

Catastrophe Insurance When Capital is Limited:
A Comparison of Public and Private Approaches

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In the early 1990s, the United States was struck by a succession of unusually high cost natural disasters. Losses included Hurricane Iniki (1992, \$1.5 billion), Hurricane Andrew (1992, \$14.5 billion) and the Northridge Earthquake (1994, \$12 billion). A major share of the financial burden of these disasters was borne by private insurance markets, and the sheer size of these insured losses has led private insurers to question the wisdom of offering this line of insurance. Unable to sustain another major hit let, alone a mega-catastrophe (for example a hurricane of the force of Andrew hitting Miami with losses in the \$50 billion range), private insurance companies have systematically tried to avoid offering the catastrophe line.

This has led to fundamental changes in the structure of the catastrophe insurance industry. Because of the importance of catastrophe insurance to mortgage lenders (and therefore ultimately to the whole real estate industry), states at risk to catastrophe losses have intervened to try to ensure that catastrophe insurance remains available. This intervention has taken a number of forms. In two States, Hawaii and California, the States have themselves set up agencies that provide catastrophe insurance coverage. In two other States, Florida and Texas, the Insurance Commissioners, using new laws and regulations, have induced private market companies to participate in joint underwriting associations. In those states in which state government has intervened, private catastrophe insurance, to the extent that it exists at all, is a mere shadow of its former self.

These changes are the focus of this paper. We are interested in two questions:

- 1) Why did the private market in catastrophe insurance fail? To answer this question we draw on our earlier paper, Jaffee and Russell (1997).
- 2) What are the prospects for success of the new state schemes? Since different states have approached the problem of providing catastrophe insurance in different ways, a review of the

variety of experience will enable us to draw some general implications for state provision of catastrophe insurance.

In answering question 2), we advance the following hypothesis. In the present state of capital markets, no entity, be it private or public, is likely to provide guaranteed full insurance against a mega-catastrophe. Therefore the success or failure of any plan, public or private, depends crucially on how the plan structures contracts which of their nature can provide only partial insurance. We believe an examination of the factors determining the demand for partial insurance (a question largely overlooked so far in the insurance literature) will be of interest both to officials charged with administering state plans and to private insurance companies considering re-entry into the catastrophe insurance market.

1. Why Private Catastrophe Insurance Markets Fail

Why has the private market in catastrophe insurance failed? We have argued elsewhere, Jaffee and Russell (1997), that the difficulties in providing catastrophe insurance do not stem from well understood insurance market problems such as adverse selection or moral hazard. Rather, we suggest that non-insurability arises as a consequence of the fundamental mismatch between the size of the actuarially fair premium pool that can be collected in a given year, and the size of a mega-loss that might occur in any year.

This mismatch can be seen by looking at loss ratios over time. In California, for example, loss ratios were under 10% from 1972 to 1986, but equaled 2272 in 1994; see Jaffee and Russell (1997), Table 2. This seems to occur only in the catastrophe line, as can be seen by looking at company loss ratios across lines. As noted in Jaffee and Russell (1997), Table 1, the only lines in which loss ratios systematically exceed 100% are those affected by hurricanes and earthquakes.

The problem of how to match an annual premium flow to a potentially much larger

annual loss is a problem for capital markets not insurance markets. In principle capital markets could work in one of two ways. The firm itself could operate an internal capital market, accumulating premiums against anticipated losses. Alternatively in the event of a loss, the firm could access external capital markets, the annual premiums providing the cash flows necessary to repay the loans.

Within current institutional arrangements, however, neither the internal nor the external capital market allows the flow of premiums to be capitalized and these capital market imperfections have caused insurance companies to leave the catastrophe line rather than risk their total capital on one catastrophic event.

Internal and external capital markets have failed for different reasons and we turn now to an examination of each case.

Internal Capital Markets

In principle an insurance firm could provide for a large future loss by setting aside each year sufficient premiums earmarked to pay for the loss. This fund would not finance a loss that occurred early in the firm's life, but over time, with correct pricing, this fund would on average provide the capital necessary to pay the claim. Three institutional features work against the setting up of such a 'rainy day' fund, see also Wallace and Althoff (1994):

a) Standard accounting procedures in the United States (in particular F.A.S.B. 5) prevent insurance companies from treating anticipated losses as a liability. Thus private companies cannot isolate catastrophe premiums for use to pay only catastrophe losses. Of course the firm can retain earnings and build up a general surplus, but this surplus must serve all lines, and as we will see in a moment, any firm with a large liquid surplus runs the risk of hostile takeover.

b) In the United States, the premium earnings which are necessary to provide capital for the future loss are taxed at regular corporate income tax rates. This works as a disincentive for private companies to accumulate these funds. This tax treatment of private insurance stands in contrast to the tax –exempt status the IRS has granted to public insurers.

c) As we noted in a) an insurance firm could try to accumulate a large general surplus, this surplus to be used in the event of a catastrophe. As noted by a number of writers on corporate governance, however, the presence of a large unprotected stock of ‘free cash’ frequently acts as a magnet to corporate raiders, Jensen (1986), Blanchard et al (1994). Not even the mutual form of ownership protects an insurance company from such attentions, because demutualization is always an option and current legal reform is making this option easier to execute. For all these reasons, internal financing of catastrophe risk seems not to be viable. What about external financing?

External Capital Markets

The traditional source of external capital for catastrophe insurance has been the reinsurance markets. Reinsurers too, however, have grown shy of catastrophe risk and even the grandfather of all reinsurance capital providers, Lloyds of London, has recently had to initiate organizational reforms to limit its overall capital exposure. It seems unlikely that the traditional reinsurance market by itself can be looked to provide the level of capital needed for this line, see also Froot and O’Connell (1996).

This has led to a search for new sources of capital, and in recent years several new instruments have been developed to bridge the gap between insurance markets and financial capital markets. Among these new instruments are derivatives such as catastrophe options, futures and swaps, and primary instruments such as contingency lines of credit and Act of God bonds. Financial engineers

have high hopes for these new instruments because the primary ‘asset’ underlying all of these contracts is a change in wealth occurring at a random point in time, and this wealth change is likely to have a low to zero correlation with wealth changes in equity markets. For this reason catastrophe based instruments offer portfolio managers a convenient hedge.

This said, the growth in size of these markets has been far from spectacular, and the current capacity falls far short of requirements. This situation may change. The slow growth of the market may reflect the difficulty which fund managers face in calibrating each bond’s risk. To this end, the recent decision by Moody’s Investors Service and Fitch Investors Service to rate catastrophe bonds for the first time enables fund managers to explain to their superiors how these bonds compare in risk with say junk bonds. This rating seems to have been instrumental in the recent successful placing of catastrophe bonds by Swiss Re and USAA and may be expected to lead to more such placements, see New York Times (1997).

At this time, however, limitations on the supply of external capital and the difficulties in accumulating internal capital, prevent many private insurance companies from voluntarily participating in catastrophe insurance markets. This lack of private catastrophe insurance has led to a number of public (state) responses.¹ We turn now to an examination of these schemes.

¹ It should be noted that, throughout the availability crisis, there have been numerous attempts to provide catastrophe insurance through the agency of the Federal government. So far these efforts have not been successful, and we will not discuss them further in this paper.

2. State Responses to Private Market Failures

In response to the failure of the private markets for catastrophe insurance, several states have created quasi-public catastrophe insurance plans. In particular, California has created the California Earthquake Authority, Florida has created two Joint Underwriting Associations for hurricane risks, and Hawaii has created the Hawaii Hurricane Relief Fund.² In this section, we describe the structure of these three state plans, and then evaluate how well they are performing.

2.1 The Quasi-Public State Catastrophe Insurance Plans

In each of the three states, the need for a quasi-public entity arose because the private insurance companies did not wish to provide catastrophe insurance on their own account. The state facilities differ substantially, however, in how they have been structured. Therefore, it is useful to compare and contrast the plans with regard to a specific list of features:

1. Which entity holds the underwriting risk of catastrophe losses?
2. What are the capital and other financial resources?
3. What are the arrangements for reinsurance and other risk-sharing instruments?
4. What is the structure of the insurance policies?
5. How will claims be paid if losses exceed the entity's financial resources?
6. How are the premiums set?
7. Is the entity exempt from federal tax?
8. How are claims to be settled?
9. Is there a role for a separate private market?

²Texas has also created a Catastrophe Pool, but this will not be discussed in this paper.

The three state plans differ substantially in terms of features (1) to (5), while they are quite similar in terms of features (6) to (9). We begin by summarizing features (1) to (5) for each plan.

The California Earthquake Authority (CEA)

The CEA was created in 1996, following the 1994 Northridge earthquake. An extended period was needed in order to create legislation that balanced the needs of the insurance industry and consumers.³ In the end, the CEA was designed to cover an aggregate loss as high as double the Northridge quake, although this estimate is based on the smaller level of claims that would arise under the limited CEA earthquake contract. Approximately 70% of the state's insurance companies that write homeowners policies have joined the CEA. The CEA Board consists of the Governor and the Commissioner of Insurance, with input from a Policy Advisory Board of insurance industry and consumer representatives. It has the following basic structure.

1. Which entity holds the underwriting risk of catastrophe losses?

The underwriting risk rests directly with the CEA, which is officially described as a “privately financed, publicly managed state agency that will provide insurance coverage for earthquake damage to residential property owners, mobile homeowners, and renters”.⁴ If earthquake losses exceed the CEA's available resources, then the state treasurer can issue debt up to \$ 716 million, which will be repaid through assessments on CEA policyholders. Otherwise, the legislation specifically precludes the use of state general funds to pay for CEA losses. The participating companies, as well, have no liability other than their invested capital (see next).

³ There was a series of 3 legislative acts, the first 2 took effect on January 1, 1996 and the last was passed on August 28, 1996 and signed into law by Governor Pete Wilson on September 27, 1996.

⁴ Press release of the California Insurance Department, dated August 29, 1996.

2. What are the capital and other financial resources?

CEA financial resources include premium income and total capital of approximately \$7.5 billion.⁵ The capital resources provided by the *participating insurance companies* are:

- \$ 700 million in nonreimbursable capital;
- A commitment to provide an additional \$2.148 million if needed for claims.
- An assessment of \$1.432 billion if claims exceed \$6 billion.

3. What are the arrangements for reinsurance and other risk-sharing instruments?

The CEA is to purchase \$1.432 billion in reinsurance and is authorized to borrow an additional \$716 million. Capital market investors are to provide \$1.074 billion to pay claims in excess of \$ 4.9 billion and less than \$ 6 billion.

4. What is the structure of the insurance policies?

The CEA provides a single contract, sometimes called the “Mini Policy,” since the coverage is less than was previously available from the private companies. Its key limiting features are:

- Claims are subject to a deductible that is 15% of the underlying home coverage;
- The policy does not cover associated structures (such as pools and detached garages);
- The policy provides only \$5,000 for lost personal effects and \$1,500 for living expenses.

⁵ All values quoted in this paragraph are based on the participation rate of state insurers in the scheme. This rate turned out to be just over 70%. Many of the numbers originally quoted assumed a participation rate of 100%, in which case the fund was capitalized at \$10.5 billion .

5. How are claims to be paid if losses exceed the entity's financial resources?

If losses exceed the CEA's financial resources, payments to policyholders will be prorated, and paid in full only if and when more resources become available (such as from future premiums). Neither the state nor the insurance companies have any further legal responsibilities. In addition policyholders have no recourse to the state insurance guarantee fund.

The Hawaii Hurricane Relief Fund (HHRF) ⁶

The HHRF was created in 1992 following the large losses created by Hurricane Iniki. Administratively, the HHRF is a state agency operating under the Hawaii Department of Insurance. The HHRF has been designed to provide up to \$1.7 billion in coverage for a single event of the same dimension as the 1992 Iniki hurricane. Approximately 95% of the state's hurricane insurance is provided by the HHRF. The following describes its basic structure.

1. Which entity holds the underwriting risk of catastrophe losses?

The underwriting risk for hurricanes rests directly with the HHRF. If hurricane losses exceed the HHRF's available resources, then the state treasurer can issue debt up to \$200 million, and an assessment of up to 5% can be placed on all property and casualty premiums. No other access is provided to general state funds or to the capital of the participating insurance companies.

2. What are the available capital and other financial resources?

The HHRF has no paid in capital and no arrangements for tapping contingent capital.

⁶ This description is based on material in "Academic Task Force on Hurricane Catastrophe Insurance, Final Report," The Collins Center for Public Policy, September 30, 1995.

3. What are the arrangements for reinsurance and other risk-sharing instruments?

Reinsurance to cover losses above the \$700 million level is financed through premiums, a 3.75% assessment on all property and casualty premiums, and a .01% surcharge on mortgages.

4. What is the structure of the insurance policies?

HHRF residential policies cover losses up to \$750,000 per risk. Deductible levels are available from 1% to 5% of insured value.

5. How are claims to be paid if losses exceed the entity's financial resources?

Just as in California, if losses exceed the HHRF's financial resources, payments to policyholders will be prorated, and paid in full only if and when more resources become available. Neither the state nor the insurance companies have any further legal responsibilities.

The Florida Joint Underwriting Associations⁷

Florida provides for hurricane insurance through two joint underwriting associations (JUAs), which together cover all of the state's area. The Florida Windstorm Underwriters Association (Windstorm JUA) was formed in 1970 originally to provide hurricane coverage that was not otherwise available in the Florida Keys. The Florida Residential Property and Casualty Joint Underwriting Association (Residential JUA) was formed in 1992 following Hurricane Andrew to provide hurricane coverage that was not otherwise available in areas of the state not covered by the Windstorm JUA. Both entities operate as residual risk pools, in that they provide hurricane coverage to homeowners who are unable to obtain coverage through the private

⁷ This description is based on material in "Academic Task Force on Hurricane Catastrophe Insurance, Final Report," The Collins Center for Public Policy, September 30, 1995.

market. The structure is thus comparable to the assigned risk pools that are used for auto insurance in certain states. At their peak size in 1996, the two JUAs had over 1 million policies in force, making them Florida's third largest property and casualty insurer.

The Windstorm JUA's governing Board represents the insurance industry, while the Residential JUA's governing Board represents the insurance industry, consumer groups, and the Insurance Commissioner. In practice, each entity operates as a regular insurance company, but one owned jointly by all of the state's licensed property and casualty insurance companies. The following describes the structure of the Florida JUAs.

1. Which entities hold the underwriting risk of catastrophe losses?

The state's property and casualty insurance companies bear the underwriting risk in that assessments on these companies would be used to pay for any JUA deficits. Each company's assessment would be based on its market share in the prior year. The state of Florida also administers the Florida Hurricane Catastrophe Fund, a tax-exempt trust fund created in 1993 to provide reinsurance for the hurricane risk of Florida insurance companies. The companies pay actuarially determined premiums for the desired amount of reinsurance coverage. At year-end 1995, the Fund had net assets of \$890 million and a capacity, based on additional borrowed funds, to pay claims of \$5.5 billion.

2. What are the capital and other financial resources?

The JUAs have no paid in capital. Their only financial resources are premium income and the right to assess the participating companies (see above).

3. What are the arrangements for reinsurance and other risk-sharing instruments?

Most premium income is used to purchase reinsurance and other risk-sharing instruments.

4. What is the structure of the insurance policies?

JUA policies follow the same basic forms used in the private market.

5. How are claims to be paid if losses exceed the entity's financial resources?

Unlike California and Hawaii, the JUAs have the right to assess the participating insurance companies for all payments to policyholders. In the event of a hurricane greater than Andrew, it is likely that policyholders would receive their full payments from the companies only over a number of years. The state has no legal responsibility for loss payments.

Other Plan Features

The 3 state plans are more homogenous with respect to the features (6) to (9) listed above. These are described as follows.

6. How are the premiums set?

In all three states, catastrophe premiums are to be set using actuarial methods. In practice, however, premium setting is better described as an artful mix of actuarial science and politics. This occurs because alternative actuarial methods can determine a potentially wide range of catastrophe premiums. For example, for earthquake risks, scientific estimates of the likelihood of a quake at a given location can differ widely. Furthermore, there is a choice whether (1) to allow premiums to vary significantly across many small geographic zones, or (2) to set premiums at average values that cover a smaller number of large geographic zones.

Discussions of premium levels have been most heated in California, where there is wide disagreement over the relative risk of earthquakes in the south (Los Angeles) versus the north (San Francisco Bay Area), as well as along individual fault lines. If very small rating areas are used,

premiums could potentially range from a high over \$10 per \$1,000 coverage to a low below \$1 per \$1,000 coverage. In contrast, a single rate could be set for the entire state in the range of \$3 per \$1,000 coverage. The CEA has recently announced plans to reconsider, once again, its premiums, with a probable move toward a middle-ground compromise.

Both the Florida and Hawaii plans have recently announced premium reductions. These reductions, however, are based on political, not actuarial, factors, in that there is no new actuarial evidence in either state (the good fortune of new recent losses notwithstanding).⁸

7. Is the entity exempt from federal tax?

The Internal Revenue Service has provided all three state plans with an exemption from the federal income tax. This allows net premium income and income on capital to be accumulated over time on a tax-free basis. This is most relevant for the California plan, which is the only plan to hold a significant pool of capital.

8. How are claims to be settled?

In all three states, claims are to be settled by the company that carries the primary homeowners policy on the insured dwelling.

9. Is there a role for a separate private market?

Each of the three states provides for a separate private market, but it seems that an active and voluntary private market has not developed in any of the states. In Hawaii, only 5% of the market is served by firms that did not join the state plan, and apparently only 1 firm has entered the market

⁸ Florida law also requires that JUA premiums be at least as high as the premiums for “comparable” private market policies. This seems to be violated at times, in part because it can be hard to find comparable policies.

in order to provide a contract with more complete coverage than the state plan. In California, approximately 30% of the market is served by firms that did not join the state plan, but it could well be that most of these firms plan to leave the state altogether. As in Hawaii, we know of only 1 firm has entered the market in order to provide a contract with more complete coverage than the state plan.

Florida represents a more complex case, since Florida law requires the firms to renew at least 95% of their policies from one year to the next. Thus, although private firms service most of the market, much of this participation may be involuntary. Florida also recently passed legislation to induce private firms to underwrite policies currently in the JUA portfolios. Inducements include a bounty as high as \$100 per contract. We comment on this further in section 4.

3. The Demand for Partial Insurance : A Behavioral Model

Despite the advantages that they enjoy over private agencies, the state schemes we have just examined have also been unable to access the levels of capital that would fully underwrite a mega-catastrophe. Thus whether it is explicitly recognized or not, catastrophe insurance is in fact a form of partial insurance.⁹ In this section we discuss a number of factors which influence the demand for partial insurance. How the various state schemes respond to these factors will determine their ultimate success.

Partial Insurance

⁹ California does explicitly recognize the partial nature of the CEA insurance. The contract states ‘ In accordance with California Insurance Code Section 10089.35, if at any time, the available capital of the CEA is insufficient to meet anticipated losses... the CEA may pay claims on a pro rata basis .from the remaining funds available... ‘

We begin by defining partial insurance. Partial insurance arises whenever an insurer lacks sufficient capital to pay claims in the event of a large loss. From the consumer's viewpoint, partial insurance is a form of lottery.¹⁰

Define Λ_i as the loss sustained by individual i in the event of a catastrophe.

Define L as the total catastrophe loss of the insurance company that carries individual i 's policy.

Define K as the capital available to this insurer to meet this catastrophe loss.

Then if $K \geq L$, the insured will receive full compensation for loss Λ_i .

However if $K < L$, the insured will receive $(K/L)(\Lambda_i)$, where K/L is the pro rata pay out ratio that exhausts available capital. The payoff from this lottery is determined by the probability of total loss L relative to available capital K .

For a given quantity of capital, an insurance provider can vary the contractual terms of a partial insurance contract in a number of ways. Different contracts are then associated with different lotteries. What determines the demand for these different partial insurance contracts?

The standard textbook answer to this question assumes that individuals maximize expected utility. This hypothesis was first applied to insurance demand in the early 1960s as an application of the then newly revived Bernoulli doctrine, see Arrow () and Borch (1990).

As noted by Johnson et al , however, 'there is abundant evidence, although much of it is anecdotal, that consumers do not make these choices rationally,' (1993) p. 36. In this section, we analyze the demand for partial insurance using the techniques of behavioral decision theory.

In probabilistic terms, the purchase of insurance, full or partial, is the exchange of one probably density function over wealth w , say $f_1(w)$, for a less risky probability density function say $f_2(w)$ where the premium is included in $f_2(w)$. For an expected utility maximize, (and even, in

¹⁰ More technically, partial insurance is a form of put option.

some cases for a Machina Generalized Expected Utility maximizer see Russell(1997)) the only question is whether the expected utility of $f_1(w) = \int u(w) f_1(w) dw$ exceeds or falls short of the expected utility of $f_2(w) = \int u(w) f_2(w) dw$.

The behavioral analysis of the insurance conscious decision departs from this hypothesis in two major ways:

- a) In evaluating probability density functions, the EU maximization hypothesis is replaced with a descriptive hypothesis that is consistent with subject's observed behavior in the laboratory. At this time the best developed behavioral hypothesis is Prospect Theory, see Kahneman and Tversky (1979), which is the hypothesis which will be used here.
- b) Unlike the EU maximization hypothesis which reduces choice under uncertainty to a comparison of probabilities density functions, behavioral decision theory recognizes that the words used to describe choices can influence the outcome of choices whose probability density functions are identical. The presence of such 'framing' effects in insurance demand is well documented by Slovic et al (1982a).

We begin by examining partial insurance demand in terms of prospect theory.

Partial Insurance Demand and the Certainty Effect

One of the key differences between EU theory and Prospect Theory is the latter's prediction of a 'Certainty Effect,' in which 'the reduction of the probability of an outcome by a constant factor has more impact when the outcome was initially certain than when it was merely probable,' Tversky and Kahneman (op.cit.) p.455. This 'certainty effect' already presents an obstacle to the selling or partial insurance. When Kahneman and Tversky gave subjects a choice between full insurance which the subjects found just acceptable and partial insurance (one half the

coverage at one half the premium) 80 % of subjects preferred the full insurance though partial insurance in this case gives higher expected utility, see Kahneman and Tversky (1979).

Full insurance, of course, is not an option when capital is limited, but in this case the insured could be given a choice among several kinds of partial insurance contracts. The contract terms can be varied with respect to a) the deductible, b) the extent of coverage, and c) the size of the premium.

a) Deductibles

From the viewpoint of the certainty effect, an increase in the size of a deductible has two opposing consequences. In the first place, it clearly reduces the share of the loss taken by the insurance company and increases the share that falls on the insured. This moves the insured away from certainty. On the other hand, an increase in a deductible, by reducing required total capital in the event of loss, increases both the amount which can be paid per contract and the probability that the contracted amount will actually be paid. This moves the insured in the direction of certainty.

Which of these two effects will dominate is an empirical question. Because the size of the deductible is clear on the face of the contract whereas the probability of being paid is more vague, we hypothesize that increases in the size of the deductible will reduce the number of policies sold. This hypothesis can be tested on Hawaiian data since in that plan consumers can choose the level of their deductible.

Since the number of policies sold will in part determine available capital, an increase in the size of the deductible designed to conserve capital can have the perverse effect of reducing the total quantity of capital available.

b) Extent of Coverage

Another way to make available capital go further is to limit the extent of the coverage of the contract. For example coverage can be restricted to the primary residential structure excluding garages, outhouses, swimming pools, etc. Again, limiting coverage has two effects vis a vis certainty. It moves the insured away from full coverage on the total property at risk. However it moves the insured closer to full coverage on that property which is actually insured. We hypothesize that this second effect dominates in that consumers prefer full coverage of part of their property to partial coverage of all.

This is consistent with the pseudo-certainty effect of Slovic, et al (1982b). They found that 40% of 211 subjects chose to be vaccinated against a disease when vaccination protected $\frac{1}{2}$ of the recipients. However 57% of subjects chose to be vaccinated against 2 diseases when told vaccination would protect against one disease but not the other.

c) Premiums

Exactly as in the other two cases, an increase in premiums has two effects. First higher premiums by enlarging the capital stock produce higher quality contracts. Second, as with any demand curve, higher premiums reduce the number of policies sold. Since demand is reduced by an increase in premiums but quality is increased, it is an empirical question whether higher premiums raise or lower demand. (In other areas of property casualty insurance, i.e. in auto insurance, the estimates of premium elasticity are quite high, see Jaffee and Russell (1997)).

In each of these cases, actions taken by an insurance provider to protect and enhance capital can, by reducing sales of policies, actually reduce capital. Whether or not this is the case requires detailed empirical analysis. In section 4 we provide a preliminary review of the experience in the various state plans.

Partial Insurance and Framing

The existence of framing effects in the structure of contracts also needs to be examined. For example, to what extent is the average purchaser of the CEA insurance contract even aware that

- i) The State of California has no liability for loss.
- ii) The CEA can pro rate losses.
- iii) Assessments can be levied on the premiums to pay off bonds.

It would not seem unreasonable for consumers to assume that a CEA policy issued under the auspices of the Commissioner of Insurance of the State of California is backed by the full faith and credit of state government. Again detailed empirical work is necessary to determine how this contract is being ‘framed’ in the minds of its buyers.

4. Evaluation of the State Catastrophe Insurance Plans

Mother Nature has been kind to all three of the new state insurance plans, since none of them has suffered a significant catastrophe, let alone a “big one,” since the plans started. Nevertheless, there is dissatisfaction with each plan, to a degree that varies across the states. We begin this section by summarizing the recent experience in each state.

The Hawaii Hurricane Relief Fund (HHRF)

Hawaii seems to be the state most satisfied with its plan, no doubt due in part to a recently announced premium reduction. Nevertheless, there is widespread recognition that the HHRF is providing only *partial insurance*, since the plan has total resources (primarily reinsurance) to cover only an event comparable to the Iniki hurricane of 1992 (that is, approximately \$1.7 billion in total insured losses). Were losses to exceed that level, policyholders would receive prorated

payments, and could only hope that additional payments might be made in later years from future premiums. Policyholders might also hope that state or federal agencies might provide help as well.

The Florida Joint Underwriting Associations (JUAs)

There seems to be even greater concern in Florida that the JUAs are providing partial insurance. In particular, the immediately available resources of the Florida JUAs are adequate to cover only a hurricane equivalent to Andrew. Beyond that, the participating companies could be assessed for the full amount of any deficit, but it is possible that policyholders would receive their full payments only after an extended period. For this reason, the Florida legislature recently took action to encourage the insurance companies to transfer policies back to the private market from the JUAs. The benefit is that when a policy is on the books of a private company, the full capital of that company is available to make payments on any claims. The Florida legislature has offered a bounty of as much as a \$100 per policy for each policy that a company is willing to shift to its own account from the JUA. Already, 15 companies have participated in this plan, reducing the size of the JUA by well over one-half (from a maximum level of over 900,000 policies).

Indeed, as this is written (August 1997), the state's two largest home insurers, Allstate and State Farm, are negotiating the terms under which they would participate again in the state's private homeowners insurance market. It is particularly interesting that Allstate is attempting to charter a new, stand alone, Florida company, presumably with the intent of creating a wall between the claims that would arise from a large Florida hurricane and the parent company's total capital resources.

The California Earthquake Authority (CEA)

The California plan has now been actively operating for little more than 6 months, but there is already strong evidence of consumer resistance to the CEA policy. The available evidence suggests that possibly as many as 50% of the homeowners who previously had private earthquake policies are forgoing their earthquake coverage rather than purchase the CEA contract. This resistance is based on the common view that the premiums are much too high given the limited (“mini”) coverage and high deductible (15%) provided under the CEA contract. It appears the CEA will soon announce a new lower schedule of premiums, but it seems likely that widespread disappointment with the CEA plan will continue.

5. Conclusions

Catastrophe insurance requires a very large pool of capital if there is to be a high degree of confidence that resources will be available to pay the claims that could be expected to result from the very largest events. In principle, this capital could be provided by private primary insurance companies or by quasi-state agencies. In fact, neither one is willing to provide this capital. The private insurance companies seem willing to pass up the likely profits of selling catastrophe insurance in order to avoid the “risk of ruin from a big one.” State governments seem equally unwilling to place public resources at risk. The result is that the quasi-state catastrophe plans can do little more than use their premium income to purchase reinsurance.

Because capital is limited, the resulting policies reflect partial insurance. Higher premiums, however, may reduce the degree to which insurance is partial, since higher premiums allow more reinsurance to be purchased. Thus, while higher premiums raise the cost of the insurance, they also raise the insurance quality. It is therefore an empirical question whether higher premiums raise or lower demand. If it is the case that consumers are unwilling to pay the higher premiums

that are necessary to finance complete insurance contracts, this leaves the managers of the state plans in the quandary that they are damned if they do provide a complete coverage contract (because the premiums are then unacceptably high) and they are damned if they don't (because consumers then lobby for more complete coverage).

Plan managers should also consider carefully how they design the various terms of the partial insurance, such as the deductible and the extent of coverage. These contract terms affect the demand for the insurance, although the direction of the effect is unclear, since it may depend on the consumers' tradeoff between higher expected value versus higher certainty, on how the issues are framed, and similar issues. Were consumer preferences on these issues known, the partial insurance contracts could be designed to satisfy consumers as much as possible. We hope to shed light on these questions in our future empirical research

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