“The Impact of a Catastrophic Earthquake on Insurance Markets”

91-09-01

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THE IMPACT OF A CATASTROPHIC EARTHQUAKE ON INSURANCE MARKETS

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Prepared for the Federal Emergency Management Agency
September 1991

1We would like to express our appreciation to Jack Morrison for his advice and input to this report.
SUMMARY OF CONCLUSIONS

This report specifically addresses the financial impact of a catastrophic earthquake (CE) on the insurance industry. For this reason there are a set of factors that need to be explicitly considered when interpreting our conclusions:

* The probability of CEs is very low. Earthquakes and other natural disasters which are more frequent but less calamitous (e.g. Loma Prieta earthquake, Hurricane Hugo) appear to create much less serious problems for the insurance industry than the event analyzed in this report.

* This report does not address the role of mitigation in reducing damages from earthquakes. Earthquake mitigation can play an important role in reducing losses from earthquakes of many different sizes.

* The very short deadline for completing this study precluded us from undertaking more extensive studies as to the impact of different earthquake scenarios on losses to insurance companies as well as the impact on other stakeholders affected by the earthquake.

The conclusions which are summarized below are based on an analysis of a reoccurrence of a disaster of the same magnitude and geographic location as the 1906 San Francisco earthquake. Hence when we utilize the acronym CE we are referring to this specific event. No attempt is made to specify a probability for such an earthquake occurring.

1. Insurance that is currently available against earthquakes will provide only limited compensation for damage caused by a catastrophic earthquake based on the 1906 San Francisco earthquake. A large proportion of the projected losses will be uninsured or underinsured. For example, public sector losses are normally self-insured; a substantial fraction of commercial and residential structures are also uninsured; most insurance policies related to earthquake damage have sizeable deductibles; and many are written for amounts which are much less than the actual values exposed.

2. A CE will create financial impacts which vary greatly across insurance firms. We examined the effect of a CE on a sample of 18 insurance firms 7 of whom had surplus greater than $2 billion, 5 of whom had surplus between $1 and $2 billion and 6 with surplus of less than $1 billion. The loss/surplus ratio was utilized as a measure of the direct impact that a CE would have on the firms' balance sheet. For several large insurers the CE would have a relatively minor impact on their loss/surplus ratios. However, 5 out of the 11 insurers with surplus less than $2 billion would suffer losses that exceed their surplus and cause them to be insolvent.

3. The non-shake damage or indirect losses from a CE exceeds the shake damage for every firm in the sample. Earthquake insurance covers primarily "shake damage" while other insurance covers some of these indirect losses. Even if there were no earthquake insurance in place today the losses to the insurance industry would be substantial from a CE primarily because of these indirect losses.
Specifically, the following insurance policies (as they are currently written in the United States) cover indirect losses from earthquakes: fire, automobile, workers' compensation, life and accident, and general liability.

4. Catastrophe reinsurance will have only a limited impact in helping primary insurers to maintain their financial strength. Most firms will still have a significant percentage of their surplus at risk from a CE and the 5 firms who would have been insolvent without reinsurance will still be insolvent.

5. A CE will reduce the ability of insurers to continue business in other lines of coverage because their surplus will be depleted. They will either have to raise new capital from investors, decrease their coverage or increase their chance of insolvency. Only 6 out of the 14 firms who responded to the survey would emerge from a CE with surplus level which are currently regarded by regulators as "safe". Of the other 8, five are insolvent and the remaining three would have to contract coverage or attempt to raise new capital. Thus we would expect that a CE would be followed by a problem of insurance availability.

6. A CE will severely impact private reinsurers since the premiums they collect for covering highly unlikely losses will be small relative to the magnitude of the claims for which they are responsible. Not all reinsurance will be collectible and there will be limited reinsurance available following the CE.

7. Insurers are able to meet their obligations without serious insolvencies for disasters of a smaller magnitude than that considered here. For a CE, private reinsurers will not provide sufficient coverage to cover the losses. Hence consideration should be given to some type of federal reinsurance program subject to the condition that appropriate incentives be given to property owners to adopt cost-effective mitigation measures. Disaster assistance (DA) is an inappropriate substitute to an insurance program since it reduces the incentive for mitigation and imposes an additional financial burden on the general taxpayer to cover other people's losses. However, DA is needed to supplement insurance to compensate uninsurable losses.
1. INTRODUCTION

This section of the study addresses the impact of a catastrophic earthquake on the functioning of insurance markets. As an illustration, we consider the effects of a quake that measures 8.3 on the Richter scale, with an epicenter on the North San Andreas fault line. This is a re-occurrence of the famous 1906 earthquake.

We provide a measure of the financial exposure of insurers to such an event and address their ability to meet their policy obligations. A central question relates to the ability of the insurance market to recover from the earthquake. Specifically, will it have the financial resources to offer coverage for the whole range of insurable exposures that are currently offered to consumers and businesses? For this section of the study, insurers are assumed to be able to liquidate their financial resources at their pre-earthquake market values. It is unclear what the impact of the earthquake will be on financial markets; however, the release of large blocks of assets by insurers in order to pay earthquake claims is not expected to significantly depress prices.\(^2\)

CONSEQUENCES OF MAJOR EARTHQUAKE FOR THE INSURANCE INDUSTRY.

A. Insured Losses

Insurance coverage is offered for the consequences of an earthquake under various types of polices and for various classes of clients. Some of the coverage is explicit (e.g. shake damage) but other coverage arises from the indirect consequences of an earthquake (e.g. fire following quake).

Shake damage. Insurers offer coverage for the effects of shaking on structures, both residential and commercial. For residential coverages this is normally in the form of an endorsement on homeowners coverage to include shake damage. In California, coverage is usually subject to a 10% deductible so that widespread minor damage suffered by many homes would not be covered; only serious structural damage would impact insurers\(^3\). Today approximately 25% of homes in California are covered for shake damage. (Roth, 1991).

\(2\) In the normal course of their business, insurers do not have to sell off financial assets in order to pay their claims. Normal loss experience is fairly predictable and can be met from the natural maturing, and turnover, of longer term financial assets and by holding some assets in near cash form. However, catastrophic losses require that the insurer liquidate substantial quantities of financial instruments. At issue is whether the release of such quantities will tend to depress price and whether this will be compounded by other financial market effects as investors interpret the economic consequences of the earthquake. A more detailed discussion of this issue is contained in the section on Banking and Financial Markets.

\(3\) The deductible is usually lower in other parts of the country, such as 2 percent in the New Madrid area.
For commercial structures there is no typical pattern of insurance coverage. An estimated 50% of large businesses are thought to have some shake coverage, but protection for smaller businesses is unusual.4 There is no standard deductible on commercial policies; it varies from 2% to 10%, depending on the class of building, and it is expected that many commercial losses would exceed their deductibles. Additionally, many commercial earthquake insurance policies are for limited amounts on a "first loss" basis excess of the deductible.

Non Shake Damage. In addition to the shake damage, insurers are exposed to other possible liabilities arising from a large earthquake. Some of these losses will be covered by standard insurance policies even if the policyholder has not considered the earthquake risk. The most obvious of these is damage caused by fire following an earthquake, as was dramatically illustrated by the 1906 earthquake. Losses from fire following an earthquake are routinely covered under standard property and business interruption insurance coverage. Other standard coverage will be triggered by an earthquake. Life and health insurance policies will be evoked to pay for deaths, injuries and medical expenses incurred. An earthquake during working hours can cause injuries to employees, thereby giving rise to workers’ compensation claims.

Various types of liability policies cover the inevitable flurry of lawsuits that follow such incidence. Thus, even though the damage might be thought of as an "Act of God", architects, engineers, contractors, etc., are inevitable targets, as plaintiffs assert that damage resulted from a design defect or poor construction (Association of Bay Area Governments, 1984). Other normal claims that the insurance industry is likely to incur include marine insurance losses (from tsunamis) and automobile losses.

Insurance for other losses requires that the policy contain a special rider to cover the earthquake peril. Business interruption claims arising from shake damage fall into this category. As buildings and plants are damaged or destroyed, their owners are denied productive use of these assets and consequent loss of earnings. In the event of a major earthquake, these losses are likely to be severe due to the long lead time in rebuilding since the construction industry, and related industries, will be stretched beyond their normal capacity to do repairs and rebuild.

B. Withdrawal from Insurance Markets following a Major Catastrophe.

(i) Effects on Primary Insurers

The financial strength of insurers usually is measured by their surplus or equity. The surplus provides a "cushion" in the event that claims turn out to be abnormally large. Thus, while the insurer can pay normal losses from the reserves set up from premiums, the surplus provides a safety net should the aggregate

losses turn out to be higher than predicted. This is why the equity of the insurer is often called the "policyholders' surplus". The larger the surplus, the greater the ability of the insurer to withstand adverse loss experience without defaulting on its policy obligations. Thus the surplus determines the capacity of the insurer to write business. Other things being equal, the larger the surplus, the greater the volume of insurance the insurer can sell while still offering financial security to its policyholders.

A major earthquake will deplete the surplus of most insurers and therefore its capacity to do business following the earthquake. As we show later in our illustrative scenario, some will become insolvent and their supply will be lost to the market. But even many surviving insurers will emerge from a major earthquake with a seriously depleted capacity. In the post earthquake phase, there are the following possibilities.

- Insurers do not replace surplus but continue to sell at their pre-earthquake volume of business. The consequence will be that the quality of insurance will be compromised. In other words, insurers will have lower surplus to cover their liabilities and this will increase the probability for future insolvencies. For a large reduction in surplus, insurers will probably be forbidden by regulators to maintain current levels of supply. Regulators closely monitor ratios of premium to surplus and will not allow such ratios to become too high. The rough guideline used is that the premium/surplus ratio be below 3. Most insurers typically maintain a premium/surplus ratio of about 2.

- Insurers do not replace surplus but reduce volume to a level which provides similar financial security to the pre-earthquake regime. While the quality of insurance will be maintained, there will be a problem of insurance availability.

- Insurers are able to replace surplus and maintain volume. Neither quality nor availability will be long standing problems. However, even in this case, raising new capital takes time and consumers will be exposed to some mixture of quality and availability problems in the immediate post earthquake phase.

The likelihood of these competing prospects depends upon the degree of access of insurers to new capital following the earthquake and on how attractive it is for investors to put additional funds into this industry. Some points are pertinent. The current regulatory environment is not conducive to new investment in insurance. This is particularly true in states and lines of business which are subject to severe price regulation. Thus we would expect insurers which have concentrations of business in automobile and workers' compensation in states such as California, Massachusetts, New Jersey, and Maine to find it difficult to raise new capital; the quality and/or availability of all their insurance products

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5 Mutual insurers cannot go to the capital market to raise new capital. They must wait for the slow accumulation of retained earnings over time to replenish surplus.
would deteriorate following a major earthquake. For such lines and states, investors are quite likely to conclude that their investment will not earn a competitive rate of return. Given limited capacity, insurers will attempt to allocate capacity to lines that have highest profitability and or least risk (see Winter, 1990). Thus, in addition to regulated lines, we would expect commercial liability insurance to become a serious problem, repeating the "liability insurance crisis of the mid 1980’s."

The other essential point that determines access to new capital is organizational form. Mutual insurers simply cannot go to the capital markets to raise new equity. In 1989 these firms accounted for 32% of the non-life insurance sold in the U.S. Since they would not be able to raise new capital they would have to cut down on their supply of coverage or increase their chance of insolvency. Price regulation, uncertainty, and lack of access to the capital market suggest that availability and quality problems will not be uniform but will be concentrated by location, type of business and type of insurance firm.

Although we cannot quantify these effects with data that currently exists, we can say that given the magnitude of shocks to surplus considered below, a CE would have a significant effect on availability and quality, at least in the short-run. As we shall see below, these effects will be enhanced by the effects of a major earthquake on reinsurance markets.

(ii) Effects on Reinsurers

Primary insurers who sell directly to individuals and firms frequently will insure part of their liability with other insurers called reinsurers. Reinsurance is routinely used to protect primary insurers against catastrophic risk. Each reinsurance policy has special characteristics but a typical transaction might be characterized as follows. A primary insurer who offers coverage for earthquakes and other natural disasters purchases a reinsurance agreement from two firms. The first reinsurer provides a layer of protection for losses from a single catastrophe (e.g. a CE, hurricane) that are between $50 million and $150 million. The second reinsurer provides a layer of protection for losses between $150 and $250 million. No other reinsurance is available to this firm. In other words, the primary insurer must cover any losses below $50 million and above $250 million for a catastrophic disaster.

The table below indicates who incurs the losses for four different catastrophic events ranging from $50 million to $350 million.

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6 The reinsurance market is comprised of professional reinsurers who sell only reinsurance as well as primary insurers, who in addition to selling directly to the public, also sell reinsurance.

7 Reinsurers frequently protect themselves by reinsuring their liabilities with other reinsurers. This practice is known as retrocession.
<table>
<thead>
<tr>
<th>Primary insurer's total losses from one event (e.g., hurricane, earthquake)</th>
<th>Reinsurers</th>
<th>Prim. Insurer's net retention</th>
</tr>
</thead>
<tbody>
<tr>
<td>$50m</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>$150m</td>
<td>$100m</td>
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</tr>
<tr>
<td>$250m</td>
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<tr>
<td>$350m</td>
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In principle this form of reinsurance protection is very valuable to primary insurers. Although they are still directly liable to their policyholders to honor claims, they can recover from their reinsurers should claims be excessive, thereby mitigating the depletion in surplus. This should have two effects which are relevant to our analysis. First, primary firms are less likely to become insolvent in the event of a major catastrophe, such as the one addressed in this report. Second, the availability of reinsurance permits primary insurers to offer both more insurance coverage and coverage on bigger risks since it permits greater diversification. If primary insurers were unable to obtain reinsurance protection, a substantial portion of the coverage that is currently provided would be unavailable.

Unfortunately, the practice is not as clean as the principle. First, a major catastrophe will, paradoxically, impact reinsurers MORE SEVERELY than primary firms. To see this consider the probabilities of severe catastrophes and the effect on premiums. In the above example, losses below $50m are the most likely and the primary firm will charge substantial premiums for this coverage. Losses between $50m and $150m have a much lower probability and the premium collected by the first reinsurer will reflect this low risk. Losses in the range $150m-$250m are even less likely and the premium for the second reinsurer will be correspondingly smaller than that for the first. Thus, in the event of say a $300m earthquake, all firms would have the same net liability, but the primary firms would have considerably more income to meet this liability then the reinsurers. Consequently, for very severe liabilities there is, ironically, even greater probability that reinsurers will become insolvent than primary firms. This has two consequences. First primary firms will be left holding the bag; default by reinsurers does not absolve them from discharging their primary contracts. Second, following a major catastrophe, there is likely to be very

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8 The availability of reinsurance is critical to the ability of small insurers to credibly write insurance.

9 The individual losses from any major natural catastrophe tend to accumulate in reinsurers' accounts as a result of their international treaty commitments. Recent case studies show the overproportionately high participation of reinsurers in extreme disaster losses. For example, for the 1985 Mexico City earthquake, foreign reinsurers paid 98 percent of the total insured loss of U.S. $275 million. (Berz, 1991).
little reinsurance available.\textsuperscript{10}

3. AN ILLUSTRATIVE SCENARIO

Below we examine the financial impact on the insurance industry in the event of a recurrence of a disaster of the same magnitude and geographic location as the 1906 San Francisco earthquake. Since the purpose of this study is to examine what \textit{can} and indeed what \textit{might} happen to the insurance industry from a catastrophic earthquake, no attempt is made to specify a probability for this scenario.

The analysis which follows attempts to show under what circumstances the industry, or its component firms, could survive such a catastrophe, whether firms would be able to meet their financial obligations to settle claims in full and whether following the earthquake there would still be a sufficient number of financially healthy firms still selling high quality insurance products.

The details of the specific scenario are as follows. An earthquake measuring 8.3 on the Richter scale is assumed to have occurred at 2:00 pm on a weekday. The time of the quake is of some importance. Although shake damage to structures will be affected little by when the earthquake occurs, timing will certainly have an impact on the extent of the injuries to people and loss of lives, and hence other insurance claim payments. For example, workers' compensation losses are likely to be high since the loss occurs during prime working and school hours. Indirectly, this injury exposure also magnifies the prospective losses for architects' engineers' and contractors' liability.

A. Nature of Insured Losses

The estimated insured losses that appear in Table I come from a number of different sources.

The residential shaking losses were estimated by a computer simulation model developed by the Allstate Research and Planning Center. The exposure base for calculating the losses was the January 1987 owner-occupied and renter-occupied housing units by zip code available from the Bureau of the Census. \textit{(The Earthquake Project 1989)}

The Commercial Shaking Losses were taken from the California Insurance Department Annual Report, in which all companies writing earthquake insurance in California report their aggregate insurance in force by zone

\textsuperscript{10}Reinsurers were particularly hard hit by a succession of severe catastrophes that hit in 1989 and 1990, including Loma Prieta, hurricane Hugo and the severe storms in Western Europe. Not only did some smaller retrocessionaires fail, but there has been a severe shrinkage of reinsurance capacity since then, as we discovered by talking to the primary insurers in our sample who were finding it difficult to secure the amount of reinsurance they desired. Notice that even the accumulation of these disasters (about \$20b) was far less serious than the CE we consider in this study.
and calculate the PML from ground shaking using a simplified formula by class of construction. (California Department of Insurance 1990)

The Fire Following Losses were estimated in a report done by the All Industry Research and Advisory Council (AIRAC, 1987). This report calculates the insured losses resulting from conflagration using a computer simulation model.

The losses stemming from Workers’ Compensation and General Liability were estimated by the AIRAC. The methodology approximates Workers Compensation and General Liability—Bodily Injury losses by determining casualties caused by building damage. General Liability—Property Damage losses were estimated by determining the number and degree of damage to buildings. (AIRAC 1988)

The estimated total insurance industry losses of $40.3 billion are based on 1987 dollar values. To the extent that there is inflation and/or increase in property values these figures will underestimate the total cost of a catastrophic quake. The considerable uncertainty associated with the magnitude of the earthquake, its epicenter and time of occurrence suggest that the range of possible damage is very wide. Hence the $40.3 billion estimate should be viewed as an illustrative example to examine relative impacts.

Table I does not include ALL economic losses from an earthquake. Many losses are uninsured. Moreover, homeowners’ policies carry a deductible, typically of 10%, and losses below this value are self insured. Our concern here is simply with the insured losses and the impact of these losses on the insurance industry. The table does not include some lines of coverage that could also sustain losses, such as inland marine insurance.\textsuperscript{11}

To put the aggregate insured losses into some perspective, the total of $40.3 billion may be set against the total surplus of the industry of $130 billion. This $130 billion figure overstates the actual surplus available to pay losses since some carriers do not operate in California.\textsuperscript{12} In other words at least one third of the industry’s surplus is at risk in a catastrophe of the magnitude depicted in Table I.

It appears as if the industry as a whole has sufficient resources to cover

\textsuperscript{11}Inland marine insurance provides coverage for goods being shipped or in storage while on land. This includes exports, imports, domestic shipments, and the instrumentalities of transportation (for example, bridges, tunnels, and pipelines). Inland marine insurance also covers personal property such as fine arts, jewelry, and furs.

\textsuperscript{12}For example, in 1988 the surplus of the entire U.S. insurance industry was $118 billion, and the surplus of insurers that operated in California was $98 billion. (California Department of Insurance).
such an unusual loss, but this is deceptive. For one thing, it assumes that the earthquake does not coincide with other abnormal loss experience for the insurance industry nor does it suffer other major catastrophes such as windstorms, hurricanes or cleanup losses in the current time frame. In addition there are a set of distributional issues. Losses will not be the same across firms nor are they proportionate to insurers' ability to pay them. Some firms will be able to absorb their commitments while still retaining sufficient surplus to function afterwards; others will become insolvent and default.

A second implication that is immediately apparent from the industry aggregates is that the bulk of the loss to the industry does not arise from shake damage. Even if the home or business is NOT protected by earthquake insurance, it is likely to be covered for indirect losses by other coverage which are normally purchased. For example, practically all homes and businesses are protected against fire losses so policyholders can make claims for any damage caused by fire following any earthquake. Health and life insurance policies provide coverage for the costs of injuries and fatalities from a quake. Workers' compensation insurance will cover these earthquake-induced losses to businesses. Similarly, business interruption policies will cover losses that are earthquake induced if the proximate cause of the loss is an insured peril, e.g. fire following an earthquake. Thus, even if insurers do not sell any earthquake policies, they have a massive exposure from a catastrophic shake. These indirect losses, termed HIDDEN EXPOSURE, are often not recognized outside the insurance industry.

B. Impact on Individual Insurance Firms.

To consider the distributional impact across insurers, we have attempted to allocate the loss for each line of business to individual insurers based upon their estimated earthquake insurance exposures. The exposure of firms was estimated on the basis of their premiums written in California. To determine a particular insurer’s exposure the following methodology was utilized:

Industry losses were compared with industry premiums to produce a loss to premium ratio for each line of business and/or type of loss. For example, the estimated insurance industry payout for workers’ compensation losses is $3.1 billion. This was compared to the total workers’ compensation (WC) premium written in California, which was equal to $6.07 billion, producing a loss/premium ratio equal to .496. This ratio was then

13 See Section Cl of this report: Insurance and the Catastrophic Risk.

14 In California in 1990, earthquake premiums made up only 2.6% of total personal lines premiums.

15 The approach described below is similar to the one utilized by the Earthquake Project in determining potential losses to individual insurers.
multiplied by each company's WC premium written in California\textsuperscript{16} in order to estimate the company's WC loss.

Below we report estimates of the impact of the earthquake on a sample of insurers. This sample was chosen to span a range of small, medium and large firms\textsuperscript{17}. Some of these firms are national companies while others are regional ones; some are multi line while others are specialized firms. The analysis which follows is based on the size of the firm. The 18 firms in the sample accounted for 36\% of the total surplus of the insurance industry and 41\% of the total net premiums written (See Table II). The limited sample was selected in order to enable us to obtain data on reinsurance transactions through a mail survey of these companies. Although the sample is small, the fact that these insurers write over 40\% of the property-casualty business in the U.S. makes it reasonable for us to draw conclusions regarding the condition of the industry after a CE.

**Direct Exposure** Table III reports the impact of the earthquake on the loss/surplus ratio for the eighteen insurance firms in our sample. A comparison between small, medium and large firms is depicted in Figure 1. Loss is divided between shake and non-shake damage. The estimated loss reflects the claims that the insurer would be obligated to pay on policies sold directly to individuals and firms. These figures exclude any consideration of reinsurance policies bought from, or sold to, other firms. Some of the key aspects of this analysis are:

\begin{itemize}
  \item The financial impact of the earthquake varies greatly across firms. For several larger insurers (e.g. A, E and G) the earthquake would have a relatively minor impact on their loss/surplus ratios even without their reinsurance taken into account. On the other hand, five out of the eleven small and medium firms, suffered losses that exceeded their surplus; in other words these firms would become insolvent. All of the firms had losses which were ten percent or more of their surplus.\textsuperscript{18}
  \item For every firm, the non shake damage exceeds the shake damage. In other words, the "hidden exposure" from a earthquake has a significant impact on the loss/surplus ratio.
  \item While the impact of the loss on surplus varies across firms, small firms are, on average, more vulnerable than medium size firms who
\end{itemize}

\textsuperscript{16}This data was obtained from the 1989 Best's Data Base.

\textsuperscript{17}Large, medium and small firms were defined as having surplus greater than $2$ billion, less than $2$ billion but greater than $1$ billion, and less than $1$ billion, respectively.

\textsuperscript{18} As a general guideline, a loss of more than 10\% of surplus from a single event is a cause of regulatory concern. (California Department of Insurance 1990).
are, in turn, more vulnerable than the large firms. This pattern could arise either from the fact that larger firms were more adequately capitalized or because they were more diversified. Most of the small firms were regional companies whose business was concentrated in California.

**Role of Reinsurance**

To determine the amount of catastrophe reinsurance in place we undertook a mail survey of the 18 primary companies in our sample.\(^{19}\) (See Appendix A for a copy of the questionnaire). Table IV depicts the impact of catastrophe reinsurance on the loss/surplus ratio for the 14 companies that responded to the survey, assuming that all reinsurance is collectible.\(^{20}\) The analysis does not incorporate other types of reinsurance coverage the firm may have, such as quota share or surplus share. Nor does our analysis take into account any of the liabilities to primary insurers from their underwriting reinsurance for other primary insurers. These omissions will tend to offset each other, though we cannot be sure what the net effect will be.

Recognizing that the sample of firms is relatively small, the data strongly suggest that private reinsurance will not significantly change the story from the one described in Table III above:

- Even assuming all reinsurance to be collectible, most small and medium firms, and two large firms, still have a significant percentage of their surplus at risk from a catastrophic earthquake.

- Those insurers responding to the questionnaire and predicted to become insolvent without reinsurance will still become insolvent with reinsurance. Specifically firms H, M and R will have loss/surplus ratios greater than or equal to 1.

Figure 2 depicts the ratio of the amount of catastrophe reinsurance to total loss for the 14 companies who responded to the mail survey. This ratio is less than 1 for all firms, and less than .25 for ten of the firms, indicating that their total loss was much greater than the amount of catastrophe reinsurance protection held. The data in Figure 2 suggests that the private reinsurance market does not by itself remedy the effects of a catastrophic loss on primary insurers, as suggested previously. Given that virtually all primary companies in the sample will be requiring full payment from their reinsurers, it is inevitable

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\(^{19}\) We would like to express our appreciation to Darrell Ehler, Harry Lazalessa, Gene Lecomte, Jack Morrison, Wesley Ooms and Richard Roth for assisting us in the development of the questionnaire.

\(^{20}\) As shown in Appendix A each primary insurer was asked what type of catastrophe reinsurance coverage they had, what their retention was, what the coinsurance above the retention was, and how much reinsurance they had above the retention.
that the reinsurance sector will experience difficulties in meeting payments and offering cover after the catastrophe.

The insolvencies identified in the case study will not leave policyholders out in the cold. They may receive partial payment from the insolvent company and are likely to obtain the remaining portion from the California insurance guarantee fund. Surviving insurers are expected to make good the default through levies allocated on the basis of their state premium income. Thus, theoretically, all defaults could be covered. However, the extend of such protection is limited. First, given the magnitude of the event, the levies required to fully compensate for all defaults would be substantial and could even lead to further insolvencies amongst those insurers surviving the initial financial impact of the earthquake. Second, the guarantees only provide limited protection. This would probably offer sufficient protection to many households. But large residential claims would be only partly compensated (given property values in Southern California these could be many such cases) and large commercial claims would receive only limited compensation from such programs. Thus, while insolvency guarantees would mitigate the effects of insolvency for policyholders, this would be adequate for many residential losses but not for larger commercial claims.

A final note on the effects of the disaster on insurers relates to the values of their surplus and their assets. The exercise we have conducted uses published book value of the insurers surplus. These values are not true economic values. For example, the major financial assets carried by property liability insurers are bonds which are carried, not at market value, but at an amortized value which relates to interest rates prevailing at the time of issue. In a time of abnormally high interest rates, the value of insurers' assets will be overstated; conversely when interest rates are abnormally low. Thus should a major catastrophe arise when interest rates are abnormally high, the surplus figures used in this exercise will be too low and the number of insolvencies would be correspondingly higher. With low interest rates, the problem would be less severe.

Impact on premium/surplus ratio. Table V provides an indication of the industry's ability to continue to write coverage after a catastrophic earthquake. Both regulation and financial prudence limit the amount of insurance business that can be sold by insurers relative to its surplus. As pointed out above, the regulatory guideline used by the National Association of Insurance Commissioners (NAIC) is that the premium/surplus ratio (i.e. its financial leverage) should not exceed

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21The practice was introduced during the recession when many insurers were technically insolvent given the current market values of their assets. Revised statutory accounting procedures permitted insurers to carry bonds at amortized values which, in general, were higher at that time. This created an illusion that insurers were actually financially sounder than they actually were. Notice that the ability of insurers to meet their obligations rests on the market value, not the book, value of its assets, for in the final analysis, it is these assets that must be liquidated to pay claims.
3 to 1.\textsuperscript{22} Even apart from such regulations, it is clear from financial and actuarial analysis that the quality of the financial guarantees offered by insurers when they sell policies will be degraded as its financial leverage increases.

Given the impact of the earthquake scenario presented in Tables III and IV it is clear that most primary insurers will emerge from the earthquake with insufficient surplus to maintain current operations. For those insurers offering several lines of business and operating in several states, the immediate prospect is that there would be a contraction of insurance supply. Moreover, as mentioned earlier, this effect would not be restricted to coverages offered in the afflicted area. Even if supply was maintained, this would be a dubious blessing as operation at high leverage would create significant risk of future insolvencies.

Table V depicts how a catastrophic earthquake would affect the premium/surplus ratios of the 18 firms in our sample. Column 1 depicts the current premium/surplus ratio of these firms. While, there is considerable variation in leverage, all insurers have ratios below 3 and thus are currently operating within the NAIC guideline. After depletion of surplus due to the earthquake, the premium/surplus ratios rise considerably if firms continued to offer the current levels of coverage, as shown in column 2. Of the sample firms, only five of the fourteen firms that responded to the survey could maintain present offerings at the reduced level of surplus while staying within the NAIC guidelines. All other firms would have to reduce coverages, or raise new surplus, to satisfy the NAIC premium to surplus guideline.

These findings imply that a major earthquake is likely to be followed by a disruption in insurance supply and/or by the insurance industry generating massive demands for new equity capital. This should dispel any illusion that the current surplus of the insurance industry represents some sort of reserve fund from which earthquake losses can be simply prepaid.

\textsuperscript{22}This ratio forms part of the IRIS early warning system to detect financially troubled insurers.
4. POLICY OPTIONS

We will address policy options in a generic way. Though we have not addressed mitigation here, we recognize that it is an important policy tool and that alternative choices as to how to pay for a major earthquake affect incentives for mitigation.

Insurance Mechanisms

Consideration of equity and the desire to minimize the dislocations (such as insolvencies amongst banks, commercial and industrial firms etc.) suggest that the costs of a major earthquake be distributed widely. Insurance provides a mechanism for distributing such costs. Insurers are able to meet their obligations without serious insolvencies and to maintain the quality and availability of insurance in the ensuing period for disasters of a smaller magnitude than that considered here. This is not to say that there will not be stresses. For example, a recent series of disasters (the Loma Prieta earthquake, hurricane Hugo and the recent European storms), have contributed to problems of reinsurance availability and there have been some insolvencies amongst smaller reinsurers and primary insurers. These losses have been absorbed by insolvency guarantee schemes present in each of the states.

For truly catastrophic events, the stresses could result in a serious disruption of the industry. There would be a number of insolvencies and these could not be offset by current guarantee schemes without placing an intolerable burden on surviving insurers. Moreover, the post disaster period would be one in which availability of insurance and the financial condition of surviving firms would be of concern. The inability of the industry to cope with such a major disaster stems from the inability of private reinsurance to withstand such losses.

The advantages of maintaining the supply of earthquake insurance through the private insurance sector for smaller disasters are that:

- it provides a distribution system for compensation in the event of a major catastrophe.
- the industry is largely competitive
- it provides a mechanism for providing appropriate incentives for mitigation (risk based premiums). This mechanism has so far been under-utilized

There are several problems associated with providing earthquake coverage entirely through the private sector:

* The industry has a massive hidden exposure from earthquakes from non-dedicated policies that cover non-shake damage. These exposures are difficult to rate for the earthquake risk. In Japan, this problem has been addressed by having insurers only pay for shake and non-shake losses if the policyholder has earthquake coverage. In other words, all direct or indirect losses are purchased explicitly.
* The current regulatory environment in some states and for some lines of business is one in which investors perceive that current premium rates deny insurers a fair rate of return. Should a CE occur there would be limited interest in new capital investment to replenish surplus which would create serious availability problems for other lines of coverage.

* Private reinsurers will not provide sufficient reinsurance relief to cover the losses to most insurance companies should a CE of the magnitude of the 1906 San Francisco earthquake occur. Some type of federal reinsurance program for covering unusually large losses from a CE is likely to be necessary. One proposal that is self-financing has been advanced by the Earthquake Project. We feel this proposal regarding federal reinsurance is attractive subject to the very important condition that there be appropriate incentives for property owners to adopt cost-effective mitigation measures and for primary insurers to engage in prudent underwriting.

**Disaster Assistance**  An alternative route is to rely on disaster assistance to either supplement current insurance claims in the case of a CE or to replace earthquake insurance entirely. We see tremendous practical problems should the private insurance industry relinquish this role. If insurers exited from the earthquake market this would entail canceling existing policies and inserting clauses in all other policies denying coverage for all losses caused by an earthquake. State insurance regulators (particularly in earthquake-prone areas such as California) will be unlikely to permit such actions. Furthermore such action would undoubtedly trigger liberal Federal relief following both major and minor earthquakes. The additional financial burden would then be shifted from the pool of insured policyholders to the general taxpayer. Not only would disaster relief discourage mitigation but it would raise questions of equity regarding who should pay for disaster losses—the victim or the general taxpayer.

5. FUTURE RESEARCH

**Stakeholder Analysis**  A detailed analysis is needed to determine the impact of different types of insurance arrangements and disaster assistance programs on the distributional burden of future catastrophic earthquakes. In particular, one would need to determine the amount of losses that will be insured and uninsured, what proportion of losses will be borne by the potential victims, the insurance industry and federal and state government. This study should also include an analysis of the role of mitigation on private and public sector structures in reducing the losses from a catastrophic quake.

**Primary Insurance Study**  It would be useful to examine the impact of different policy options on the two key financial ratios depicting the effect of a catastrophic earthquake on primary insurers: total loss/surplus and premium/surplus. In particular, how would alternative federal reinsurance arrangements affect these ratios across different insurance firms relative to the status quo? What impact would different policy options have on the availability of insurance? What amount of private reinsurance would be needed to maintain financial stability of most primary insurers?

**Reinsurance Study**  There is a need for a more detailed study on the private
reinsurance market. Due to the complicated nature of reinsurance contracts (layering of coverage and retrocession market) it is difficult to know the impact that a catastrophic earthquake will have on primary reinsurers and hence on the insurers themselves. Recently there has been significant shrinkage of the retrocessional market (due to abnormal catastrophe loss experience in the late 1980s through 1990). Reinsurance capacity has thus been drastically cut and prices charged by reinsurers have tended to rise over their previous levels. A future study should determine what private reinsurance capacity for covering losses from a catastrophic earthquake is likely to exist and how the reinsurance industry would be impacted if such a disaster occurred.

Voluntary Versus Mandatory Earthquake Insurance. A more detailed study is needed on the rationale for voluntary vs. mandatory earthquake insurance coverage. There is considerable empirical evidence that most homeowners do not voluntarily protect themselves against low probability high consequence events (Camerer and Kunreuther 1989). The normal argument for voluntary coverage is freedom of choice. On the other hand, if the federal government comes to the rescue with liberal disaster relief for uninsured victims, then there is a cost that society bears for the failure of individuals to protect themselves voluntarily.

An additional reason for requiring earthquake insurance on all property is that it would provide a better spread of the risk and hence greater diversification. One way to do this would be to have all federally insured mortgages require earthquake coverage as a condition for a loan. However, if rates are not carefully set, policyholders may feel as if they are paying a "tax" rather than a premium.

A future study could compare different proposed arrangements for required earthquake insurance with a voluntary system of coverage with respect to: (a) the diversification of risk, (b) costs to different property owners (c) nature of the reinsurance requirements and (d) the magnitude of government assistance to cover uninsured losses under alternative disaster relief programs. This study should also investigate the role that alternative programs and rate structures might play in providing incentives for mitigation measures that would reduce losses from a catastrophic quake.
### TABLE I
Estimated Total Insurance Industry Losses For a Re-occurrence of the 1906 San Francisco Earthquake

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<thead>
<tr>
<th>Type of Loss</th>
<th>Insured Loss (in Millions)</th>
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<tbody>
<tr>
<td>Building Shaking - Residential</td>
<td>$3,400</td>
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<tr>
<td>Building Shaking - Commercial</td>
<td>11,200</td>
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<tr>
<td>Fire Following - Residential</td>
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<td>Workers' Compensation</td>
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<td>General Liability - Bodily Injury</td>
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<tr>
<td>General Liability - Property Damage</td>
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</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>40,300</td>
</tr>
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</table>

Notes
I. Sources of Loss Estimates
   a. Residential Shaking - Allstate Research and Planning Center Loss Estimating Model
   b. Commercial Shaking - California Insurance Department Annual Report
   c. Fire Following, Workers' Compensation, General Liability - All Industry Research and Advisory Council Reports.

II. These figures include an adjustment for increased loss exposure to cover loss adjustment expense, debris removal, additional living expense, and the increased cost to repair/replace property during catastrophe conditions. These figures also include an adjustment for business interruption, estimated at 50% of the loss incurred under commercial shaking, commercial fire, and general liability property damage.
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<thead>
<tr>
<th>COMPANY</th>
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<th>Company Surplus</th>
<th>Company NPW</th>
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## TABLE III
### LOSS AS A PERCENT OF SURPLUS

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TABLE IV
LOSS AS A PERCENT OF SURPLUS: BEFORE AND AFTER REINSURANCE

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<tr>
<td>R</td>
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Winter, Ralph (1990) "The Dynamics of Competitive Insurance Markets," Submitted for Publication to the JFI.
A Comparison of Earthquakes with Other Natural Hazards

The mechanism of insurance is specifically designed to deal with low probability—high consequence events. However, the earthquake peril is unique in a number of ways and certain characteristics of the risk make it difficult to insure by ordinary private sector methods. To see this, a comparison is made between earthquakes and other catastrophes using the following list of characteristics as important points of difference:

1) Probability/Predictability
2) Catastrophic potential/Severity (dependence)
3) Confidence about mitigation; ability to reduce potential losses.
4) Area at risk/Exposure
5) Insurance coverage

Natural hazards are defined as those events that occur in nature and are capable of producing injury or death to people and/or damage to property. The list of natural hazards includes earthquakes, landslides, expansive soil, riverine flooding, storm surge, tsunamis, tornados, hurricanes, and severe wind. For simplicity and brevity we will focus on how the most common hazards in the United States—flooding, tornados, hurricanes and severe wind, are different from earthquakes.

**Probability** Catastrophic earthquakes occur infrequently and the low probability of such an event causes significant problems from an insurance rate—making standpoint. In comparison, the disasters listed above occur more frequently and there is a much larger data base to allow a more credible estimate of probability. Consider that in the United States during the period 1970–1991 there were 12 hurricanes, 92 tornados, and only 2 earthquakes that caused greater than $50 million in insured damage.

The infrequency of major earthquakes and the lack of information mean that statistical analysis and actuarial techniques typically used by insurers do not work very well. As stated in Stewart Economics (1989):

Insurance is accustomed to uncertainty. But no business can prepare for a catastrophic event that might take place only once every one hundred or more years. It would require a stability of industry participants, customers, practices and needs that is impossible in a world that is constantly changing . . .

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25In addition, 126 hurricanes have struck the U.S. coastline in the period 1900–1974.
Furthermore, tax policy discourages insurers from reserving for catastrophic losses. Since reserves for contingencies can be accumulated only out of after-tax income, earthquake insurance premiums set aside for future losses would be taxed first as profits. Even if insurers wanted to accumulate after-tax funds, competition would discourage them from doing so because any insurers that raised their prices to reflect the earthquake risk would be at a disadvantage to those that did not.

Catastrophic Potential/Severity One factor that contributes to the severity of losses from a catastrophic earthquake is that areas outside of California are not prepared for it from a structural point of view. Most buildings in the East and Midwest are not constructed to withstand a large quake and this implies very large losses should a major quake occur. In contrast, areas of the country that are exposed to flooding and hurricanes are more aware of the risk and have frequent "reminders" of the damage that can be done.

Another very important difference between earthquakes and other natural hazards is that the probable maximum loss (PML) for a catastrophic earthquake is estimated to be much greater than it is for other natural disasters. The PML for a hurricane is approximately $20 billion—which is only about half of the estimated PML for a catastrophic earthquake. However, the average annual loss from other disasters, particularly windstorm, is much higher than for earthquakes and the losses from hurricanes in a year are potentially greater than the PML for a catastrophic earthquake.

Confidence about mitigation: ability to reduce potential losses Since catastrophic earthquakes occur so infrequently it is difficult to determine how effective loss mitigation will be in such an event. Judging from the Loma Prieta earthquake, however, the various structural designs performed about as well as engineers expected. According to EQE (1989) "Except for buildings near the epicenter, most cases of severe damage occurred in older buildings with little seismic capacity and in areas of extremely weak soils." 26

The potential damage from an earthquake cannot be reduced by advanced warning immediately before the event because to date no one is able to predict when an earthquake will occur. In contrast, advanced warning allows areas that are about to be hit by either a hurricane or a flood to be evacuated and measures can be taken after the warning to reduce property damage. The inability to give advanced warning to a quake prone area makes mitigation before the event even more important.

As mentioned above, one problem regarding earthquake mitigation is that areas of the country besides California that have a seismic risk are not prepared for it in terms of building codes. As for hurricanes, the damage is predictable but most building codes do not require engineers to build hurricane resistant

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buildings. Contrast these two cases with the flood risk. In order for a community to be eligible for flood insurance it MUST agree to adopt and enforce floodplain management regulations, such as restricting landuse and imposing building codes.

Area at risk/Exposure

A large portion of the United States is at risk for earthquakes. Thirty-nine of the fifty states are subject to major or moderate seismic risk. Similarly, the risk of floods and tornados extends across most regions of the country. Hurricane exposure, on the other hand, is limited to the coastal states.

An important issue is how much of the country is exposed to the hazard. If it was just California, for example, many would question why there should be federal involvement (in terms of a federal earthquake insurance program) when it is a state problem. However, it is becoming more and more clear that the earthquake hazard threatens many states besides California. For the flood insurance program it was indisputable that virtually the whole country was at risk for flooding. It is less clear for earthquakes since most people have not experienced one and are therefore more inclined to ignore the risk or feel as if "it cannot happen to me."

Insurance coverage For the natural hazards listed above, flooding, tornados, hurricanes, severe wind and earthquakes, all but the flood risk can be insured on the private market. However, they are not insured to the same degree. In terms of earthquake coverage, for example, only about 25% of homeowners in California purchase it. This is up from a few years ago when only about 7% purchased coverage. Countrywide the percentage is only about 5%. In contrast, virtually all insureds subject to hurricane purchase windstorm cover and about 13-14% of homeowners are insured for flooding.

Starting in North Carolina in 1969, mandated windstorm and beach plans have been created in 8 states stretching from the Texas border to the Virginia border. In 1985 the California legislature passed a law that required all insurance companies writing homeowners' insurance to specifically indicate to homeowners that they could buy earthquake insurance as well. This explains, to a large degree, the increase in demand for earthquake insurance from one out of fourteen homeowners to one out of four. Such involuntary plans had little impact on swelling earthquake writings on those risks unduly exposed to the peril but involuntary plans have had a major impact, and in fact have encouraged an increase in risks unduly exposed to the windstorm peril. After a major disaster, then, insurance resources will be made available to a large percentage of hurricane victims but a relatively small percentage of earthquake victims.

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27Petak and Atkisson.


29Federal Disaster Insurance from the Natural Catastrophe Perspective, prepared by AIA.
Another major difference in terms of insurance coverage is the ability of insurers to spread the risk. Since virtually all buildings exposed to the risk of hurricane have wind coverage and since flood insurance is written all across the country, it is possible to achieve sufficient diversification. For earthquake insurance, however, most of the premium volume is written in California (about 80%) and this does not allow for adequate diversification possibilities.

The above discussion helps to demonstrate that the earthquake risk is unique from other natural hazards and deserves special attention. The discussion also supports the argument that the earthquake risk meets the de facto guidelines established in 1971 for recognizing the existence of a problem that would require federal participation if a national insurance program were established. Federal participation would be possible only if it were demonstrated that (1) Adequate insurance could not be provided by the insurance industry, (2) the financial consequences of a major disaster were beyond the abilities of the insurance industry, and (3) local communities adopted and enforced loss reduction measures. According to Mittler, all three of these conditions are met.

Description of the Earthquake Hazard

In 1977, the United States Congress declared that "All 50 States are vulnerable to the hazards of earthquakes and at least 39 of them are subject to major or moderate seismic risk." But even though the whole country is at risk, the risk differs substantially across the country.

One way to describe the earthquake hazard in different areas is by using a contour map, as shown in Figure 1. The map delineates seismic zones, with zone 4 having the highest seismicity. The map shows that areas of California, Alaska and Montana are in zone 4 and parts of Missouri, Washington and Utah are in zone 3.

Four regions outside of California and Alaska are most likely to be shaken by a destructive earthquake at some time in the future. These are:

1) The Central States, where four quakes of up to 8.6 in magnitude on the Richter scale ruptured the New Madrid, MO seismic zone in 1811-1812.

2) The East Coast, where a quake measuring 7 on the Richter scale occurred near Charleston, SC in 1886.

3) The Pacific Northwest, where in the last 135 years there have been more than 1,000 earthquakes felt and a number of shocks have been of moderate to large magnitude.

4) The Nevada-Utah-Montana seismic zone, where a quake in Hebgen Lake, Montana in 1959 killed an estimated two dozen people in landslides.

The presence of active fault lines is another way to differentiate the earthquake hazard in different states. Figure 2, for example, illustrates the Southern California fault system. Although scientists are able to identify many faults, there still remain others that are unidentified, making the earthquake risk in some areas of the country unknown.

Another important factor in describing the earthquake hazard in different regions of the country is preparedness. The Central and Eastern states do not have earthquake resistant construction practices, like in California, so a similar quake in these areas could be a much worse disaster. Eastern quakes are also more damaging because of the high population density in this part of the country. Finally, Eastern earthquakes can damage a much wider area because of the nature of the earth itself. In California, for example, the terrain is generally rocky and the ripple effect of the seismic activity is captured by the rock, thereby limiting it. In contrast, the East has generally sandy soil that permits earthquake shocks to travel much farther, thereby potentially devastating an area 100 times greater in the East than in the West.

The Earthquake Project has divided up the country into nine earthquake territories. These are:
1. California
2. Alaska
3. Charleston
4. New Madrid
5. Puget Sound
6. Wasatch
7. Remainder of the East
8. Remainder of the Midwest
9. Remainder of the West

In order to give the reader an idea of how the exposure differs by territory, the following table gives an estimate of the pure premium\(^3\), before a deductible, assuming all policies are insured for earthquake shaking damage\(^4\). This includes owners, mobilehomes, fire, and landlord policies.

<table>
<thead>
<tr>
<th>Territory</th>
<th>Pure Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>$89.60</td>
</tr>
<tr>
<td>Alaska</td>
<td>213.70</td>
</tr>
</tbody>
</table>

\(^3\) There are as many faults per square mile in the Northeast as there are in California, but the ones in California are more recently formed and therefore more geologically active. Dennis Hevesi. *The New York Times*, November 28, 1988.

\(^4\) "Catastrophic Earthquakes: The Need to Insure Against Economic Disaster."

\(^3\) Pure premium is equal to the expected loss without any loading for expense, profit or tax.

\(^4\) The Earthquake Project - Actuarial Subcommittee.
3. Charleston  
4. New Madrid  
5. Puget Sound  
6. Wasatch  
7. Remainder of the East  
8. Remainder of the Midwest  
9. Remainder of the West  

These figures help to illustrate that a majority of the United States is exposed to earthquake losses, and that this exposure differs substantially from one territory to another.

REFERENCES


American Insurance Association. Federal Disaster Insurance from the Natural Catastrophe Perspective.
APPENDIX A

We are interested in learning more about how primary insurers reinsurance against catastrophic losses such as a severe earthquake.

1) a. Do you have a per occurrence excess (catastrophe) treaty for earthquake losses?

___ Yes  ___ No

If yes, what lines of insurance are part of the treaty?

___ Fire
___ Workers' Compensation
___ Homeowners' MP
___ Commercial MP
___ Other Liability
___ Allied lines
___ Farmowners MP
___ Inland Marine
___ Aircraft
___ Glass
___ Burglary and Theft
___ Boiler and Machinery
___ Earthquake

b. What is your retention?  $________________________

c. What is the coinsurance above the retention?  ________________________

d. How much reinsurance do you have above your retention?  $________________________

e. Please describe the layers of reinsurance:

________________________________________________________________________

________________________________________________________________________

2) a. Do you have an aggregate Excess or Stop Loss Treaty?

___ Yes  ___ No

b. What period of time does the treaty cover?  ________________________
c. If you answered yes to a., what lines of insurance are covered?

__________________________

d. What is your retention? ________________________________

e. How much reinsurance do you have above your retention? $ _______

f. Please describe the layers:

__________________________

3) What other types of reinsurance arrangements does your company have to protect itself against Catastrophic EQ related losses? (check all that apply)

a. _____ Quota _____ Facultative

_____ Treaty

b. _____ Surplus Share _____ Facultative

_____ Treaty

c. _____ Per risk excess _____ Facultative

_____ Treaty

Please briefly describe the amounts of coverage you have in terms of the treaty insurance checked above.

4) Reinsurance ceded = $________________________

What percentage (please estimate if necessary) is ceded to:

a) foreign reinsurers ________% 

b) domestic professional reinsurers ________% 

c) domestic insurers with reinsurance departments ________% 

Total 100%
5) Please choose one of the following to describe your company's current reinsurance coverage, in terms of pricing and availability, as compared to during 1989.
   a. The same amount of reinsurance coverage for about the same price.
   b. Less reinsurance now for a higher price.
   c. More reinsurance now for a lower price.
   d. Other ____________________________ (please specify)

6) Do you have a separate CAT treaty for California?    ____ Yes    ____ No
   Do you have a separate CAT treaty for any geographic location?
   ____ Yes    ____ No
   If yes, please specify: ________________________________