Institute of Business and Economic Research

Fisher Center for Real Estate and Urban Economics

PROGRAM ON HOUSING AND URBAN POLICY

CONFERENCE PAPER SERIES

C06-002

PUBLIC VERSUS PRIVATE UNDERWRITING OF CATASTROPHE RISK: LESSONS FROM THE CALIFORNIA EARTHQUAKE AUTHORITY

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prepared for
Berkeley Symposium on Real Estate, Catastrophic Risk, and Public Policy
March 23, 2006

UNIVERSITY OF CALIFORNIA, BERKELEY

Public versus Private Underwriting of Catastrophe Risk: Lessons from the California Earthquake Authority

by

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Abstract

Historically, relatively few California households have purchased earthquake insurance. The rate of purchase has been declining since the mid-1990's. This decline can be partly attributed to a combination of limited appetite by private underwriters and challenges faced by the public underwriter (the California Earthquake Authority) in reaching customers. The paper studies the reasons why private underwriters are reluctant to underwrite and why the public underwriter has not sold more policies.

*I thank Dwight Jaffee, Nancy Kincaid, Richard Roth, Jr., and Tom Russell for helpful comments and discussions. I also am grateful to Jeremy Forster, Michael Suher and Becky Trubin for research assistance. Errors are mine. The views expressed in this article are those of the author and do not necessarily reflect the position of the Federal Reserve Bank of New York or the Federal Reserve System.

1 Introduction

The California earthquake insurance market illustrates the problems that plague disaster insurance markets in general. In particular, relatively few purchase residential earthquake coverage, despite various public initiatives aimed at promoting the market. The reasons are varied and complex, involving considerations affecting the demand for coverage by consumers (e.g., Kunreuther [6]) and the supply of coverage by insurers (e.g., Jaffee and Russell [4]). With respect to the latter, Jaffee and Russell note that insurers are reluctant to provide catastrophe cover and argue further that earthquake risks may be "uninsurable" within the private insurance market as it exists today. This paper studies the supply side of the market and attempts to understand why today's combination of private and public underwriting has yielded only limited purchase of earthquake coverage by Californians.

The paper starts by studying the reluctance of insurers to underwrite earthquake risk within the context of the formation of the California Earthquake Authority (CEA) in 1996. The CEA offers an unusual opportunity to study this issue because, unlike many government catastrophe insurance programs that are effectively imposed on the industry, participation in the CEA program was and is voluntary. A participating company agrees to of-

fer CEA earthquake coverage to its residential policyholders, with the effect that earthquake risk becomes the responsibility of the CEA—a "privately financed, publicly managed" corporation formed by the state in the aftermath of the Northridge Earthquake of 1994. A company choosing not to participate is obligated to offer earthquake coverage along with its residential policies (e.g., homeowners (HO) policies) and thus retains responsibility for managing any ensuing earthquake exposure.

Given this choice in 1996, some insurers proved more reluctant than others. Insurers holding roughly 70% of the California homeowners market joined the CEA.[1] Thus, although a majority of residential earthquake risk was effectively transferred to the CEA within a year of its inception, a significant and growing private fringe remained outside the CEA.

The coexistence between private and public underwriting persists today, but purchase rates have slumped sharply since 1996. By the end of 2004, only 14% of California residences were insured against earthquake—down from 31% at the end of 1996. To understand this performance, we must understand 1) why private underwriters, who are in the best position to provide coverage, vary in their willingness to do so, and 2) the challenges

[1] This aggregate share had changed little by the end of 2004.

faced by the public underwriter (the CEA) in filling the void left by private underwriters who are unwilling to continue.

What considerations compelled some insurers to participate while others stayed out? Some factors are more easily understood than others. In particular, joiners had worse-than-average experience in the Northridge Earthquake, higher business volume in the California residential market, and were more likely to have non-proprietary organizational forms. All of these associations can be reconciled with modern economic and corporate finance theory (e.g., Froot and Stein [2]). For example, it is hardly surprising that those with poor results in earthquake underwriting and greater exposure to risk were more inclined to participate in the CEA. Nor is it surprising that institutions with limited access to capital markets, such as mutuals and reciprocals, imputed greater benefits to participation than stock firms. But the evidence suggests that other considerations came to bear as well.

Marketing considerations appear to have played a role. CEA participation was concentrated among insurers that relied primarily on direct marketing methods to serve residential consumers. Participation by insurers using independent agents was rare. This finding suggests that the position of the company with respect to its competitors and the nature of its customer base

may have mattered. Companies utilizing independent agents stand side by side with their competitors and are thus more exposed to adverse selection when losing control of pricing and policy design. They also may serve clients who are wealthier than average and thus may demand more extensive earthquake coverage. Thus, companies using agency distribution networks may have had more to lose in terms of customer defection and, consequently, chose to retain control and bear the risks.

Underwriting focus may also have played a role. The companies that joined were largely focused on personal lines, and, in particular, personal automobile. Beyond homeowners, most had little appetite for insurance lines with catastrophic potential or highly volatile underwriting results. In short, the skills that breed success in personal auto may have little to do with catastrophe risk management, and the companies distinguishing themselves in the former area may have had little need for or interest in developing sophistication with respect to the latter.

Indeed, the evidence suggests that companies suffered little for trimming residential earthquake exposure—whether by joining the CEA or by restricting their coverage offerings. In particular, companies joining the CEA were able to maintain or grow their homeowners market share despite consumer

migration away from CEA policies. And, in the absence of any threat to the associated auto and homeowners business, it is not surprising that insurers choose to avoid earthquake underwriting.

The rest of this paper is organized as follows. Section 2 offers background on the California earthquake insurance market and the formation of the CEA. Section 3 studies how the industry split at the time the CEA was formed, with an eye to identifying and interpreting the factors associated with participation. Section 4 examines the disappointing performance of the California earthquake insurance market subsequent to the formation of the CEA. In particular, it documents the drop in purchase of CEA policies after 1996 and offers possible reasons for why the CEA has struggled to reach and retain customers. Section 5 concludes.

2 Background

Damages from earthquakes and floods are excluded from the coverage offered under the standard HO policy forms. Consumers desiring protection from these natural disasters must purchase coverage separately. In the case of earthquake, coverage is accomplished either through the addition of a "rider"

to the existing homeowners policy or the purchase of a separate "stand-alone" policy. The latter are issued by the CEA and by some private companies.

California has a "mandatory offer" law, dating from 1985, requiring that earthquake coverage be offered along with homeowners insurance. The law specifies a minimum level of coverage offering. Specifically, the dwelling must be covered fully, but the statutory minimums for other coverages are low: For examples, minimum coverage for contents and for the loss of use of residence premises are $5,000 and $1,500, respectively, and appurtenances such as pools or patios need not be covered at all. In addition, a deductible of up to 15% of the dwelling coverage amount is permitted. Earthquake rates and rating plans are subject to commissioner approval.

After the 1994 Northridge Earthquake, companies took steps to reduce exposure to earthquake risk. Because of the mandatory offer law, companies could not simply stop offering earthquake coverage. Instead, many either stopped selling new homeowners policies or restricted their offerings. Repeal of the mandatory offer law, however, was not a politically feasible solution to the emerging difficulties in the homeowners market. Instead, the CEA was devised as a putative solution after discussions among regulators, lawmakers,

and the industry.[2]

The CEA became operational in December of 1996, pursuant to enabling legislation passed in that year. Participating insurers were obligated to make a capital contribution based on market share and agreed to provide layers of additional contingent funding for the CEA in the form of post-earthquake assessments. Upon joining, a participating insurer stopped issuing basic residential earthquake policies (i.e., policies offering coverage within the terms and limits defined by the statutory minimums); all subsequent new and renewal policies of basic earthquake coverage were to be issued by the CEA, with the participating firms allowed a percentage of premiums to cover selling and operational expenses. Participating insurers participated on a *group* basis: In all cases where an insurer joined, all group-affiliated insurers writing residential earthquake risk also joined.[3]

Firms joining the CEA effectively ceded control of earthquake policy de-

[2]See Roth [10] for background on the mandatory offer law and the politics behind the proposal of the CEA. For further details on coverage minimums and regulation of rates, see California Insurance Code Sections 10081-10089.4 (Chapter 8.5 - Earthquake Insurance) and Sections 1861.01-1861.16 (Chapter 9, Article 10 - Reduction and Control of Insurance Rates).

[3]The statute of 2005 (Section 10089.27) and Sections 8.2 and 8.4 of the Insurer Participation Agreement (available in the minutes of the Governing Board Meeting of 11/17/05) both mandate group participation and forbid competition with the CEA's basic residential coverage. Although the referenced section of the statute became effective in 2004, a CEA representative indicated that the participation agreements had contained these features since inception.

sign and pricing to the CEA.[4] The CEA's "basic" policy of 1996 featured coverages corresponding to the statutory minimums, but it started offering supplemental coverage in 1999. The supplemental policy increased the contents coverage limit to $100,000 and the loss of use limit to $15,000; it also offered the option of a lower deductible (as low as 10% of the dwelling coverage amount). Actuarial techniques were used for pricing, but political considerations were also important. In particular, final CEA pricing reduced rate variation by limiting the number of geographical "rating zones." Of course, the reduced variation was accomplished at the expense of introducing the potential for mispricing within each zone—as noted in Jaffee and Russell [5].

3 The Calculus of CEA Participation

The main apparent benefit for a company joining the CEA was in being relieved of the responsibility for underwriting earthquake risk (required under the mandatory offer law) while continuing to participate in the California homeowners market. In addition, there are potential pecuniary benefits—

[4] The insurer *is* permitted to offer coverage *supplemental* to that offered by the CEA—although a CEA representative opined that supplemental offerings by CEA participants were insignificant as of 12/31/05.

in the form of commissions and operating expense reimbursements—to be derived from acting as a service provider to the CEA. The proximate costs of participation included the non-refundable capital contribution, the potential for post-earthquake assessments, and the loss of pricing control over the earthquake coverage being sold to clients.

Table 1 lists the private insurers that joined the CEA in 1996, along with their market shares (based on 1996 direct premiums written in the homeowners market). The 12 groups that joined held about two-thirds of the homeowners market and about three-quarters of the residential earthquake market. There were 79 groups opting to remain outside the CEA.

The survival of the private market, even in the presence of a public alternative, shows that catastrophe risk is not "uninsurable"—suggesting instead that insurability may best be characterized according to degrees rather than absolutes. Private underwriting continued after 1996 and, as will be detailed below, grew in relation to the public market—despite the cooperation of the state's largest personal lines companies with the CEA. Yet, the latter cooperation illustrates that commitment to private underwriting is far from absolute and evidently depends on factors particular to the underwriter in question. In what follows, we study what factors were associated with

private willingness to continue underwriting earthquake risk.

Since only 12 groups joined the CEA, attempts to distill an "essential" factor from the data are very likely to be misleading. Accordingly, we start by broadly characterizing the distinguishing features of the joiners. The primary source for data is the NAIC's compilation of insurance company statutory reports. All analysis is done at the group level and is restricted to the 90 groups that had direct premiums written (DPW) in the homeowners line in California in 1996.[5] Table 2 presents summary statistics by group (companies that joined versus companies that didn't join) for a number of key variables. For each variable, the table also presents a t-statistic for a test of the equality of means across the two groups.

Exposure to California Earthquake Risk: Variables (2), (3), (5), and (6) By some measures, companies with a significant presence in the California homeowners market were more likely to participate. In particular, the five largest underwriters in terms of California HO market share (Variable (3)) joined. However, although this difference was statistically significant in

[5] There were in fact 91 groups, but the 91st, Twentieth Century, is omitted from the analysis. This group sustained especially heavy losses in Northridge and reached a special arrangement with the California Department of Insurance to exit the homeowners market. The California FAIR Plan, a state insurer that joined the CEA, is also excluded from the analysis.

a univariate test, high market share was not a prerequisite for: Most of the remaining firms that joined had small shares.

Moreover, there was not an obvious connection between participation and *relative* exposure. On average, California homeowners premiums made up a slightly *lower* percentage of a participating group's insurance book (Variable (2))—and there were companies with significant relative exposure that did not join. Similarly, California earthquake premiums made up a lower percentage of a participating group's insurance book (Variable (6)) and 1994 earthquake losses amounted to a smaller percentage of a participating group's 1996 surplus (Variable (5)), although neither difference was statistically significant in a univariate test. On the other hand, the foregoing results were driven somewhat by several companies with heavy exposure and heavy losses that did not join: Analysis based on the median firm suggests a positive association between relative exposure and participation.

Unfavorable Experience in Northridge: Variable (4) Groups that joined also tended to have had worse experience in the Northridge Earthquake. In particular, the 1994 loss ratio for the earthquake line (estimated as direct losses incurred (DLI) divided by direct premiums earned (DPE))

was higher on average for CEA joiners than for non-joiners, and this is also true at the median. This was not, however, an absolute criterion. The percentiles of Table 2 reveal examples of firms that fared well in Northridge joining the CEA, as well as firms that fared poorly staying out.

Specialization in Personal Lines versus Commercial Lines: Variable (1) Participation was linked to specialization in personal lines. Most of the groups that joined had relatively little involvement in underwriting commercial lines. "Commercial lines" are defined here as Fire, Allied Lines, Farmowners Multiple Peril, Commercial Multiple Peril, Ocean Marine, Inland Marine, Medical Malpractice, Workers Compensation, Other Liability, Products Liability, Commercial Auto Liability, Aircraft, Fidelity, Surety, Glass, Burglary and Theft, Boiler and Machinery, Credit, and International. Again, however, this was not absolute—with 3 of the joiners having more than 50% of premiums in commercial lines as defined above.

Reliance on Direct Marketing: Variable (8) Participation was significantly higher among companies relying on direct marketing methods. Nine of twenty-two direct writers joined the CEA, while only 3 of 68 using other methods (mostly independent agents) joined. Designation of marketing

method was based on *Best's Key Rating Guide* for 1996. A.M. Best classifies firms as "direct" if they use exclusive agents or if they use direct selling techniques (e.g., mail order). Each firm was classified as "direct" or "non-direct" based on the Best's classification, and groups were classified as "direct" if 50% or more of their 1996 California Homeowners DPW were written in member companies classified as "direct."

Stock versus Non-stock Organizational Forms: Variable (10) Eight of 29 mutual and reciprocal groups (including 5 of the 6 reciprocal groups) joined, while only 4 of 61 stock groups joined. Groups here are classified according to the flagship company in the hierarchical structure. More precisely, it is common for mutual and reciprocal companies to own stock subsidiaries; in these cases, the group was classified according to the organizational form of the top company rather than the subsidiary.

Size and Financial Strength: Variables (7) and (9) The firms that joined the CEA tended to be larger than average, although there were examples of small groups that joined and large groups that did not. The association between financial strength and participation, however, was weak.

As noted earlier, some of these findings are consistent with theory of risk

management in financial firms (e.g., Froot and Stein [2]). Those with the greatest absolute amounts of exposure to the residential market (and, consequently, with the highest risk management costs) did join, as did many of the insurers who were stung badly by the Northridge Earthquake. In addition, consumer-owned firms with limited access to capital markets (and, thus, higher implicit costs of financial distress) were significantly more likely to join than stock firms. However, other evidence relating to the cost of risk bearing was mixed: Those firms best positioned to bear risk due to diversification or strong balance sheets were not necessarily those that continued underwriting. For example, extensive diversification through underwriting in other geographic markets does not seem to have dissuaded some of the largest national carriers from joining, while heavy concentration in the California residential market did not persuade some of the smaller regional carriers to join. Theory, of course, predicts that firms with heavier concentration in the California market would, ceteris paribus, have higher costs associated with bearing California risk. Evidently, other considerations were also important.

One possibility, suggested by the correlation between personal lines specialization and CEA participation, is that the decision to join partly reflected idiosyncratic organizational attitudes toward risk. Relative to personal lines,

commercial lines feature bigger individual risks and, with less regulated pricing, more volatile industry underwriting results from year to year. Hence, specialization in personal lines could reflect insurer risk aversion beyond what can be identified with observable variables. Such risk aversion, whether stemming from idiosyncratic cultural factors or from variation in sophistication with respect to risk management, could potentially explain the inclination among large personal lines specialists toward participation.

Another consideration is suggested by the strong association between direct marketing methods and CEA participation. Specifically, this might mean that insurers had different expectations with respect to the consequences of participation, depending on what clientele they were serving and how they interfaced with consumers. Direct marketers interface with consumers on a one-to-one basis and thus may be less likely to lose business if a consumer is unhappy with the CEA earthquake coverage. To illustrate, an exclusive agent might be tempted to persuade the consumer that CEA coverage was the only or best option, and even a skeptical consumer would be confronted with starting the insurance search from scratch (i.e., having to contact a different company/agent and restarting the risk classification process). Companies using independent agents, however, stand

side by side with their competitors. Thus, independent agents can easily steer a consumer who desires extensive earthquake coverage to a suitable company. Moreover, a company selling through independent agents might face adverse selection risks if its competitors proved capable of exploiting any mispricing by the CEA. Such shortcomings would be accentuated for those companies with wealthy customers needing high coverage limits. In summary, these marketing considerations could potentially affect how a company's other business lines would be affected by participation in the CEA.

Participation in the CEA does not seem to have hurt member companies in other lines of business. In particular, the CEA's relative losses in the earthquake insurance market share (in Figure 1, and discussed further in Section 4) seem neither to have affected nor to have been affected by the performance of participating companies in the homeowners market. As seen in Figure 1, California Department of Insurance (DOI) data show the aggregated California homeowners and dwelling fire market share of CEA companies increasing between 1996 and 2004, and even jumping three points in 1997—perhaps reflecting the removal of underwriting restrictions at companies as they joined the CEA.[6]

[6] The DOI figures, downloaded from the website compilation of the Earthquake Premium and Policy Count Data Calls, are based on policies, while the NAIC figures are

The longer term picture offered by NAIC data confirms that the combination of Northridge-related retrenchment and CEA participation was associated with a small positive change in the longer term homeowners market share of participating groups. The formation of the CEA was associated with a full recovery of California HO market share lost after 1994, plus additional gains. This compares favorably with a slight drop in aggregated market share nationally over the same time period. The CEA companies did lose share in California's personal auto market, but this performance was mirrored in the national statistics.[7]

4 Earthquake Insurance after 1996

Public involvement did not prove to be a panacea. Although the evidence above suggests that the CEA initiative may have helped to stabilize the homeowners market after Northridge, it has borne little fruit with respect to increasing insurance purchase. The disappointing performance of the Cali-

based on DPW taken from the California State Page of the statutory reports. The DOI figures also include the California FAIR Plan. Removing the latter does not substantially change the results.

[7] Statutory report data indicates CEA group share of California personal auto liability DPW fell from 72% in 1995 to 63% in 2003. Nationally, their share of personal auto liability and PIP fell from 50% to 44% over the same time period.

fornia earthquake insurance market after 1996 makes it imperative for us to reflect not only on the factors restraining private willingness to underwrite, but also on the reasons why the CEA has not attracted more business.

Jaffee and Russell [5] document a decline in the purchase of residential earthquake insurance between 1996 and 1998, noting further that the decline was especially steep with respect to CEA policies. Figure 2 shows that these trends have continued. At the end of 2004 (the most recent data available from the DOI), only 12% of the residential policyholders in participating companies bought earthquake coverage from the CEA. This was a dramatic drop from the 36% takeup rate at participating companies in 1996.[8] For non-CEA companies, earthquake polices as a fraction of residential policies also fell (from 21% in 1996 to 16% in 2004), but the decline was not nearly so sharp. As shown in Figure 1, CEA market share fell from 79% of policies (issued, at the time, mostly by the participating companies themselves) in 1996 to 63% in 2004.

Part of the divergent experience can be accounted for by changes within the private (non-CEA) market since 1996. Prior to the creation of the CEA, residential earthquake coverage was mostly issued along with homeowners

[8] Since the CEA was formed in December, most of the earthquake policies in the 1996 data were presumably underwritten by the companies themselves.

policies. Jaffee and Russell [5] describe the emergence of earthquake policy *specialists* after the formation of the CEA, arguing further that these firms were "cherry-picking" the CEA's customer base. By 2003, the state's largest underwriter of residential earthquake insurance (after the CEA) was GeoVera Holdings. In 2003, the GeoVera group, whose California business consists solely of stand-alone residential earthquake policies, accounted for nearly 40% of the residential earthquake premiums outside the CEA. Thus, the drop in purchase of CEA coverage may partly reflect migration by potential CEA customers toward stand-alone policies. On the other hand, GeoVera's rise seems more likely to be an outgrowth of the turmoil surrounding the CEA's creation than a proximate cause. The takeup rate among CEA customers plummeted by nearly 50% between 1996 and 1997, while GeoVera commenced operations in 1997 and did not have sufficient business in 1997 to account for the loss of business at the CEA.

The CEA is not the first public disaster insurance initiative to face challenges with respect to market penetration. The National Flood Insurance Program (NFIP), founded in 1968, is a noteworthy example of a government disaster insurance initiative that has faced similar problems over its lifetime. Like the CEA, the NFIP offers standardized policies with limited coverage

(currently, up to $250,000 for the dwelling and up to $100,000 for contents)[9] and markets the policies largely through "participating" insurance companies who issue and service the policies in return for a percentage of the premium. Pricing is based on actuarial principles, although subsidies are allowed for structures in flood hazard areas that pre-dated the creation of the Flood Insurance Rate Map.

From its inception, the NFIP has struggled with lower-than-desired penetration, a problem that has led to various legislative initiatives. Specifically, the Flood Disaster Protection Act of 1973 tied community participation in the NFIP to eligibility for disaster assistance and required flood insurance purchase for federally related mortgages; the National Flood Insurance Reform Act of 1994 took aim at lender compliance with mandatory purchase provisions. Even with these initiatives, however, the NFIP has been unable to fully solve the problem of low penetration (see Pasterick [8]).

While there are important differences between the two programs, the basic similarities between the CEA and NFIP suggest that the shared problem of low penetration may have similar causes. In particular, private insurance companies devote significant resources to pricing, designing policies to meet

[9] *National Flood Insurance Program - Summary of Coverage*, downloaded from the FEMA website on 2/28/06.

identified consumer needs, and marketing. In each of these areas, to varying degrees, the public programs seem to face ongoing challenges in replicating the private activity. We consider each in turn.

4.1 Pricing

It is well known theoretical result that pooled prices for insurance may lead to adverse selection under a variety of conditions. Specifically, if the low risk customers in the pool do not find the price attractive, they will decline to buy the insurance. As noted by Jaffee and Russell [5], the politicization of CEA pricing[10] opened the door to adverse selection by giving low-risk consumers incentives either to drop coverage or to shop elsewhere for insurance.

4.2 Coverage

As noted above, CEA coverage in 1996 corresponded to statutory minimums, which meant that the contents and loss of use coverage were insufficient for many customers. Recognizing the unfulfilled consumer needs, the CEA introduced supplemental coverage in 1999 that, among other things, extended the contents and loss of use limits and offered a lower deductible option. Even

[10] See also Petak and Elahi [9].

with the introduction of supplemental coverage, however, the CEA offering falls short of what is available in the private market.[11] It seems likely that the CEA has lost consumers who desired more extensive coverage (and had homes that met stricter underwriting criteria) to private insurers, such as the earthquake specialists—especially before supplemental coverage was available.

Testimony to the importance of extended coverage can be found in the private market. A number of other insurers outside the CEA also offered only limited coverage, perhaps partly as a means of managing earthquake exposure. Using a website for earthquake insurance consumers, we identified a sample of companies offering "limited" earthquake coverage similar to the CEA's and a sample offering "extensive" coverage.[12] We then compared the subsequent premium growth in earthquake premiums at the two groups over the 1993-2003 period. The group offering limited coverage had only 0.4%

[11] For example, the author was able to obtain a quote for $2,000,000 of dwelling coverage, $1,000,000 of contents coverage, and $25,000 for loss of use coverage at the website of a broker specializing in California earthquake insurance.

[12] The companies are identified based on a list provided by the following URL: http://earthquakeadvisor.com/financial/insurance.html, accessed on 3/1/06. Note that this method may have classification error, since it classifies companies based only on a single point in time. The "limited" companies were Civil Service Employees, Eagle West, California Capital, Residence Mutual, Topa, Century-National, and Travelers Property Casualty. The "extensive" companies were Amica Mutual, Clarendon National, Hartford Underwriters, Chubb Custom, GeoVera, and Pacific Select.

annual growth in aggregated earthquake premiums over the decade, despite annual growth in aggregated homeowners premiums of 11%. The group offering extensive coverage,[13] on the other hand, saw annual growth of 15% in aggregated earthquake and in aggregated homeowners premiums.[14]

While this test is far from definitive, it seems that those offering limited coverage enjoyed some success in controlling earthquake exposure, despite growth in the homeowners market. This may be attributable in part to concurrent measures, in addition to limiting the coverage offerings, taken to limit exposure. For example, they may have set prices at relatively unattractive levels (while staying within the boundaries of usual fairness standards required by statute). But it also seems likely that the stagnation in earthquake business at these companies owed partly to offering coverage options that were unattractive to consumers.

[13] GeoVera and Pacific Select are omitted from the analysis because they 1) wrote earthquake only and no homeowners and 2) entered the market in the middle of the sample period. However, it should be noted that they experienced rapid growth over the period and soon eclipsed the other underwriters in the sample in terms of earthquake volume.

[14] Shifts in the commercial lines/personal lines split at the sample companies does not seem likely to account for the differences between the groups. Commercial multi-peril property premiums grew at about the same rate as homeowners premiums at companies offering limited coverage and were insignificant relative to homeowners premiums at the companies offering extensive coverage, except at Chubb Custom. Chubb Custom, however, reported minimal amounts of homeowners and earthquake coverage.

4.3 Marketing

Life insurance, it is said, is sold rather than bought. While persuasion and selling skills are not usually accorded such respect in property-casualty insurance, they may be important in the disaster insurance context where many consumers are reluctant to purchase (Palm [7]). The NFIP has attempted to boost penetration with advertising campaigns in recent years, apparently with some success. More fundamentally, the approach to selling NFIP policies was revamped in 1983 with the creation of the Write-Your-Own (WYO) program: With this change, the NFIP moved away from selling directly through private agents to selling through insurers acting as servicing carriers, as described above (Pasterick [8]).

The CEA also sells through participating companies acting as servicing carriers, but it is not clear if the participating companies have strong incentives to push earthquake insurance. Participating companies are currently[15] allowed to retain 12.8% of the CEA premium to cover commissions and operating expense. This is lower than that allowed by the NFIP (a commission of 15% plus an expense allowance that has amounted to an additional 15% or more in past years). Moreover, participating company exposure to con-

[15] CEA website FAQ's, downloaded on 3/1/06.

tingent assessments depends on its corresponding share of CEA premiums: The more CEA policies sold by participating company, the greater its assessment in the event of an earthquake. Given the commission rate and the assessment issue, it would not be surprising if the sale of CEA policies were being de-prioritized at participating companies.[16]

5 Conclusion

There are plausible economic rationales for why private underwriters have a limited appetite for California earthquake risk. The risk is difficult to diversify and, consequently, costly to manage. Thus, it is not surprising that earthquake coverage in the primary market is perceived to be expensive and that many companies have taken steps to limit exposure.

This paper finds little evidence of private underwriters being penalized for shunning earthquake risk. Companies joining the CEA were able to maintain their residential market share. Companies staying outside the CEA but offering only limited earthquake coverage did grow more slowly in the residential market than those offering extensive coverage, but the evidence

[16] Roth, Jr. [10] notes that participating insurers also may have attempted to limit exposure to assessment by restricting their sale of homeowners policies.

was hardly definitive. Overall, insurers seem to have succeeded in reducing their residential earthquake exposure without jeopardizing the associated homeowners and auto business.

In short, it seems that insurers avoid residential earthquake risk partly because they can. Many consumers are apparently willing to go without coverage or to settle for what is offered. Even a consumer who shops for earthquake coverage may end up purchasing a stand-alone policy and keeping the existing carrier for homeowners and auto coverage. Whatever the case, companies opting either to join the CEA or to reduce their earthquake underwriting by other means did not suffer significant consumer defections as a result.

A number of insurers stayed out of the CEA. These companies tended to have smaller books of California business; this may have made the risk easier to manage, even though some had significant concentration in the California market. They also tended to have fared better in the Northridge Earthquake, which could possibly indicate better underwriting skills and sophistication with respect to seismic risk.

They also may have had more to lose. Insurers who stayed out mostly used independent agents. Thus, they may have had choosier clienteles and

faced greater risk of losing customers to competitors who stayed out the CEA. Retaining control over pricing and coverage options could well have been more valuable to such insurers.

Importantly, those insurers with an appetite for earthquake risk—such as the specialist underwriters and other companies offering extensive coverage—have shown an ability to grow the earthquake business quickly. However, the overall appetite is limited. Even with the entry of specialist underwriters after 1996, private earthquake insurance still covers a relatively small portion of the residential market.

Hopes that the CEA would be able to increase purchase rates, given the limited industry appetite for earthquake risk, have not been realized. Despite what amounts to a publicly mandated appetite for earthquake risk, California DOI data shows that CEA policy counts have dropped every year except 2004 and, in 2004, stood at less than half the level of those issued in 1996 by participating companies. The paper argued that this performance may owe to difficulties that public insurers face in replicating the richness of pricing, coverage options, and selling innovations offered by a private market. In the case of the CEA, regulatory and statutory limits on pricing, coverage, operating expenses, and executive compensation, as well as having to sell

only through participating companies that face conflicting incentives with respect to sales of CEA product, may have constrained the CEA's ability to reach consumers and to respond to developments in the marketplace.

One can imagine radical reforms of the California earthquake market—running the gamut from a complete privatization (together with repeal of the mandatory offer law) to deeper public involvement. Contemplation of such reforms is far beyond the scope of this paper. Instead, we conclude with some lessons based on the CEA experience.

The first lesson is that demand matters. To the extent that consumers are indifferent about earthquake coverage, private personal lines insurers face little competitive pressure to underwrite. Palm [7] observes (p. 66) that, due to limited demand, "... universal, voluntary insurance coverage, even in an area at risk from earthquakes ... is unlikely to be realized." Unfortunately, the extent of demand often determines the extent of underwriting interest. But the willingness of insurers to underwrite, and some even to underwrite aggressively—depending on circumstances, suggests that private suppliers will respond to increased consumer demand for coverage with an increased appetite for risk.

A second lesson is that the details of public insurance provision—such

as pricing, coverage design, and marketing—weigh heavily on its prospects for reaching consumers. As with any product, consumers value price and selection (of coverage options, in this case), and they also may respond to persuasion. If the public program lacks flexibility in coverage offerings and faces constraints in its sales channels or in providing sales incentives to its producers, it may well struggle to obtain and retain customers.

A final lesson is that there are real costs of production associated with underwriting earthquake risk. The aversion of private underwriters to earthquake risk partly reflects the high costs of managing that risk. In particular, both the CEA and private underwriters protect themselves with reinsurance, which is well-known to be extremely expensive for catastrophic risks such as earthquake (see, e.g., Froot [1]). Thus, it seems likely that, even with improvements in consumer demand, that equilibrium purchase rates may remain relatively low in the absence of pricing subsidies.

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Table 1 - Names and 1996 California Homeowners Market Shares of Private CEA Insurers

Group	Share	Group	Share
State Farm	24.1%	Prudential	1.3%
Allstate	14.8%	Liberty Mutual	0.8%
Farmers	14.4%	CNA	0.7%
California State Automobile Association	4.1%	Mercury	0.2%
USAA	4.1%	Armed Forces Insurance Exchange	0.2%
Auto Club Interinsurance Exchange	1.9%	Preferred Risk	0.0%

Market shares based on 1996 Direct Premiums Written.

Table 2 - Factors Associated with CEA Participation

Variable	Groups that joined the CEA (12)								
		Percentiles							
	Mean	1	5	25	50	75	95	99	T-test
(1) 1996 commercial lines DPW / 1996 total DPW	21.0%	0.6%	0.6%	4.5%	8.1%	40.2%	69.5%	69.5%	-3.9
(2) 1996 California HO DPW / 1996 total DPW	3.1%	0.1%	0.1%	0.5%	2.3%	5.2%	8.2%	8.2%	-2.1
(3) 1996 California HO market share	5.5%	0.0%	0.0%	0.5%	1.6%	9.3%	24.1%	24.1%	2.3
(4) 1994 California Earthquake Loss Ratio (DLI / DPE)	1070.0%	23.7%	23.7%	608.2%	1128.0%	1476.2%	1863.6%	1863.6%	2.5
(5) 1994 California Earthquake DLI / 1996 surplus	5.8%	0.0%	0.0%	0.4%	2.3%	8.5%	27.8%	27.8%	-0.6
(6) 1996 California Earthquake DPW / 1996 total DPW	0.6%	0.0%	0.0%	0.1%	0.6%	1.1%	1.8%	1.8%	-1.2
(7) Logarithm of 1996 assets	22.53	18.77	18.77	21.38	22.71	24.07	25.09	25.09	3.5
(8) Majority of HO premiums written using "direct" marketing:	9 of 22 joined								4.3
(9) 1996 Group Best rating of "A++" or "A+"	5 of 24 joined								1.2
(10) Organizational form of top company in group is stock:	4 of 61 joined								-2.6
	Groups that did not join the CEA (78)								
		Percentiles							
	Mean	1	5	25	50	75	95	99	
(1) 1996 commercial lines DPW / 1996 total DPW	50.0%	0.1%	3.3%	29.0%	51.0%	77.0%	93.0%	100.0%	3.9
(2) 1996 California HO DPW / 1996 total DPW	7.0%	0.0%	0.0%	0.1%	0.9%	4.7%	45.0%	75.3%	2.1
(3) 1996 California HO market share	0.4%	0.0%	0.0%	0.0%	0.1%	0.5%	1.7%	4.0%	-2.3
(4) 1994 California Earthquake Loss Ratio (DLI / DPE)	566.0%	0.0%	0.0%	154.0%	369.0%	765.0%	1773.0%	3943.0%	-2.5
(5) 1994 California Earthquake DLI / 1996 surplus	9.1%	0.0%	0.0%	0.0%	0.2%	0.9%	63.0%	393.0%	0.6
(6) 1996 California Earthquake DPW / 1996 total DPW	1.0%	0.0%	0.0%	0.0%	0.1%	0.8%	7.3%	11.8%	1.2
(7) Logarithm of 1996 assets	20.46	14.97	16.39	18.99	20.4	22.25	23.81	24.95	-3.5
(8) Majority of HO premiums written using "direct" marketing:	13 of 22 did not join								-4.3
(9) 1996 Group Best rating of "A++" or "A+"	19 of 24 did not join								-1.2
(10) Organizational form of top company in group is stock:	57 of 61 did not join								2.6

Notes: See text for additional details on the variables. T-tests compare the sample means of the joiners and the non-joiners under the assumption of unequal variances. In all cases except the one, the sample sizes are 12 for joiners and 78 for non-joiners. For the "1994 California Earthquake Loss Ratio", there were 10 joiners and 55 non-joiners: Thus, 25 observations are omitted because they did not have positive 1994 DPE for CA Earthquake.

Figure 1 - CEA Companies Homeowners and Residential Earthquake Market Share

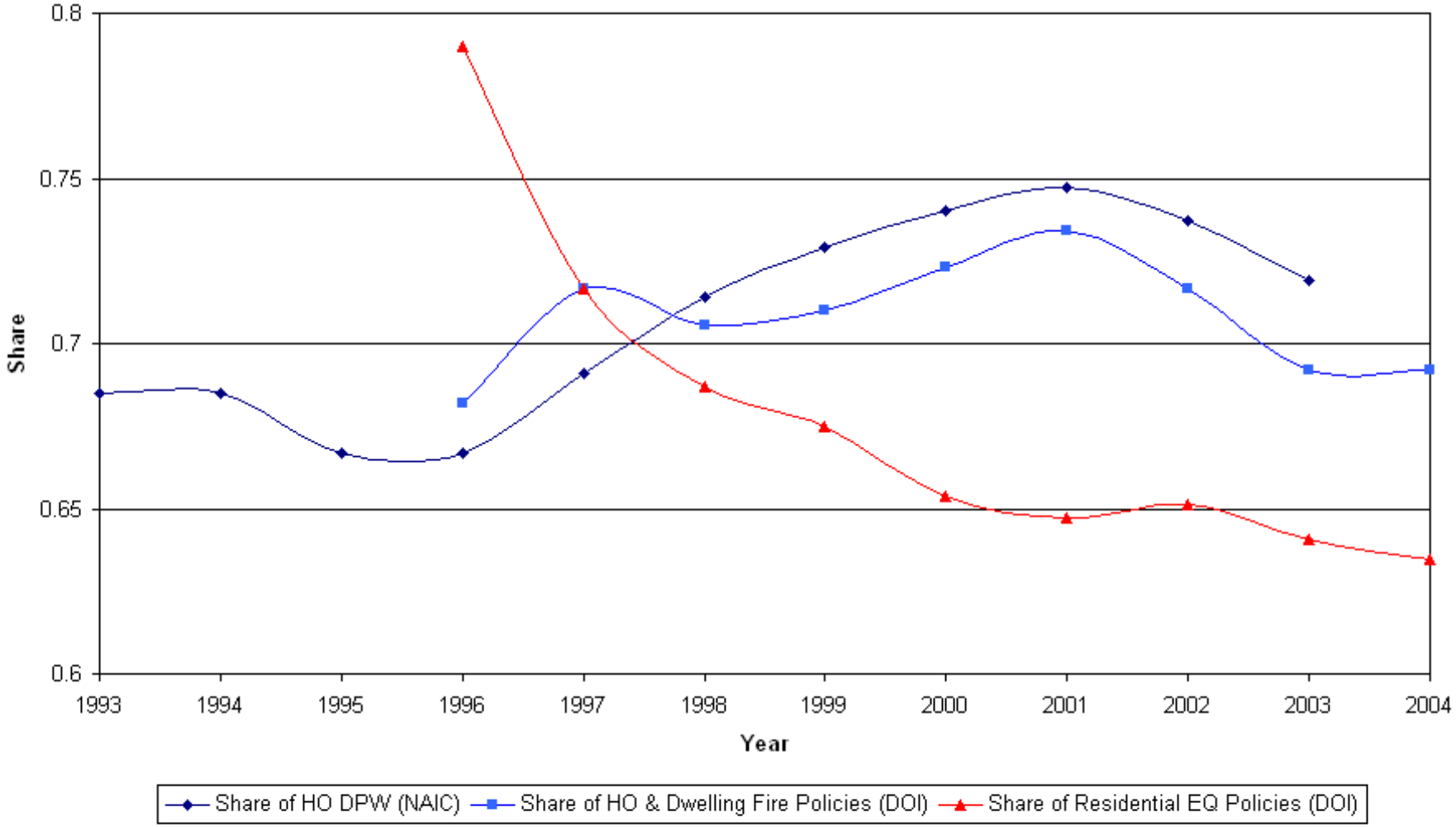

Figure 2 - Ratio of Earthquake Policies Sold to Residential Property Policies Sold