The Government, the Market, and the Problem of Catastrophic Loss

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Abstract

This article addresses the comparative advantage of the government to the private property/casualty insurance industry for the provision of insurance coverage for catastrophic losses. That the government can play an important role as an insurer of societal losses has been a central public policy principle since at least the New Deal. In addition, our government typically automatically provides forms of specific relief following unusually severe or unexpected disasters, which itself can be viewed as a form of ex post insurance. This article argues that, for systemic reasons, the government is much less effective than the private property/casualty insurance market in providing coverage of losses generally, but especially of losses in contexts of catastrophes.

Key words: government insurance; catastrophe; disaster

Virtually all approaches to the problem of catastrophic loss conclude that the magnitude and character of such losses compels some form of governmental solution, whether in the form of ex post disaster assistance or ex ante regulation to reduce exposure to the loss. With respect to disaster assistance, for example, in the U.S., a permanent source of government-provided aid has been in place since the creation of the Federal Emergency Relief Administration during the New Deal, and is frequently supplemented by the Congress in response to unusually severe or unexpected disasters, such as Hurricane Andrew in 1992 or the Mississippi River floods in 1993.[1] Indeed, assistance of this form for losses from catastrophes follows a fortiori, given the wider program of government-sponsored insurance providing coverage of non-catastrophic losses such as crop and bank failures, unemployment, and more specific losses related to economic downturns, for example, through government guarantees of farm and home mortgages.

Similarly, though the empirical examples are less dramatic, there appears to be equal agreement concerning the role of the government in creating incentives to minimize exposure to potentially catastrophic losses through direct regulation. Many commentators, for example, advocate land-use controls and enhanced building codes to reduce the impact of natural disasters such as earthquakes, hurricanes, and floods. Others promote direct governmental regulation of workplace health and safety and of environmental hazards to reduce the incidence and magnitude of societal exposure to these sources of loss.

This approach appears to be largely accepted by the authors of the four articles on hurricanes and asbestos prepared for this conference. These writers seem to concur, despite the disparate character of the natural or social disasters which they address, that

governmental action in some form provides the most promising feasible solution. Thus, with respect to hurricanes, Mr. Jobe urges greater land-use controls and zoning to limit or prohibit growth in high-risk areas (Jobe, 1996), just as Professor Kunreuther calls for more stringent building codes as well as government-sponsored "all natural hazards insurance" and government reinsurance (Kunreuther, 1996). Similarly, with respect to asbestos, Professor Viscusi describes governmental regulation as "potentially a very effective mechanism for ensuring that the level of risk exposures is not too great..." (Viscusi, 1996). And, most vigorously of all, Mr. Sinfield argues that "[g]overnment intervention is necessary to control the whole compensation environment," concluding that "[i]n essence I believe that it is time for central *control* and leadership in society" (Sinfield, 1966).

These endorsements of enhanced government insurance and regulation in the context of catastrophes are commended, if no more, by the eminence of these commentators within their respective fields. The fact that they are unanimous in the approach surely strengthens the point. Moreover, it should not be ignored that these respective calls for greater government involvement in the context of catastrophic losses derive from individuals who, either as private-sector insurers or as economists, might otherwise be expected to be suspicious of a greater governmental role.[2] This article, however, attempts a different view. It addresses more generally the role of government, versus the market, in providing insurance for losses caused by catastrophic events, whether, after the fact, through the provision of government insurance, or, in anticipation of the loss, through regulation.[3] It begins from the substantial theoretical and empirical literature describing the operation of the private market for insurance. Over the years, the scholarly community has developed a strong and clear understanding of how private insurance operates; the learning of this literature is widely accepted and is shared, I would believe, by virtually all participants at this conference. This article does little more than bring this learning to bear on the question of the most effective means of dealing with catastrophic loss through insurance or regulation and the comparative advantage, if any, of the government in doing so. I believe that it is an implication of our understanding of insurance that there are serious questions as to whether the government can serve as the most effective insurance mechanism or is, in contrast, structurally prevented from effectively serving an insurance role, both in the context of catastrophes and in contexts of less calamitous forms of loss. The empirical demonstration of this point is difficult, of course, because our experience has been so affected by the governmental insurance programs in effect since the New Deal. I believe that it is the implication of the approach, however, that once weaned from government assistance, it will become clear that the market for private insurance, rather than the government, provides substantially greater hope for dealing with catastrophes as well as other societal losses. This conclusion suggests that the most common solutions proposed for addressing catastrophic losses must be more closely examined.

Section 1 presents a simple and, I believe, uncontroversial discussion of how insurance in a competitive market operates to reduce the risk level. Section 2 compares the ability of the government to provide similar insurance services. It includes a discussion of two recent reports of government-provided disaster assistance that suggest systemic problems with government-provided insurance services. Section 3, then addresses the comparative effectiveness of the government to the market as a risk regulator. In principle, there are

few strong reasons to expect risk regulation by the government to be more effective than regulation by a competitive insurance market, though this descussion must remain speculative given the often perverse regulatory incentives created by ex post governmental insurance systems. Section 3 also evaluates the civil liability system as a regulator, most questionable in the context of catastrophic loss.

1. A Simple discussion of how insurance reduces risks

There are three principal features of the operation of insurance that determine the extent to which an insurance regime effectively reduces the risk level: the aggregation of risks, the segregation of risks into separate risk pools, and the control of moral hazard through deductibles, coinsurance, and exclusions of coverage. These features of insurance markets are surely well-known to participants at the conference. Thus, I will only briefly review them in order to provide background for the broader analytical point.

1.1. Risk aggregation

Insurance operates where losses have some stochastic or probabilistic character. Losses that are certain to occur in some particular period cannot be insured against; one can only accumulate savings before the loss occurs or shift savings after the loss is suffered to restore the previous economic position. In contrast, for insurance to reduce the risk level, the insured losses must be probabilistic, either as to whether or not the losses will occur at all, or as to when losses certain to occur actually will occur (for example, whether one will die before or after full life expectancy).

Insurance reduces the risk level by aggregating uncorrelated risks. To the degree that risks are uncorrelated (that is, statistically independent), aggregation will reduce variance by leading the error terms of the risks to cancel out. Aggregation does not change the extent of underlying loss. However, the cumulative risk of loss, measured by the variance of the distribution, can be reduced by aggregation, again, to the extent that individual risks are statistically independent. For statistically independent risks, the sum of the aggregated risks is less than the sum of the risks taken individually.

The risk-reducing function of aggregation derives from operation of the law of large numbers—the empirical phenomenon according to which the probability density function of a loss tends to become concentrated around the mean as the sample number increases. The law of large numbers implies that, as one increases the number of insured persons possessing independent and identically valued risks, one increases the accuracy of prediction of the risk generated by each individual. The increase in predictive accuracy derives from the reduction in the variance of risk of expected outcomes.

Much of the discussion of insurance—especially in the legal literature—describes the aggregation function with the use of the metaphor of "spreading," that is, "risk-spreading" or "loss-spreading," rather than as risk-reduction. It is important, however, to distinguish between employing a large population of insureds to *shift* losses based on assumptions

concerning utility levels or distributional preference and employing a large population of insureds to *reduce* the risk level by canceling out risk terms. The important difference is that, to the extent that the losses and accompanying risks are truly independent, their aggregation not only shifts or spreads them from one individual to a group of others, diminishing the impact of a loss on an individual insured, but it also reduces the total risk level of the pool below the pre-aggregated sum of individual risks.

Loss-spreading or-shifting, in contrast, serves only a distributional end. Spreading does not change the risk level; it merely distributes existing risks across a set of the population different from the set that suffered the risks in the first instance, and is chiefly defended by the assumption of a declining marginal utility of wealth.[4] The operation of the law of large numbers on statistically independent risks, in contrast, increases the ability to predict the risk level (which is what is meant by canceling out risk terms), and thus reduces the effective risk level.

The law of large numbers will not apply, however, if the risks faced by members of the pool are not statistically independent to some degree. Aggregating such risks would be unproductive, because the reserves which an insurer would have to maintain would equal or, perhaps, exceed the reserves which individuals would have to maintain if uninsured. This problem is particularly acute in the context of catastrophes, and it is why some society-wide calamities, such as nuclear war, are essentially uninsurable. Where risks are highly correlated, they *cannot* be effectively reduced by spreading them among those subject to the risk.

1.2. Risk segregation

Risk segregation refers to insurer efforts to distinguish relatively high-risk from low-risk insureds and then to assign them to narrowly defined risk pools through the underwriting process. Risk segregation reduces the risk level in two separate ways. First, segregation can reduce statistical variance below that of a more broadly aggregated pool. Second, segregation can influence the level of the risky activity itself by setting the insurance premium to more closely reflect the risk which the activity adds to the pool.

Segregating high-from low-risk insureds can reduce risk variance and, thus, reduce the expected costs of insured injuries. The statistical basis for the effect is straightforward. Imagine two populations of insureds, one characterized by high-risk, the other by low-risk, for which the risks within each population are independent. Risk pool variance is calculated by summing the squares of the differences between each pool element and the pool mean. If the two populations are aggregated into a single pool, pool variance equals the sum of the squared differences between each high-risk and low-risk element and the mean of the combined pool. If, in contrast, the two populations are segregated into separate pools, the variance of each pool equals the sum of the squared differences between each element and the respective means of each segregated pool. It is straightforward that, to the extent of the difference between the means of the two pools, the summed variance of the two segregated pools will be less than the variance of the single undifferentiated pool. Because segregation reduces variance, it reduces the risk level.

Segregating risks by risk level reduces risk variance in a manner very similar to reducing risks by aggregation. As described above, by aggregating independent risks into risk pools, the insurer increases predictive accuracy by exploiting the law of large numbers. Increasing predictive accuracy reduces the risk level of the pool, even if it does not affect in any way the frequency of losses that actually occur. Segregating risks into separate pools according to risk levels serves a complementary function. Like aggregation, segregation according to risk level improves an insurer's ability to predict expected loss, making possible greater predictive accuracy. Again, this is what is meant by reducing risk variance. Thus, relative to broader and undifferentiated risk pools, segregation reduces both pool riskiness and total insurance costs (Crocker and Snow, 1986).

The second risk-reducing function of segregation is to set an insurance premium that most accurately reflects the risk that an insured brings to the pool. Here, relative to undifferentiated insurance pools, precise risk segregation can reduce the level of underlying losses actually suffered. Charging insureds a premium related to underlying risk informs the decisions of potential insureds as to whether and how much to engage in the activity generating the risk. For example, the higher auto premiums charged 16- to 25-year-old males (or their parents) because of higher expected claims costs serves as a market rationing device for teenage male driving. Some young males are prevented from driving or encouraged to drive more carefully because of the higher premiums charged or the fear of subsequent higher premiums should they become involved in an accident or commit a traffic violation. As a result, relative to a regime without risk segregation, the accident rate will be lower.[5] All forms of insurance premium discrimination have this effect.

Just as risk segregation charges appropriately higher premiums to the high-risk, it charges appropriately lower premiums to the low-risk. Here, precise risk pool definition extends insurance availability by controlling adverse selection. Since insurance premiums must be set according to the average level of risk brought to the pool, the wider the range between high-risk and low-risk pool members, the greater the difference between average risk and the risk of the low-risk members. If the disparity between the premium and the risks added by low-risk members becomes too substantial, low-risk members will drop out of the pool, because they find alternative means of protection cheaper than market insurance.[6] One of the most important reasons that some risks are uninsurable is that insurers are unable to narrow the assortment of risks within a risk pool.

The aggregation and segregation functions of insurance, then, are similar both in method and effect: Both serve to increase predictive accuracy in order to reduce the risk level and the effective costs of injuries. Reducing injury costs, however, necessarily generates offsetting effects. Where expected injury costs are lower, the underlying level of activity and the underlying injury rate will increase, a phenomenon known as moral hazard.

1.3. The control of moral hazard through deductibles, coinsurance, and exclusions of coverage.

Insurance regimes can reduce risk by controlling both ex ante and ex post moral hazard. Insurers will constrain or, at the limit, exclude coverage of losses particularly susceptible

to insured moral hazard. The omnipresent exclusion in life insurance policies of coverage of death by suicide is an obvious example. The exclusion serves to control moral hazard by removing the incentive that providing large monetary amounts to beneficiaries would add to other forces compelling the act. Less dramatically, the exclusion in consumer product warranties of coverage of easily broken glass parts or the easily marred product finish, or the exclusion in auto warranties of coverage of engine damage from racing or towing heavy loads serves a similar function.[7] These exclusions place the burden of these particular losses on the insureds themselves, increasing preventive efforts[8] and, at the same time, culling out (segregating) high-risk insureds who are relatively more susceptible to such losses.

Insurers also control moral hazard through the definition of insurance benefits, in particular, through the introduction of deductibles and coinsurance. Deductibles and coinsurance shift part of the loss from the insured event back to the insured itself. Only less completely than coverage exclusions, deductibles and coinsurance reduce indifference to preventive investments, and they reduce the incentives to consume what, from an ex ante view, are excessive levels of insurance services.

Although deductibles and coinsurance reduce insurance benefits, they are generally essential to the maximization of insurance benefits net of insurance costs. Deductibles and coinsurance, obviously, reduce insurance coverage by some proportion. The proportionate reduction in coverage is attractive to the dominant set of insurance purchasers, however, because, with full coverage, the insurance premium would be much higher. More precisely, the existence of moral hazard means that, in comparing full coverage to reduced coverage with deductibles and coinsurance, the proportionate increase in premium necessitated by full coverage is greater than the proportionate increase in insurance benefits to the dominant set of insureds.

Of course, insureds who expect frequent or extensive claims against the insurance are likely to prefer full coverage without deductibles or coinsurance, perhaps even at the higher premium necessitated by that level of coverage. But if there exists a set of insureds who want basic insurance coverage, but do not expect frequent or extensive claims, then the insurer may optimize insurance sales by tailoring coverage to better meet their needs through incorporating deductibles, coinsurance, and specific coverage exclusions.

The beneficial effects of deductibles, coinsurance, and coverage exclusions as methods of controlling moral hazard have been largely neglected. Because these insurance provisions directly allocate losses to the insured, their existence might seem antithetical to broad loss-spreading. But here again, the limitations of the loss-spreading metaphor becomes clear. Deductibles and coinsurance admittedly place some proportion of loss on the insured; a coverage exclusion places all of the loss. To this end, these provisions conflict with simple loss-spreading. But because such provisions lower total insurance costs, they allow the extension of basic insurance benefits more broadly to the society. Thus, for example, the exclusion of life insurance coverage to suicides allows the premium for basic life insurance to be lower, and makes it possible for some individuals who would not or could not purchase life insurance at a higher premium to obtain basic life insurance protection. Thus, though seemingly, paradoxical, reducing insurance benefits through de-

ductibles, coinsurance, and coverage exclusions can maximize the available insurance coverage to the society.

2. The Government versus the market as a risk-reduction mechanism

The previous section described briefly the three basic functions of insurance operation toward the reduction of risks faced by any society. This section evaluates the comparative advantage of the government to the market as a mechanism for risk reduction of this nature in the context of catastrophe losses. Most of the examples of the previous section were drawn from routine property/casualty contexts, and the propositions were undoubtedly well-known to most readers. The issues raised by catastrophes such as those caused by hurricanes or asbestos, however, are not qualitatively different as sources of risk and do not obviously compel a different analytical framework. Those and other castastrophes, perhaps, suggest the hardest cases: that is, those contexts in which the effective provision of insurance is most difficult. Where the provision of insurance is most difficult, however, the most careful attention must be paid to what insurance mechanism is likely to be most successful in reducing risk through aggregation, risk segregation, and the control of moral hazard.

Section 2.1. presents an analytical comparison between the private market for insurance and government-provided coverage. Section 2.2 briefly describes the findings of two recent studies of government disaster assistance, suggestive of the approach.

2.1. How effective is government insurance?

In the most common view, the government is regarded as the most effective insurance instrument of the society, with increasing effectiveness as potential disasters increase in scale. The central basis for the view is straighforward: My friend, former Dean Guido Calabresi, for example, has influenced generations of lawyers and judges with his simple but convincing point that a loss ruinous to a single individual is less ruinous if spread over a larger set of individuals and, if spread broadly enough, can be made trivial (Calabresi, 1970). Calabresi's point derives from nothing more than the assumption of a declining marginal utility of wealth. On this basis, he has popularized the metaphor of "risk-spreading" and "loss-spreading", arguing that, at the limit, the state or government is the most effective mechanism for spreading risks and losses broadly.

According to this view, the state can spread risks most broadly because it is the largest social entity in existence. Because of its scope and inclusiveness, the state comprises a wide range of disparate activities—indeed the widest range of disparate activities—so it would appear able to achieve maximum diversification by pooling the risks of, say, earthquakes with the risks of floods with the risks of industrial disability.[9] It is also widely believed that, with respect to insurance, the state possesses one other important advantage

over private insurance firms. The state can significantly constrain adverse selection—the practice of individuals dropping out of an insurance pool—because it can make insurance compulsory, beyond the power of any private insurer.[10]

Let us examine more carefully, however, the relative advantages of government versus private insurance in the context of the three risk reduction functions of insurance described above: aggregation, risk segregation, and the control of moral hazard.

2.1.1. The government versus the market with respect to risk aggregation. Perhaps the strongest intuitive case for government-provided insurance generally, and government catastrophe insurance in particular, derives from the aggregation function of insurance. It seems plausible that the government, given its extraordinary size and scope, is far superior to any private insurer in its capacity to reduce risks through aggregation.

At a first cut, there are reasons to be skeptical of the claims of uniform government superiority in size and scope. For example, the private property/casualty industry is highly competitive, not naturally monopolistic, and is dominated by firms with relatively low market shares. How can market insurers aggregate effectively with small market shares? As the most basic statistical awareness makes clear, within any distribution of risks, risk terms can be canceled out by the aggregation of relatively small numbers, as long as the risks are independent and uncorrelated. The most obvious example is modern polling. Polling organizations, such as the Gallup, Roper, or Nielsen polls, can estimate the voting behavior of 80 million voters or the consumption behavior of 200 million consumers from a sample of very small numbers, typically 1,000 or 1,200. Predictive accuracy is achieved because, as long as the poll is conducted randomly—which is to say, as long as each observation is independent and uncorrelated—the cumulative error term becomes very small.

One can see from this formulation that the advantage possessed by the government in terms of the scope of activities which it comprises is not clear. Error terms are canceled out and predictive ability is enhanced—which is to say the risk level is reduced—by aggregating *independent* risks, but not by aggregating highly variant risks. The idea that diversification can be achieved by lumping together highly variant risks—hurricane risks, earthquake risks, disability risks, unemployment risks—is misleading. To reduce the risk level by achieving predictive accuracy requires very careful risk sorting and evaluation, and ultimately specialization. This is why market insurance firms that are small can spread risks very effectively. There is no obvious advantage to government insurance from the broad scope of activities that it can incorporate.

Indeed, in the context of catastrophic loss, the ability of the government to reduce risks through aggregation becomes even more problematic. The government, by definition, must be inclusive in the insurance coverage which it offers. That is, where the government provides insurance, it must make it available to all citizens desiring coverage. In the context of catastrophes, however, the compulsion of inclusiveness *diminishes* the ability of the government to reduce risks through aggregation. An event is labeled a catastrophe where there is a highly correlated incidence of loss among the population. Providing coverage of highly correlated losses is exactly the opposite of the risk-reducing function of aggregation. Put differently, a private insurer or set of private insurers, which have the

discretion to determine the level of catastrophe exposure to accept may be substantially more effective than a government in reducing the risks of catastrophic loss through aggregation.

2.1.2. The government versus the market with respect to risk segregation. As described earlier, in private insurance markets, insurers control adverse selection by segregating the low-risk from the high-risk in order to offer the low-risk lower premiums to extend insurance availability. The higher premiums charged to the high-risk, as a price signal, reduce the level of risky activities. Moreover, controlling adverse selection by extending insurance availability to the low-risk, makes possible low-risk activities that might otherwise be thwarted.

Government insurance typically engages in no efforts to control adverse selection through risk pool segregation. Discrimination in government insurance premiums is suppressed and, most often, eliminated. Adverse selection occurs in private markets where insurers are unable to distinguish among the low-risk and high-risk, leading the low-risk to drop out of the insurance pool. Adverse selection in government insurance markets operates differently. As mentioned, government insurance is typically offered, without discrimination, to all parties at some average premium. There has been very little study of the risk level to which this average premium is directed, and it is possible that it is low enough to retain some number of low-risk parties.

Adverse selection, however, will necessarily occur. First, if the government insurance plan is self-supporting, some number of low-risk parties necessarily will find the insurance not worth the premium. Few government plans, however, are fully self-supporting. Adverse selection will still occur, nevertheless, but through the effect of a budget constraint imposed on the insurance plan. Because there is little government effort to control adverse selection, government insurance plans typically face severe budgetary problems. The most typical government response to a budget constraint, however, is not to increase the level of discrimination, but rather to lower the average level of benefits, reducing the attractiveness of insurance and reducing the extent to which the insurance serves to protect insureds against the risks of their activities. Reducing the extent of benefits, when it is achieved categorically, rather than through deductibles designed to control moral hazard, shifts—repackages—risks to insureds.

Often, the adverse selection phenomenon is invoked in favor of government insurance. The compulsory nature of government insurance is said to solve adverse selection problems that beset private markets by forcing the low-risk to stay in the insurance pool. But this effect is not properly viewed as risk reducing. There is no doubt that this form of compulsion will lower the necessary insurance premium, but, since it has no effect on reducing the ultimate level of loss—indeed, it may increase loss, since it increases the moral hazard incentives of the low-risk—it is more accurately described as redistribution rather than risk reduction. It does not provide an independent reason to view the government as superior to private insurers in employing insurance services to reduce risk.

2.1.3. The government versus the market with respect to the control of moral hazard.
Moral hazard refers to how the existence of insurance alters the incentives faced by

individuals to increase either the level of risky activity or of claims on the insurance. Private insurers control moral hazard by collecting deductibles, by sharing risks through coinsurance, and by specific limitations on insurance coverage. Each of these methods of controlling moral hazard reduces the total level of risk of the activity being insured.

The government as an insurer seldom makes efforts of this nature to control moral hazard. Though some government insurance plans incorporate deductibles and coinsurance, the extent to which these contractual methods are relied upon to reduce risk is much less than in the private sector. As a consequence, virtually every study of government insurance activities shows moral hazard problems to be severe. Many of the participants at this conference have proposed greater governmental regulation as a means of controlling moral hazard in specific contexts of catastrophic loss: for example, through land-use controls and building codes for hurricanes, and through occupational health regulation for asbestos. It is immediately clear, however, that these forms of regulation depart substantially from the more precise loss-related effects of deductibles and coinsurance and correspond more closely to underwriting guidelines. I shall discuss proposals with respect to regulation in greater detail below, but it is a difficult claim that their effects—even if optimally defined—will equal those of direct financial incentives established by deductibles and coinsurance. Indeed, the existence of deductible and coinsurance provisions in virtually all property/casualty contexts, despite full powers to underwrite, suggests that underwriting regulations are an imperfect means for achieving this end.

2.1.4. Why is the government ineffective in risk reduction? This brief review suggests that, in terms of each of the three risk-reduction functions of insurance—aggregation, risk segregation, and the control of moral hazard—government-provided insurance is probably *less* effective, not more effective, than private insurance. Indeed, the disadvantage of government insurance and the comparative advantage of private insurance are likely to be only the greater with respect to catastrophic loss.

Effective risk reduction is achieved by market discipline: by differential charges according to risk level; by constraints on benefits to control moral hazard; and by discrimination and narrow risk pool definition to control adverse selection. Private insurers are rewarded in the marketplace according to their ability to reduce societal risks in these ways.

In contrast, the state, for very good reasons, is unable to engage in any of these forms of market discipline. The size and necessary inclusiveness of government obstructs optimal risk aggregation. The state's commitment to nondiscrimination prevents control of adverse selection through risk segregation. The political responsiveness of the state to voter interests in benefits cripples efforts to control moral hazard. As a result, the state can do little to reduce risk levels.

It is frequently claimed that the state has an insurance role because it can offer coverage in contexts in which there are incomplete insurance markets—for example, the special government programs providing flood and riot insurance. The sources of the special government expertise here, however, are not clear. Private insurance markets are incomplete, not by chance or lack of interest, but because risks are essentially uninsurable where moral hazard and adverse selection cannot be controlled. In these contexts, no insurance

market can survive. The government cannot influence the survivability of an insurance pool. Indeed, because the government is less able to control moral hazard and adverse selection, the government is probably less able than the private market to make risks truly insurable.

What the government can do, of course, is to redistribute income under an insurance guise to activities that could not support an insurance market. Here, of course, the superiority of the government is obvious. The government may be ineffective at spreading risks and insuring losses, but it is a powerful source of wealth redistribution toward losses already suffered. Insurance has provided a vehicle for redistribution from the origins of the industry, and the industry remains an extraordinary instrument for redistribution today. Redistributional goals permeate government control of the insurance industry, from the interpretation of insurance contracts to regulation of insurance terms to government insurance involvement itself.

Redistribution, however, is not insurance. Redistribution does not reduce the risk of loss faced by a society but, at best, only repackages or shifts losses to different sets of citizens. Indeed, as we shall see in the next section, there are reasons to suspect that government insurance systematically redistributes toward more risky, rather than less risky activities. If so, then government insurance increases risks to society, exactly the opposite of the insurance function.

2.2. Some examples of government insurance at work: agricultural disaster assistance

Two weeks prior to this conference, the *New York Times* uncovered two unpublished government studies reviewing the operation of government-provided disaster assistance. The studies are a draft evaluation report of the Inspector General of the Agriculture Department regarding disaster assistance for agriculture following Hurricane Andrew and the 1993 Mississippi floods (U.S. Agriculture Dept., 1994), and a Staff Report to the Senate Agriculture Committee concerning crop disaster payments from 1988 to 1993 (U.S. Senate Comm. Rept., 1994). Both reports describe massive payments of disaster aid in questionable contexts. While many of the examples presented may represent no more than insurance fraud—a problem that also afflicts private insurance—the magnitude and character of the problem are suggestive of a broader structural effect.

Government assistance for agricultural disasters is separate from and additional to other government farm assistance programs, such as federal crop insurance. The aid is available only where either disasters have been officially declared—such as in the case of the Mississippi River flooding of 1993, or where, because of the magnitude of loss, the claim qualifies as disaster-related. For these programs, disaster aid is calculated according to the difference between a producer's actual yield and the expected yield per acre. The expected yield is determined, within a state, according to a county average, per crop, and is set by the county office of the Agricultural Stabilization and Conservation Service (ASCS). Some set of government officials and local county producers (farmers) sit on each ASCS

county committee determining these yields and, thus, levels of disaster aid. The difference between actual and expected yield is multiplied times an estimate of market price to determine the base level of loss.

Disaster aid is provided at two different levels, depending upon whether the farmer purchased government-supported crop insurance prior to the loss or not. If the farmer purchased crop insurance, then the calculation begins by determining the extent to which the farmer's actual yield is less than 65% of the county-wide expected yield per acre; if the farmer did not purchase crop insurance, then by the extent to which actual yield is less than 60% of expected yield. Disaster aid equals 65% of these adjusted losses.[11] In theory, thus, if the farmer suffered a total loss, these programs would provide aid equal to .4225 to those who purchased crop insurance (.65 × .65); equal to .39 for those who did not (.60 × .65). Put conversely, these insurance programs incorporate a 57.75% coinsurance obligation to those who purchase crop insurance and a 61% coinsurance obligation to those who do not. Note that these coinsurance amounts are substantially higher than coinsurance provisions typically appearing in private insurance markets.

The findings of the two reports are cumulative, but their flavor can be illustrated with a few examples. It was found, for example, that a farmer in Missouri received $200,000 in disaster aid following the 1993 Mississippi floods, though the farmer had purchased the property, including land, house, and equipment, three weeks prior to the flooding for only $138,000.[12] As an illustration of a more systematic problem, it was discovered that 45% of national disaster aid for crop losses of turnip greens were distributed to three individual counties, none of which had reported any acreage of turnip greens plantings prior to the disaster program.[13]

The problems in the provision of disaster aid highlighted by these reports all derive from government management and operation of the system:

1. The reports found that producers systematically earned more in disaster years than in normal years. ASCS, for example, calculated the projected sales for one Florida orchard producer whose crops were destroyed by Hurricane Andrew at $145,610 and paid the producer $51,000 in disaster and tree assistance for these losses. The Agriculture Department Report found that that producer's prior year gross income under normal growing conditions had been only $26,833.[14] Many of these problems stemmed from apparent miscalculations of prevailing market prices for purposes of calculating expected returns. In other cases, the ASCS committee did not seriously monitor producers' claims with respect to affected acreage. As an example, the Report found that one Florida ASCS committee calculated a disaster payment of $96,000 to a producer for losses to 1,900 acres of grass seed, when, in fact, the acreage was not a commercial seed operation, but carried livestock.[15] Similarly, the reports found substantial levels of aid distributed to farmers for losses to double-cropped acreage. For example, a review of one Georgia county found that 31 of 48 turnip green producers receiving aid had both double-cropped the greens after peanut and cotton harvests and had failed to irrigate the greens.[16]

2. The reports found that the structure of disaster payments was often unrelated to the actual economic loss suffered. For example, in many instances, disaster losses increased

after market prices for crops fell, because, given the lower market price, producers did not find it worthwhile to harvest the crop. In addition, disaster aid, calculated as the difference between expected yield and actual yield, is not adjusted for the cost savings that become available from not harvesting the crop.[17]

3. The reports found that disaster aid was not adjusted for losses that might be attributed to producer behavior itself. The Agriculture Department Report concluded that "County committees were not required to, and generally did not, reduce the level of benefits even through producers did not plant within the optimum growing season, did not irrigate, and did not apply appropriate levels of fertilizer, herbicides, insecticides, etc."[18]

4. The Agriculture Department Report concluded that "None of the producers cited in these findings bore the first 40% of loss from the disaster, as required by regulation..."[19] Both reports found that overpayments in agricultural aid were growing over time, as the Congress increased appropriations for disaster aid.[20]

Typical of government reports, of course, the recommendations of the two studies consist of changes chiefly in the management details of the programs: tighter monitoring, better record keeping, reassignment of directors, and the like. The problems indicated by these studies, however, appear more systemic and are related to government versus private provision of insurance.

Risk aggregation. There is little in the government provision of disaster insurance that resembles the aggregation of independent and uncorrelated risks. On the contrary, government assistance is defined to become operative only when risks occur that are highly correlated, exactly the opposite of the risk-reducing character of insurance.

Risk segregation. Insurers reduce the risk level by segregating high-risk from low-risk activities and charging risk-related premiums that create price signals discouraging risky activities. Risk segregation of this nature is totally alien to government-provided disaster insurance which charges no pre-loss premiums whatsoever. Thus, it is not surprising that claims against the disaster insurance continue to rise year after year, a phenomenon that would lead to cancellation or nonrenewal in the private insurance market, but that follows systemically from no-premium insurance.

Control of moral hazard and adverse selection. Closely related is the fact that private insurers reduce risks through defining deductibles, coinsurance, and exclusion provisions to penalize high-risk behavior. Government disaster insurance, defined as aid for the needy, is antithetical to exclusions or other limitations of coverage. Though, in theory, the governmental disaster aid described above includes a significant coinsurance feature, in practice, the coinsurance is ineffective, as illustrated by the many examples of farmers receiving greater returns in disaster years than in "normal" growing years.

Problems with government management. Government disaster insurance is provided on the basis of estimates of projected yields crop-by-crop, county-by-county, across the U.S. It is unrealistic to imagine that all such decisions could be intelligently made from Washington, D.C. While it is not inconceivable that the government might establish a network of local agents similar to those of large national casualty carriers, it is not surprising, given its democratic character, that our government has delegated operational decisions to separate county committees, whose members are appointed from among local producers and farmers themselves. Yet, given this delegation, it is also not surprising that the ethic of committee management will involve extending aid as broadly as possible—including self-dealing—rather than the disinterest and discipline characteristic of the adjustment process in private casualty markets. Unlike private insurers, there is no incentive for government insurance managers to carefully monitor the need for insurance, to underwrite risks as precisely as possible, to evaluate and adjust claimed losses to avoid overpayments and, more generally, to maximize insurance sales by structuring insurance policies in order to provide the maximum coverage at the lowest total premium.

More generally, the principles that motivate the maximization of profit and insurance coverage to a private insurer are directly opposite to the principles that motivate the government provision of insurance in general and of coverage of catastrophic losses in particular. Political incentives compel inclusiveness, not the aggregation of only uncorrelated risks; the maximization of total benefits, not the careful definition through deductibles and exclusions to maximize only basic coverage; the avoidance and elimination of discrimination, not the deliberate attempt to make certain that high-risk insureds pay premiums appropriate to the risk that they bring to the pool; the most expansive forms of coverage, not continuous efforts to exclude coverage attended by moral hazard. The principles underlying the government's provision of insurance are directly antagonistic to insurance as a risk-reduction mechanism.

3. The Government versus the market as a regulator

This section briefly reviews the comparative advantage of the government to the market in terms of regulating risks to reduce their ultimate impact. Virtually all commentators, including the authors of the preceding papers of this conference, advocate an important role for government regulation in this respect, whether in the form of enhanced zoning, land-use controls and stricter building code requirements in the case of hurricanes, or more effective occupational health and safety regulation in the case of asbestos. Section 3.1 will address the direct forms of governmental regulation suggested by these recommendations. Section 3.2 will address the liability system as a risk-regulation device.

3.1. Direct regulation by the government and by private insurers

Each of the preceding authors at this conference has recommended enhanced governmental regulation as a means of reducing the risks of hurricanes and, separately, asbestos or

other occupational or environmental harms. The foundation for these recommendations is clear: If fewer citizens build homes on southeastern beaches, or if they build their homes with stronger structural elements or design, there will be fewer losses from hurricanes. Similarly, if some governmental authority had in the past constrained the manufacture of asbestos or in the future would constrain the manufacture of some soon-to-be-discovered occupational hazard, there would have been or will be lower levels of occupational loss.

However counterfactual, these conclusions are uncontroversial. The appropriate question, however, is not simply whether government can do better, but whether government can do better than private insurers. Private insurers are not indifferent to the prevention of loss and engage in loss-prevention activities in many forms. Much of private loss prevention is implemented through the underwriting process. Insurers who offer lower premiums to firms which have installed fire protection systems or who refuse coverage entirely to firms without them are engaging in a form of risk reduction through regulation. Similarly, the implementation of deductibles, coinsurance, and coverage exclusions, by creating financial incentives for insureds to avoid loss, indirectly affect risk reduction. Finally, the levy of differential insurance premiums according to risk level and the refusal to offer coverage for some sets of risks affect risk reduction investments by firms or individuals that either engage in the activity at their own risk or move their investments into safer activities.

The question, then, is which mechanism for reducing risk is likely to be the more successful? There seems to be an implicit conclusion of authors recommending governmental regulation that risk regulation by private insurers is somehow unavailable or must necessarily be insufficient. The explanation for this conclusion, however, is not immediately evident. Indeed, just as we have observed that differences between risk reduction in terms of the provision of ex post insurance as between governmental and market sources are substantial, there is little reason to believe that such differences will not also be manifest in contexts of direct regulation itself.

Put less abstractly, assuming that there is some optimal, cost-effective building code or zoning definition for some hurricane-exposed area, is the society more likely to find such a definition put in place through collective action through the political process or by private insurers in a competitive marketplace? In principle, there is no reason to believe that private insurers cannot determine the optimal building code and implement it through underwriting decisions. New houses might only be insurable if they met the requirements of that code. Existing houses might only be insurable or insurable at a particular rate if investments are made to comply with the code. Similarly, private insurers might define the optimal zoning or land-use policy through their underwriting decisions as to whom and at what locations to provide coverage of hurricane-related losses.

Some proponents of government regulation suggest that there might be cases in which there are collective goods problems with respect to loss prevention (Kunreuther, 1996). For example, a private insurer in a competitive market might well be able to implement through underwriting building or structural requirements that provide for optimal loss prevention for, say, an individual home, but may be indifferent to structural requirements within a single home that are beneficial to the neighboring group of homes. Of course, the hypothesis of such an effect is only a hypothesis. It is not evident that, if some effect of

this nature exists, it is not solved by the competitive desire of the insurer to provide coverage for more than one home in the neighborhood or that it could not be solved by industry standardization, as is the case for standardization problems in other industries. More importantly, the policy issue is not whether market imperfections can be defined in theory, but whether it is plausible that theoretical market imperfections will be solved by practical government. Indeed, the factors that point to superior risk-reduction discipline by private insurers in the context of the provision of insurance coverage appear to derive from regulatory ability: from the absence of an ethic of maximizing inclusiveness; from the ability and the financial incentive to carefully discriminate on grounds of riskiness; from the advantages of controlling moral hazard through shifting risk to the insured parties. Each of these factors seems no less applicable to risk regulation than to risk reduction through the definition of insurance coverage.

There are two more serious explanations why private insurers may lack underwriting discipline which are related to governmental activities themselves. First, many governments compel insurers to provide disaster-related insurance as an element of coverage. The State of California, for example, has compelled the inclusion of earthquake coverage in the basic homeowners' policy. Given such a compulsion, the calculus for the insurer becomes more complicated: It is no longer, is it possible to offer such coverage, and, if so, to whom and in what locations, but rather, are we more likely to profit with or without the entire line of homeowners' coverage?

Closely related is the fact that the existence of governmental insurance and the potential of governmental relief in the future complicates the calculus to the private insurer. In contrast, where a state is credibly committed to providing *no* relief in the context of a disaster, and, thus, where the only source of disaster coverage is that available from private insurers, the underwriting process is clean, and market incentives may serve to generate optimal building codes or zoning plans, irrespective of governmental action. Where the governmental response to a disaster is uncertain, the calculus changes dramatically. The insurer who might become insolvent should an earthquake or hurricane of a particular magnitude occur, and, thus, who might otherwise enforce strictly optimal underwriting requirements, must now evaluate its position in the market given some likelihood that the state will itself shoulder the losses, whether through disaster assistance to the victims (as recent examples, through providing lodging and relocation assistance) or, at the limit, through the state's insurance guarantee fund for insolvent insurers.

3.2. The liability system as a regulatory mechanism

In recent years, the law and economics literature has portrayed the civil liability system in this country as a risk regulation device (Posner, 1993). In theory, civil liability judgments serve to impose the price of risky behavior on the individual or firm creating the risk, leading to optimal ex ante risk reduction as well as optimal ex post compensation (coverage of the loss). The expansion of liability since the mid-1960s has been largely justified and motivated by this ambition.

Mr. Sinfield's graphic description of the asbestos problem surely challenges this Pan-glossian view of the world. While there is some argument available that the experience of the asbestos manufacturers and the unfortunate insurers who had dealings with them will serve to deter the future manufacture of hazardous substances, it would be fanciful to describe that deterrence as optimal or to imagine that any further liability can helpfully add to the effect. Indeed, catastrophic losses, almost by definition, would seem poor candidates for deterrence through the liability system.[21]

The failings of the liability system as a risk-reduction mechanism, however, may not be unrelated to the failings of government insurance and regulation generally. Most impor-tantly, the safety standards generated by the civil liability system are not standards derived in the face of financial incentives created by a competitive market. Instead, they are constructed by judges on grounds largely innocent of economic effect—whether effects on consumers or on manufacturers. In addition, they are implemented by lay juries through some process of collective action, if anything, more undisciplined than legislation with respect to effect. There is no reason to believe that such judgments approach the optimal.

4. Conclusion: insurance, the government, and catastrophes

This article has viewed catastrophic loss as a problem in risk reduction and has attempted to analyze whether insurance and regulation provided by the government or the market is more likely to be successful as a risk-reduction mechanism. Putting the question in this way, by definition, challenges the view—perhaps it should be described as a normative belief—that providing disaster relief is one of the principal functions, if not the most basic function, of government. It is not evident, however, that catastrophic losses generate public goods problems. Indeed, on the contrary, when examined carefully in terms of the mechanics of risk reduction, there are reasons to believe that the government is particu-larly ineffective as an insurance provider and even as a regulator.

If the societal goal is to optimize risk reduction, there are strong reasons to terminate government disaster assistance in its entirety. Such a policy would require those that engage in relatively risky activities, such as building homes on coasts, fault lines, or floodplains, to learn from private market premiums what the risk-related costs of their location decisions actually are. Yet, even if it is fanciful to imagine that a 20th-century government will abjure the political gains from disaster assistance, there are equally strong reasons to redesign government aid on the principles of market insurance, includ-ing pre-loss premiums that are risk-related with coverage limitations, including deduct-ibles, coinsurance, and exclusions of particularly risky activities that maximize coverage net of loss. However generous and humanitarian our governments may be, all face serious budget constraints. Just as with private insurance, the implementation of risk-related premiums, deductibles, coinsurance, and exclusions can serve to maximize government coverage to best achieve its admirable humanitarian ends.

Acknowledgment

Notes

1. See, for example, the Dire Emergency Supplemental Appropriations Act of 1992 (Hurricane Andrew); Emergency Supplemental Appropriations for Relief From the Major Widespread Flooding in the Midwest Act of 1993.
2. The recommendation of greater government regulation in Professor Viscusi's analysis of the asbestos problem is perhaps most striking, given that he has made his academic reputation demonstrating the imperfections of governmental risk regulation in a wide range of other areas.
3. Much of the discussion derives from a talk which I gave as the Inaugural Address for the John M. Olin Professorship in Law and Economics at Yale in November 1986.
4. See the discussion of Guido Calabresi's advocacy of risk-spreading, *infra* TAN ___.
5. For a demonstration of a dramatic increase in the accident rate following the prohibition of insurance discrimination by age, sex, violation record, and accident experience in Quebec, see Devlin (1988) (9.6% increase in fatal accidents, 26.7% increase in bodily injury claims, and 5.3% increase in property damage claims following adoption of nondiscriminating, no-fault plan).
6. For empirical estimate of adverse selection from the adoption of nondiscriminating, no-fault auto insurance in Quebec, *see* Devlin (1988, p. 21, p. 24) (decline of 8.1% in total auto registrations, though an underestimate of decline in registrations by low-risk, since number includes increase in registrations by high-risk).
7. See, Priest (1981) generally, for many other examples.
8. Direct-risk monitoring by insurers (such as requiring the installation of specific safety devices and inspecting for compliance) is very similar to the control of moral hazard by exclusions. Private insurers can be expected to select the combination of such techniques most effective in terms of sales, which is to say, in terms of extending insurance most broadly. See Priest (1981), generally.
9. Professor Kunreuther endorses this point in his article in this issue.
10. Though unrelated to the analysis in this article, it is also frequently claimed that the state is superior to the private sector in the marketing and administration of an insurance program. The best evidence is the very low administrative costs of Social Security—2% of benefits—far lower than any private insurance plan and far lower even than comparable social insurance plans in other—smaller—countries.
11. U.S. Agriculture Dept. (1994, pp. 1–2).
12. U.S. Agriculture Dept. (1994, p. 6).
13. U.S. Senate Comm. Rept. (1994, p. 1).
14. U.S. Agriculture Dept. (1994, p. 5).
15. U.S. Agriculture Dept. (1994, p. 21).
16. U.S. Agriculture Dept. (1994, p. 10).
17. U.S. Agriculture Dept. (1994, p. 12).
18. U.S. Agriculture Dept. (1994, p. 9).
19. U.S. Agriculture Dept. (1994, p. 5).
20. U.S. Agriculture Dept. (1994, p. 30); U.S. Senate Comm. Rept. (1994, pp 5–6).
21. Thus, it is unnecessary to rehearse the many weaknesses of our modern civil liability system in dealing with more ordinary sources of loss. See Priest (1987).

References

Calabresi, Guido. (1970). *The Costs of Accidents.*

Crocker and Snow. (1986). "The Efficiency Effects of Categorical Discrimination in the Insurance Industry," *Journal of Political Economy* 94, 34.

Devlin, Rose Ann. (1988). "Liability Versus No-Fault Automobile Insurance Regimes: An Analysis of Quebec's Experience." University of Toronto Law & Economics Programme.

The Dire Emergency Supplemental Appropriations Act of 1992 (Hurricane Andrew).

Emergency Supplemental Appropriations for Relief From the Major Widespread Flooding in the Midwest Act of 1993.

Jobe, Edward B. (1996). "Managing Hurricane Exposure," Paper prepared for The Stanford University Conference on Social Policy Toward Catastrophic Risk.

Kunreuther, Howard. (1996). "Mitigating Disaster Losses Through Insurance," *Journal of Risk and Uncertainty* 12.

Posner, Richard A. (1993). *Economic Analysis of Law,* 4th ed.

Priest, George L. (1987). "The Current Insurance Crisis and Modern Tort Law," *Yale Law Journal* 96, 1521.

Priest, George L. (1986). Inaugural Address for the John M. Olin Professorship in Law and Economics, November.

Priest, George L. (1981). "A Theory of the Consumer Product Warranty," *Yale Law Journal* 90, 1297.

Sinfield, Nick. (1996). "Asbestos—Human or Natural Disaster," Paper prepared for The Stanford University Conference on Social Policy Toward Catastrophic Risk.

U.S. Dept. Agriculture, Office of the Inspector General. (1994). *Evaluation of the Disaster Assistance Program Agricultural Stabilization and Conservation Service Report No. 03600-50-Te,* August (indicated "Draft") (cited as "Agriculture Dept.").

U.S. Senate, Commission on Agriculture, Nutrition, and Forestry. (1994). "Questionable Disaster Payments: $92 Million to 8 Non-Program Crops in 9 States, 1988–93." Staff report, August. (indicated "DRAFT 9/9") (cited as "Senate Comm. Rept.").

Viscusi, W. Kip. (1996). "Alternative Institutional Responses to Asbestos," *Journal of Risk and Uncertainty* 12.