"The Role of Insurance in Reducing Losses From Natural Hazards"

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1. Setting the Scene

This paper addresses the role of insurance in reducing losses from natural disasters. In theory, insurance should be ideally suited to aid the financial recovery of victims suffering damage from natural disasters while at the same time reducing losses from future ones. A homeowner or business who has purchased insurance is protected against a severe loss through the payment of a small premium. At the same time, if premiums are based on risk, then insurance should encourage individuals to adopt cost-effective loss reduction measures on their homes.

Figure 1 depicts a conceptual framework that should enable different countries to evaluate how insurance coupled with other policy tools, such as mitigation and land use regulations, can reduce losses from natural hazards. The current institutional arrangements—existing legislation, judicial rulings and cultural norms—affect the benefits and costs of different strategies for reducing disaster losses.

A starting point is to provide information on the risks facing individuals in hazard-prone areas. Insurance can do this very effectively through a rate schedule. Higher premiums for the same amount of coverage or protection implies a greater potential chance of suffering losses. Another way to convince individuals to take certain actions is through economic incentives. Here insurance can play a key role by providing premium reductions to those who invest in mitigation or loss-reduction measures. Finally one can turn to standards and regulations. Insurers can require that certain standards (e.g., building codes) are met before issuing an insurance policy; financial institutions can refuse to issue a mortgage on ones property unless the owner has insurance.

These different policies need to be evaluated with respect to their effects on resource allocation (efficiency) as well as distribution (equity). For example, if insurance rates are based on risk, then low income individuals living in high hazard areas may not have funds to adopt cost-effective mitigation measures or purchase an insurance policy. Should one provide them with low-interest loans or grants to undertake loss-reduction measures? Should insurance be subsidized so the rates are affordable to them? The answers to these questions will differ between countries as a function of the types of hazards they face, the composition of their population and available resource bases. In addition, the current institutional arrangements,
as depicted in the top row of Figure 1, will play a key role in ranking alternative disaster management programs.

In examining the potential role of insurance in reducing losses from natural hazards the following questions need to be addressed:

(1) Why have so few individuals voluntarily purchased insurance and adopted cost-effective mitigation measures for natural hazards?

(2) Why have private insurers been reluctant to promote and market coverage against natural hazards?

(3) What are the features of an insurance program that will be attractive to potential disaster victims and insurers which promises to reduce losses from future natural disasters?

Section 2 addresses the first question by looking at empirical evidence on homeowner behavior in hazard-prone areas of the United States. In Section 3 the conditions for making a risk insurable are examined. The following section examines the challenges insurers face in providing coverage against some natural hazards. Section 5 proposes a hazard management plan (HMP) in which insurance coupled with regulations and standards plays a central role. This HMP takes into account individuals reluctance to protect themselves from disaster damage as well as private insurer reluctance to provide coverage. The final section of the paper raises a set of questions regarding the implementation of the HMP.

Although the empirical portions of the paper will focus primarily on experience in the United States, the framework and conceptual ideas should have relevance to other parts of the world. Of course, the actual design of an HMP will vary from one country to another because of differences in past history and current institutional arrangements.

2. Why There Is Limited Interest in Insurance and Mitigation

Consider the following hypothetical example to illustrate the potential role of insurance in reducing losses from natural hazards. Suppose that seismologists have estimated that the annual chances of a severe earthquake that will cause damage to a home in Tokyo is 1 in 200,
and that the total damage will be $20,000. If there were no deductible on an insurance policy\(^2\), then the actuarially fair annual premium for covering the $20,000 loss is $100.\(^3\)

If a homeowner is averse to risk and hence wants to pay a small premium to avoid a large loss, then insurance should be an attractive option even if the premium somewhat exceeds $100. Following an earthquake the family will be reimbursed by its insurance company rather than having to finance recovery with their own resources, bank loans or disaster assistance from the federal government.

Now suppose that a homeowner could invest $50 to securely attach their water heater to the wall to prevent it from toppling during an earthquake. If gas or electrical lines are broken as the water heater falls, this may cause a fire as well as water damage.\(^4\) Suppose that by adopting this measure the best estimate of the reduction in damage to the home and contents if a severe earthquake occurs is estimated to be $4,000. This means that the insurer can reduce the actuarially fair premium to the homeowner by $20 (i.e., .005 x $4,000). The homeowner now has to decide whether to invest $50 today to save $20 each year over the life of the house. It should be clear that this investment is a cost-effective one for any house that is likely to be occupied for even just a few years.\(^5\)

**Empirical Evidence** In developing programs for reducing losses from natural hazards it is important to recognize that the vast majority of individuals do not purchase insurance voluntarily or invest in mitigation and loss prevention methods. In a recent survey of 3,500

\(^2\)A deductible refers to the amount of money that the policyholder has to pay from his or her own resources before collecting on insurance. In the United States the normal deductible is 10 percent of the value of a policy. Hence if a homeowner purchased coverage of $100,000 then he would be responsible for covering the first $10,000 of any losses from an earthquake.

\(^3\)An actuarially fair premium is determined by multiplying the probability of the event by the resulting loss. In this case, .005 x $20,000 = $100.

\(^4\)See California Seismic Safety Commission (1992) for a detailed description of alternative loss reduction measures that can be adopted by homeowners.

\(^5\)We will analyze the relevant tradeoffs in showing how to determine whether a particular mitigation measure is cost-effective in the next section.
homeowners in four California counties subject to earthquake damage Risa Palm and her colleagues reported that only between 5 and 9% had adopted any loss-reduction measures. If most of these homeowners had purchased earthquake insurance, their behavior could have been explained by their feeling that they were covered against potential losses. That was not the case, however. Although recently there has been a much greater interest in earthquake insurance than there was 20 years ago, only 30% of homes in earthquake prone areas of California have purchased coverage today.

With respect to flood insurance most individuals in hazard-prone areas do not purchase coverage voluntarily. Of the approximately 9.6 million households in flood prone areas of the United States, it has been estimated that less than 2 million currently have flood insurance (Kusler and Larson, 1993). As a specific example, consider the seven Midwest states affected by the Mississippi floods of August 1993. Less than 42,000 households out of the 803,000 residing in special flood hazard areas had purchased flood insurance as of August 3, 1993. (Karr 1993)

There are several principal reasons why individuals do not protect themselves voluntarily against the consequences of natural hazards. Many individuals initially focus on their perceived probability of a disaster (p) and unconsciously set a threshold level (p*) below which they do not worry about the consequences at all. If their estimate of p < p* then they assume that the event "will not happen to me" and take no protective actions.

This decision to ignore events where p < p* is exacerbated by a tendency for individuals to underestimate the probability of a future disaster if they have not personally experienced the event. For this reason many individuals do not believe that they will suffer damage to their homes, even in areas where scientists have predicted that there is likely to be a severe disaster in the next decade.6

The contingent weighing model proposed by Tversky, Sattath and Slovic (1989) provides a useful framework for characterizing individual choice processes with respect to this

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6Similar behavior has been found with motorists estimates of their driving ability. Svenson (1981) found that over 90 percent of subjects interviewed that they were "above average" in their driving ability.
lack of interest in adopting protective measures such as insurance. In this descriptive model, individuals make tradeoffs between the dimensions associated with alternatives, such as probability and outcomes. The weights they put on these dimensions are contingent, because they may vary depending on the problem context and the way information is presented. People often weight these dimensions differently than would be suggested by normative models of choice such as expected utility theory.\(^7\)

It is easy to see why the "it will not happen to me" strategy violates the tenets of expected utility theory or benefit-cost analysis. Instead of weighing the outcome from an event by its perceived probability of occurrence, individuals who utilize a threshold model treat low probabilities as having a zero chance of occurrence. They do not even consider the consequences from events which they treat as impossible, when, in fact, they may actually occur. Those homeowners who follow this decision process will have no interest in purchasing insurance because they do not think about the consequences of a disaster. Even though their actions are not motivated by the possibility of generous disaster relief, these funds may still be made available after a major catastrophe.

Another reason why many individuals do not voluntarily purchase insurance is because they view such expenditures as poor investments. Many homeowners have a difficult time justifying the voluntary purchase of coverage next year if they have not made a claim on their policy in previous years. In the case of natural hazards it is highly unlikely that a disaster of any magnitude will occur to any specific individual during a three to five year time period. It is difficult for many people to continue to buy coverage against a loss and say to themselves and others that "the best return is no return at all".

A third reason why some homeowners will not invest in cost-effective loss-reduction measures (LRMs) is that they focus on upfront expenditures without recognizing the potential long-term benefits from these LRM. In other words their calculation of benefits is based on very short-time horizons so that the cost of the investment appears large relative to the returns which are calculated over just the next year or two.

\(^7\)See Camerer and Kunreuther (1989) for a more detailed discussion of the decision processes of individuals with respect to low probability high consequence events.
Premium reductions to reflect the benefit of the protective measure would help a person see the wisdom of this investment. However, because of myopic behavior the annual premium reduction will have to be relatively large to encourage them to invest in these measures. The example presented in the introduction illustrates this point. If the homeowner only consider the $20 premium reduction over the next two years then the $50 investment in mitigation will appear to be a poor investment. (Konruether, Slovic and Hastie 1994)

Homeowners are not the only ones who have failed to adopt protective measures and purchase insurance prior to a disaster. While there is limited empirical data on business behavior, a recent study reveals that relatively few small businesses have earthquake insurance, unless they are required to purchase coverage in order to secure a loan. In particular, firms located in earthquake-prone areas of the Midwest or Eastern United States appear to have an "it will not happen to me" attitude. (Alesych 1993)

With respect to the degree of protection undertaken in the public sector a very comprehensive study by Burby (1992) and his colleagues reveals that most local governments have not adopted hazard mitigation measures or purchased insurance. More specifically, a study by French and Rudholm (1990) of the damage to public property in the Whittier Narrows, California, earthquake of October 1987 revealed that few public buildings were protected by earthquake insurance, even though it is readily available from the private sector. Consequently, a large portion of the damage was paid for by the Federal Emergency Management Agency (FEMA) in the form of disaster relief.

3. What Makes a Risk Insurable?

Any firm should be interested in offering coverage against any natural hazard which satisfies the conditions of insurability. The conditions for insurability are widely discussed in most insurance textbooks and were formalized in a book by Berliner (1982). Below we discuss the key elements of insurability that need to be taken into account:

Uncertainty. Insurance policies are designed to cover events that are unintended and uncertain. In the case of natural disasters, there is general agreement that today they satisfy this condition. A risk would be uninsurable based on this condition, if seismologists could make accurate predictions as to the timing, location and magnitude of earthquakes in the
future. Insurers would then have no interest in providing coverage to individuals and firms who faced a certain loss from an earthquake next year, except by charging a premium that approaches the magnitude of the loss itself.

**Low correlation.** The possibility of a catastrophic loss from a single event may make the risk uninsurable. When the risks covered by the insurer are independent of each other, such as an automobile accident, then the losses from any single event are likely to be small. If the insurer fears the possibility of a catastrophic loss from a single event, such as a flood or earthquake, then it will be reluctant to provide protection to a large number of homes that are located in the same hazard-prone area.

**Identification of losses.** Losses must be well defined as to time and place. In the case of a piece of property, it is generally possible to determine from past data what the distribution of damages is likely to be from fires. For other natural disasters such as floods and earthquakes one has to rely primarily on scientific studies by hydrologists and seismologists which relate the characteristics of a particular disaster (e.g., duration, magnitude) to the loss. For example, to estimate the damage to a particular structure from an earthquake one would have to determine the magnitude and duration of ground-shaking which is then translated into some type of scale such as the modified Mercalli intensity. This scale is then utilized to estimate the percent of the structure that will be damaged should such a quake occur. (Arnold 1990) Even if one knew the epicenter and type of quake that would occur, there would still be uncertainty as to the extent of the damage to the structure (Dames and Moore 1990).8

**Estimating the Probability of Loss** Ideally, the probability distribution of future losses should be accurately estimated in setting insurance premiums. If there is considerable ambiguity associated with the chances of certain events occurring, then the risk may still be

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8Even if there is uncertainty as to the magnitude of the loss, the insurer is normally protected by the upper limit on the policy it issues. Thus if a $250,000 house is insured against earthquake for only $100,000, then the insurer knows that the policy limit will define the maximum it will ever have to pay even if the house is destroyed by a severe shock.
insurable. However, underwriters and actuaries will generally reflect this uncertainty by charging a higher premium than for more well-specified risks. (Kunreuther et al. 1993)

For frequently occurring disasters, such as fire, it is possible to estimate the chance of their occurrence. Low probability high consequence events, such as hurricanes, floods and earthquakes, present more challenging problems because there is limited past data available. Here one has to rely on risk assessments undertaken by hydrologists and seismologists. These scientists will be the first to admit that there is considerable uncertainty and ambiguity with respect to the estimating the chances of a particular disaster occurring in a specific area. For example, many seismologists and geologists feel that we are now entering a cycle of high earthquake activity but there is considerable uncertainty as to whether this cycle will culminate in a large earthquake in 50, 100 or 200 years and where such a disaster would occur. (Hamilton 1992)

Avoid Moral hazard. Moral hazard refers to a situation where the insured behaves more carelessly than he normally would simply because he knows that his losses are now covered by insurance. Some hazards have a limited degree of moral hazard because the risk cannot be controlled by the individual. Natural hazards normally fall into this category, since the events are triggered by external forces. Even in these situations there is the possibility of moral hazard. For example, if an insured person is warned about a possible flood damaging the basement of his house, he may move old furniture there with the intention of collecting on his policy.

One way to avoid such behavior is to impose a reasonably high deductible or coinsurance clause on the policy. Individuals are much less reluctant to behave carelessly if they know that they will have to pay some of the resulting losses out of their own pockets.

Reduce Adverse Selection. A risk is uninsurable if the premium is based on the experience of a large population but only those in the highest risk category purchase coverage. This is known as adverse selection. One reason insurers inspect a house before providing fire

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9An 80 percent coinsurance clause in a policy indicates that the insurer pays 80% of any loss and the insured party absorbs the other 20%.
coverage or require medical exams before issuing a health insurance policy is to estimate individual risks more carefully and charge premiums which reflect this.

Adverse selection presents special problems in the case of natural disasters if one sets a uniform premium across a wide area and only those who face the most severe risk purchase coverage. Thus, if only those individuals living closest to the river buy flood insurance at a premium which reflected the damage to a much broader area, then the insurer would have an adverse selection of policies.

The principal way of avoiding adverse selection is to take advantage of scientific studies differentiating the hazard coupled with an inspection of individual structures prior to issuing an insurance policy. This would enable insurers to customize rates based on risks. This may be a relatively costly process if the insurer had to bear the costs; however, if each owner were to incur this expense as a condition for a mortgage then it may be feasible.

4. Why Insurers Do Not Promote Coverage Against Natural Disasters?

The two principal reason that private insurers do not offer flood policies or actively promote earthquake and hurricane coverage is because of the uncertainty with respect to the risk and a fear of the economic consequences to them of a catastrophic disaster.

Turning to the uncertainty of the risk a recent survey of underwriters illustrates how ambiguity affects their premium-setting behavior. A questionnaire was mailed to underwriters of primary insurance companies and reinsurance firms asking them to specify the prices which they would charge to insure a factory against property damage from a severe earthquake under the following four different cases: Case 1: well-specified probabilities (p) and known losses (L); Case 2: ambiguous probabilities (Ap) and known losses; Case 3: well-specified probabilities and uncertain losses (UL) and Case 4: ambiguous probabilities and uncertainty losses.\(^\text{10}\)

For the non-ambiguous case, the probability of the earthquake (p) was set at either .01

\(^{10}\)An ambiguous probability refers to the case where "there is wide disagreement about the estimate of p and a high degree of uncertainty among the experts". A well-specified loss (L) means that all experts agree that if a specific event occurs the loss will equal L. An uncertain loss refers to the situation where the experts' best estimate of a loss is L with estimates ranging from \(L_{\text{min}}\) to \(L_{\text{max}}\).
or .001 and the loss should the event occur (L) was specified at either $1 million or $10 million, yielding four different scenarios.\textsuperscript{11} If one standardizes the premium set by the underwriter at 1 for the non-ambiguous case, then one can examine how ambiguity affects pricing decisions. Table 1 depicts the ratio of the other three cases relative to the non-ambiguous case (p, L) for the four different scenarios which were distributed randomly to underwriters in primary insurance companies.

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<td>L=$10 million</td>
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N= Number of Respondents
* Ratios are based on Mean Premiums Across Number of Respondents for Each Scenario
Source: Adapted from Table 3 in Kunreuther, Hogarth and Meszaros (1993)

For the highly ambiguous case (Ap,UL), the premiums were between 1.43 to 1.77 times higher than if underwriters priced a non-ambiguous risk. The ratios for the other two cases were always above 1 but less than the (Ap,UL) case. (Kunreuther, Hogarth and

\textsuperscript{11}These well-specified scenarios were p=.005 L=$1 million; p=.005 L=$10 million; p=.01 L=$1 million and p=.01 L=$10 million.
Meszaros (1993)]

Turning to the fear of crippling catastrophic losses, empirical analyses show that insurers have a right to be worried. In the past several years we have had a series of disasters within close proximity of each other which have caused billions of dollars in damage to different regions of the country and created large losses to the insurance industry. The insurance industry's catastrophic losses from 1989-1992 were over $34 billion in 1992 dollars, more than the combined total for such loss over the previous 21 years (The Standard, 1993).

To be more specific, damage from the 1989 Loma Prieta earthquake caused over $900 million in losses to the insurance industry (California Dept. of Insurance 1991/92). The estimated losses to the insurance industry from Hurricane Andrew is now estimated to be $15.5 billion, making the disaster the single most costly natural disaster in history. Insurers such as State Farm and Allstate suffered financial losses from Andrew of $3.5 and $2.5 billion respectively. (Snyder, 1993) A computer simulation model indicated that if Hurricane Andrew had hit Miami the losses could have exceeded $40 billion and led to many more than the seven insolvencies that resulted from the actual disaster. (Insurance Services Office 1994).

A recent study also suggests that a catastrophic earthquake would have severe consequences on the surplus of private insurers in the United States (Doherty et al. 1991). Data were collected from 18 insurance firms providing earthquake coverage in California, to determine the financial impact to them should there be a reoccurrence of a disaster of the same magnitude and geographic location as the 1906 San Francisco earthquake.

The study found that if such a catastrophic earthquake (CE) occurred, five out of the eleven firms with surpluses less than $2 billion would suffer losses that would exceed their surplus and cause them to be insolvent. The seven larger firms in the survey with surpluses exceeding $2 billion would be less severely affected by the catastrophic earthquake. Though none of these large firms would be insolvent, three of them would have to curtail their current business or raise new capital because their surplus would be sufficiently depleted from the CE that they could not meet current regulatory guidelines.

Medium and small-sized insurers in the United States use the reinsurance market to
protect themselves against the possibility of large losses from events such as a CE.\textsuperscript{12} Since reinsurance data is not in the public domain, a questionnaire was distributed to the 18 firms in the sample to determine the amount of catastrophic reinsurance in force. Fourteen companies responded to the survey. Three of the five firms predicted to be insolvent from the CE without reinsurance responded to the survey; all of them would still be insolvent, even if the reinsurers paid all their claims.

The impact of a catastrophic disaster on the private reinsurance market has not been well studied. These firms are likely to face an even greater problem than the primary insurers if such an event occurs. The premiums that the reinsurers believe that they can charge for such an event is relatively small because of its low probability, but the losses to them from a large-scale disaster could be enormous.

If one looks at the catastrophe related claims that have been paid for all disasters in the United States in the past forty years, 45 percent have been paid since 1990. As a result of the extraordinary trend in both the frequency and severity of natural catastrophes, reinsurance capacity to cover insurers and their policyholders has diminished. The largest United States reinsurance broker reports that between 1989 to 1993 there was a decrease of 57 percent in the amount of catastrophic reinsurance that they were able to place for its client base (Nutter 1994).

5. A Proposed Program for Integrating Insurance with Mitigation

The above evidence suggests that homeowners and insurers are reluctant to deal with natural disasters for very different reasons. Many homeowners at risk are not anxious to purchase insurance because they feel the disaster will not happen to them; others who have compared costs with potential benefits may feel that insurance and loss reduction measures (LRMs) are not good investments.

Private insurers have been reluctant to promote coverage against hurricanes, floods and earthquakes because of the uncertainty regarding the risk and a concern with the financial consequences to them of the consequences of a catastrophic disaster. Hence they want to limit

\textsuperscript{12}Some of the large personal lines insurers do not purchase any reinsurance.
their exposure.

The present situation can be costly to all of the interested parties concerned with disasters. First, the potential damage from natural hazards will be larger than it would be if cost-effective LRMs were adopted on new and existing property. Second, the large losses and potential insolvencies to insurers resulting from a catastrophic disaster will significantly reduce their surplus and lead them to set higher premiums and restrict coverage on policies which are unrelated to the specific disaster in question (e.g., automobile coverage, homeowners insurance).

In other words, the impact of a particular severe flood, earthquake or hurricane could have a negative impact on the availability of insurance throughout the country. [Gron (1989), Winter (1988, 1991), Doherty and Posey (1992)]. Doherty, Keffner and Posey (1993) examine how insurers have responded to a variety of surplus shocks in the past. Their analysis suggests that only 50 percent of the lost surplus is likely to be replaced following a catastrophic loss, so that the availability of coverage in many different lines of insurance will have to be reduced.

Third many uninsured homeowners will be saddled with large recovery costs following a severe disaster. If the past is a guide to the future the federal government will come to the rescue by providing victims with liberal disaster relief. Hence all citizens will have to pay for the losses generated by future severe disasters.

To cope with each of these three problems the following elements of a hazard management program (HMP) should be explored. A more detailed discussion of the objectives of such an HMP program and an expanded treatment of the interaction between different policy tools can be found in Kunreuther, Ericksen and Handmer (1993).

1. Institute more stringent building codes on new homes. Relevant government agencies should develop stringent building codes which incorporate cost-effective mitigation measures on new structures, and insure compliance with, and enforcement of, the codes. The limited voluntary adoption of these measures on existing homes in the United States suggests that innovative ways need to be found to encourage homeowners and the building industry to modify structures to meet appropriate standards. This means ensuring that key players, like
the building industry and home owners, are behind the program.\textsuperscript{13}

While building codes can serve an important function in reducing future property damage, Cohen and Noll (1981) provide an additional rationale for having them. When a building collapses it may create economic dislocations and social costs in addition to the economic loss suffered by the owners. These may not be taken into account when the owners evaluate the importance of adopting a specific mitigation measure.

2. Use seals of approval on structures meeting codes. Each building that meets or exceeds the specific building code would be given a seal of approval. This would provide homeowners with the knowledge that the building has been safely designed and built in accordance with a federal or national code.

One way to institutionalize the seal of approval procedure would be for financial institutions to require an inspection of the facility at the time that a mortgage is issued. This inspection, which would be a form of buyer protection, is identical in concept to the termite inspection that is normally required today as a condition for a mortgage in the United States. A new homeowner is unlikely to know how safe her structure is, so this inspection should be viewed as desirable.\textsuperscript{14}

3. Use insurance to encourage hazard mitigation. To reduce their losses from disasters, insurers may want to limit coverage to structures that are given a seal of approval. If banks require insurance as a condition for a mortgage, then financial institutions together with the insurer can help enforce building code regulations. The reduction in potential losses from the adoption of building codes should be reflected in the form of reduced premiums, lower

\textsuperscript{15}The Insurance Institute for Property Loss Reduction in the United States is now in the process of establishing a relationship with the American Society of Home Inspectors to enhance building code compliance. The specific elements of the program have not been identified yet. (Personal communication with Paul Cogswell, May 6, 1994.)

\textsuperscript{14}If a house does not meet the relevant building code then there is the question as to whether it must be improved prior to the sale of the house or if it is sufficient to provide the new buyer with this information. This is an area which has both economic and political ramifications.
deductibles and/or higher coverage limits.

The government could require insurance as a condition for federally backed mortgages. In the United States the National Flood Insurance Program has such a condition for homes located in Special Flood Hazard Areas. Unfortunately this requirement has not been routinely enforced. A survey they conducted in Texas following a major flood in 1989 revealed that 79 percent of the owners of damaged properties required to purchase flood coverage when taking out their mortgages were uninsured at the time of the disaster. (U.S. General Accounting Office 1990)

An interesting set of competitive pressures create a lack of interest by banks in requiring homeowners to take flood insurance as a condition for a mortgage. Prospective homeowners who are not concerned with the flood hazard will want to obtain their mortgage from a bank that does not require flood coverage. Until a recent court decision in the state of Connecticut banks have not been fined if a house in the flood-plain is uninsured nor do they have to pay for any flood damage if the house is flooded. For similar reasons, banks have no incentive to ensure that homeowners renew their flood insurance coverage which they purchased at the time of their mortgage.

There is a need to impose fines or other penalties on lenders who are obligated to require flood insurance but do not do so. A recent bill introduced into the U.S. Congress would require lenders to inform purchasers of how to obtain insurance and subject to penalties of up to $350 for each violation. This penalty may only be partially successful in forcing banks to take the appropriate action. A much more effective penalty would be to hold banks and financial institutions responsible for the costs of repair on any uninsured home which had been required to have coverage. (Kunreuther and White 1994)15

15The maximum amount of the fine could be determined by the amount of insurance that the structure would have under required coverage.
4. Develop all-natural hazards insurance. The insurance industry should be encouraged to market a new type of homeowners insurance which includes protection against earthquake, flood and hurricane damage. Rates would be based on risk, with the potential losses diversified throughout the country. This type of insurance policy would also eliminate having to determine the causes of a loss, as insurers in the United States currently have to do for hurricane damage.

5. Institute government reinsurance. The Federal government should provide reinsurance protection against catastrophic losses from all disasters on the newly designed homeowners policy. Private insurance firms would build up the fund by being assessed premium charges in the same manner that a private reinsurance company who levy a fee for protection. The need for such a government fund arises from the apparent inability of the private reinsurance market, due to limited financial capacity, to provide sufficient protection against large-scale disasters that might occur in the United States.

The advantage of a Federal reinsurance program is that it reduces uncertainty to insurers about the consequences of a catastrophic disaster and should enable insurers to reduce their premiums for disaster coverage. By having federal involvement in one portion of the natural disaster program, it is then possible for some government agency (e.g., FEMA) to play a more salient role in encouraging the enforcement of mitigation measures.

In addition federal reinsurance for catastrophic losses will restore the financial conditions of insurers following a catastrophic losses and hence greatly reduce the likelihood that insurers will cut back on the availability of coverage in the future. For example, following Hurricane Andrew eight companies announced that they would be cutting back coverage in Florida due to their severe losses. Insurers also reduced availability of homeowners insurance in other hazard-prone areas such as the Massachusetts shoreline (Blanton 1993).

6. Subsidize low income families. Many poorly constructed homes are owned by low-income families so that they cannot afford the costs of mitigation measures on their existing structure
nor the costs of reconstruction should their house suffer damage from a disaster. Two measures should be undertaken to aid these households:

- low interest loans and grants should be provided for them to adopt cost effective mitigation measures or to relocate their home.
- special disaster assistance should be given to them to aid their recovery process.

In summary, by coupling insurance requirements with building codes and risk-based premiums for adopting cost-effective LRMIs, we will have taken a giant step in reducing losses from future natural disasters as well as aiding the recovery process of homeowners who suffer severe damage to their property.

6. Open Questions and Issues

In this concluding section we will raise a set of questions and issues that need to be considered by each country as they reflect on the role of insurance as part of a hazards management program. They are grouped under different headings that address the insurability issue and the role of insurance coupled with other policy tools in reducing losses from future natural hazards.

ESTIMATING THE RISK

- What risk assessment techniques are currently available for determining the potential losses to structures in different hazard-prone areas?
- How costly is it to undertake these risk assessments?
- Is it appropriate for the government to bear the costs of risk assessments or should this be borne by the residents in the hazard-prone community?

ENFORCING BUILDING CODES

- What are the challenges in having Federal and State governments develop more stringent building codes and a low-cost system of compliance and enforcement at local authority level?
Are adequate data available to specify cost-effective mitigation measures for different hazards?

SEALS OF APPROVAL

- How easy is it to determine whether a particular structure meets a specific code or standard so as to be able to give it a seal of approval (e.g., building consents and code compliance permits)?
- Can one easily determine whether a damaged building has not met the building code following a disaster?
- Who would determine whether a structure meets code (e.g., scientific experts; local government building inspectors)?
- Is it appropriate to require the local government to pay for the full damage from a disaster should the code not be met?
- Will the threat of such a penalty induce local governments to inspect buildings carefully before a disaster to see that the building code is met?

LINKING INSURANCE WITH SEALS OF APPROVAL

- What type of competitive pressures may lead insurers to provide coverage for structures that do not have seals of approval?
- Under what circumstances are banks likely to require insurance as a condition for a mortgage?

PREMIUM REDUCTIONS FOR ADOPTING MITIGATION MEASURES

- What are the most effective ways for insurers to reflect the loss reduction so that homeowners perceive the benefits of mitigation (e.g., lower deductibles, lower premiums, higher coverage or some combination of these)?
- Are there analogies from other types of coverage (e.g., fire insurance) that can assist the industry in answering the above question?
ALL-NATURAL HAZARDS INSURANCE PROGRAM

- Are there legal impediments in developing all-natural hazards insurance? (E.g., is it possible to include flood damage in such a program in the United States given the existing National Flood Insurance Program?)
- How feasible will it be to charge rates based on risk if they vary considerably from one region of the country to another?
- Should the insurance industry share the responsibility for, and cost of, identifying natural hazards on a region-wide basis?

FEDERAL REINSURANCE

- How can one structure a government reinsurance programme so it is not perceived to be a bailout for the insurance industry, and so that companies would not be inclined to buy less commercial reinsurance?
- What data are available to show that there is not enough private reinsurance capacity available to cover a catastrophic loss?
- How large a reduction in premiums and/or increase in coverage at the same premium will be possible under a government reinsurance program?
- Is there capacity for reducing premiums in a highly competitive market?

SUBSIDIZE LOW INCOME FAMILIES

- What are the appropriate measures of income to determine whether individuals qualify for loans or grants to undertake mitigation measures?
- What types of disaster assistance are most appropriate to aid the recovery of low income families?
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