorism risk through insurance, *Robert Reville (Rand Corporation)*.
- Current state of the coverage for war and terrorism risks - including NBC - in the aviation sector, *Eugene Hoeven (IATA)*
- Free market solutions for terrorism risks coverage, *Ben Garston (MAP Underwriting and Lloyd's Terrorism Panel)*.

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\* Power point presentations summarising papers included in this publication as well as other presentations made at the conference are available on the OECD Insurance homepage: <http://www.oecd.org/daf/insurance>.

- Improving insurability and affordability: the role of insurance in hazard identification, risk assessment, risk prevention and mitigation for industrial/chemical accidents, *Satyananda Mishra, IAS, Disaster Management Institute, Bhopal - Government of Madhya Pradesh, India*).

## **Session 2 - Financial market solutions to manage catastrophic risks**

- International financing solutions to catastrophic risk exposures, *Torben Juul Andersen (Copenhagen Business School)*.
- The use of risk linked securities to manage catastrophic risks, including terrorism, *Christian Mumenthaler (Swiss Re)*.
- Current challenges in terrorism risk securitization, *Gordon Woo (RMS)*.
- Financing catastrophic risks in non-OECD countries: challenges and perspectives, *Reinhard Mechler (IIASA)*.
- Current market trends for catastrophe bonds and risk linked securities, *Christopher McGhee (MMC Securities, Guy Carpenter)*.
- The potential for new risk transfer instruments to cover terrorism risks, *Michele David (The Bond Market Association)*.
- Rating agency's perspective on catastrophe bonds and risk linked securities, *Rodrigo Araya (Moody's)*.

## **Session 3 - Role of governments and development of public-private partnerships for catastrophe risk management**

- Role of governments in natural catastrophe risk management and financing in OECD countries, *Paul K. Freeman (University of Denver)*.
- Catastrophe insurance programs in emerging countries: field experience, *Eugene Gurenko (World Bank, Financial Sector Operations and Policy Department)*.
- Potential role for governments in terrorism coverage, *Dwight Jaffee (Haas School of Business, UC Berkeley)*.
- Public-private partnerships to cover terrorism risks in OECD countries, *John Cooke (International Economic Relations Consultant, London)*.

- Role of the US government in the prevention and mitigation of terrorism risks, *Robert Liscouski (Infrastructure Protection Office, Department of Homeland Security, USA)*.
- Disaster risk management policy in Japan, *Kazuhiro Kawachimaru (NIPPONKOA Insurance Company Ltd)*.
- The Spanish experience in the management of extraordinary risks, including terrorism, *Ignacio Machetti (Consorcio de Compensación de Seguros)*.
- A stakeholder approach for developing a public-private partnership: the Hungarian case, *Reinhard Mechler (IIASA)*.
- Disaster risk management policy in China, *Yuanchang Zheng and Jianguo Mu (Department of Disaster and Social Relief, Ministry of Civil Affairs)*.
- The French experience in natural catastrophe risk management, *Suzanne Vallet (Caisse Centrale de Réassurance)*.
- Earthquake risk management policy in Indonesia, *Werner Bugl (PT Asuransi, MAIPARK Indonesia)*.
- Disaster risk management policy in Mexico, *Carlos Bayo Martinez (FONDEN)*.
- Disaster risk management policy in the Philippines, *Ronald I. Flores (Department of National Defense, Office of Civil Defense, National Disasters Coordinating Council)*.
- Disaster management in India, *D. Madan (Under Secretary, National Disaster Management Division, Ministry of Home Affairs, Government of India)*.
- Management of extraordinary risks, including terrorism, in India: achievements and perspectives, *C. S. Rao (Indian Insurance Regulatory and Development Authority)*.

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## Policy Issues in Insurance

# Catastrophic Risks and Insurance

Both the frequency of large-scale disasters – be they man-made events or natural hazards – and the severity of the losses involved have increased since the late 1980's. There are strong reasons to expect this trend to continue.

Events such as the attacks of 11 September 2001 in the US or the devastating tsunami in the Indian Ocean on 26 December 2004 have raised awareness among OECD member governments that risks associated with large-scale disasters can inflict considerable damage to the vital systems and infrastructures upon which our societies and economies depend. They have also made clear that modern catastrophic risks involve financial challenges of unprecedented magnitude to policymakers and a wide range of private sector players, including insurance and reinsurance companies.

Against this backdrop, the OECD organised a Conference on 22-23 November 2004 in Paris, to stimulate high level policy discussion on ways to handle the losses caused by large-scale catastrophes.

This volume provides a selection of papers and reports presented at the conference. The combination of leading academic analysis, and information and experience sharing by governments and private sector representatives involved in the financial management of catastrophe risks, makes this publication a unique reference tool. This publication is part of the OECD's ongoing co-operation with non-member economies around the world and is co-sponsored by the Japanese Government.

The full text of this book is available on line via these links:

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