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IGNORING DISASTER: DON'T SWEAT THE BIG STUFF

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Introduction.

It is well known that individual consumers have difficulty in dealing with low-probability, high-loss events. Frequently they fail to obtain insurance against such losses, even when the insurance terms are very favorable. We begin this paper by outlining a possible explanation for such behavior based on expected utility maximization in a world where consumers experience transactions costs (explicit or implicit) associated with obtaining information about insurance and about the underlying loss probabilities. We then expand upon this model by suggesting other aspects of behavior that are traditionally not part of the expected utility paradigm but which may help us better understand behavior. Our intentions are to develop prescriptive solutions to improve the decision-making processes of insurers as well as individuals. We suggest some ways to do this in the concluding portion of the paper.

The insight that we wish to pursue with respect to the impact that transaction costs have on behavior is this: while some rare events can surely causes enormous losses when they occur, the ex ante expected value of such losses may be small. In such a case, the effect of insurance purchasing decisions on a person's expected utility will also be small. Whether a consumer bothers to obtain information on, or in some other way "pays attention" to such events depends on the gain in expected utility from so doing versus the cost in time and energy. Even when the loss in expected utility from an uninsured loss is larger than the utility attached to a certain loss of the equivalent expected value, this utility loss may be small relative to the information and attention costs. But there is more to the problem than just comparing gains and losses. What a rational person will choose to do depends on the assumptions the person makes about the functioning of insurance markets, as well as on the costs of obtaining information.

The Basic Model.

An individual is contemplating purchasing insurance against a loss from some peril that is substantial relative to his wealth. The individual knows his own loss and is aware that insurance is available in the market to cover such a loss. Initially he does not know the insurance premium or his own loss probability. Information about such matters is available, but at a fixed cost.

More formally consider a individual in a two state world---loss and no loss. The loss L is known by all parties, but the person needs to incur a fixed search cost (S) to obtain "true" estimates of the probability of a loss (p) and the premium per dollar of insurance

coverage (z). Insurance firms, who are assumed to know p and L, set a premium that reflects the chances of a loss occurring (p) plus a proportional loading factor, ë. Hence $z = p(1+ ë)$.

Consumers are assumed to be risk averse, have wealth (W), and maximize their expected utility [E(U)] by determining how much insurance coverage (I) to purchase. In this two-state world, demand for insurance for given values of p and z is determined by finding the amount of coverage I (p, z) which maximizes:

$$EU[(I(p, z)] = p\,U(W - S + L + I - zI) + (1-p)\,U(W - S - zI) \quad (1)$$

subject to $0 \leq I \leq L$

where $U(x)$ = utility of X dollars

Let $I^*(p, z)$ represent the optimal amount of insurance. It yields an expected utility of $EU[(I^*(p, z)]$

There are then three alternative choices facing the individual with respect to purchasing insurance

A. *Ignore Insurance.* Gather no information and buy no insurance.

B. *Search for Information.* Gather information at a search cost S and decide whether or not to buy insurance based on the content of the information.

C. *Buy Insurance Immediately* Gather no information but buy insurance from a randomly selected insurer at whatever premium that insurer may be charging. If the individual decides to buy insurance, the amount of coverage will be based on the premium discovered after contacting the "first" insurer. We assume the individual precommits to buying some coverage no matter what the premium turns out to be. In effect, the person precommits to just one "search."

Impact of Not Searching If the person decides not to search for information, then one can determine the expected utility associated with Alternative A or C. If the person decides to ignore insurance (Alternative A), then for any probability of a loss (p_j) the expected utility is simply:

$$E[U(p_j)] = p_j\,U(W-L) + (1-p_j)\,U(W) \quad (2)$$

Let the individual's subjective estimate that the probability of a loss will take on a value p_j be given by $v(p_j)$ with $Ó v(p_j) = 1$. The expected utility of ignoring insurance EU(N) is computed as

$$EU(N) = \sum_j v(p_j)E[U(p_j)] \quad (3)$$

To determine the expected utility of buying insurance immediately (Alternative C), we assume that an individual makes his decision based upon a point estimate associated with the probability of a loss (p_{est}) and obtains a premium estimate (z_{est}) by trying to purchase insurance. Using these two estimates the person determines the amount of insurance (I) which maximizes the expected utility as given by

$$EU[(I(p_{est}, z_{est})] = p_{est}\, U(W- L +I - z_{est}I) + (1- p_{est})\, U(W- z_{est}I) \quad (4)$$

Let the optimal amount of insurance be designated as $I^*(p_{est}, z_{est})$ and its associated expected utility as EU(Y).

Impact of Searching To decide whether to search for information (Alternative B) the individual must determine whether the value of the information he is likely to get by searching will yield a gain at least worth the search cost S compared to either ignoring insurance (Alternative A) or buying insurance immediately (Alternative C). To simplify matters, assume that information is "complete" in the sense that the person once informed will know all premiums in the market and have obtained the best estimate possible of the loss probability.

We can describe the individual's initial state of knowledge of the loss probability as imperfect in the sense that the individual believes that the probability has a range of possible values ranging from a minimum value (p_{min}) to a maximum possible value (p_{max}). The value of p_{min} could be 0 if the individual believes that the event could not happen to him or her.

In thinking about the premium, the individual is assumed to know enough about insurance markets to suspect that there is a connection between the premiums he will discover and the value of p the insured believes to be the best estimate of the risk. The lowest premium per dollar of coverage will surely be greater than this p because the insurer has administrative costs and desires to earn a profit. We therefore assume that the individual believes that the lowest premium that he might face is $z_{min} = (1+ \lambda_{min})\, p_{min}$, where λ_{min} is the lowest (proportional) loading that could prevail in the market.

The individual does not know beforehand what λ_{min} is but has a subjective probability distribution over λ as well as a subjective probability distribution over the value of p from p_{min} to p_{max}. To determine whether to search for information on both the probability and premiums the following procedure is necessary:

Step 1: The person needs to first compute the expected utility associated with the optimal amount of insurance purchased for each subjective estimate of the probability of the event (p_j) and possible premium (z_k) using (1). Denote this value as $EU[(I^*(p_j, z_k)]$

Step 2: The person needs to specify a weight reflecting the likelihood that the probability and premium will take on specific values. Let $w(p_j, z_k)$ represent the person's estimate of the likelihood that the probability of a loss will be p_j and the insurance premium will be z_k with $\sum_j \sum_k w(p_j, z_k) = 1$.

Step 3 Weight the expected utility of each optimal insurance decision for each (p_j, z_k) pair by $w(p_j, z_k)$ to obtain the expected utility of search [EU(S)] for any search cost S. This is given by

$$EU(S) = \sum_j \sum_k w(p_j, z_k)\, EU[(I^*(p_j, z_k)] \qquad (5)$$

A person will decide to search for information on probabilities of losses and insurance premiums only when EU(S) in (5) is greater than both EU(N) and EU(Y).

Implications of the Model

When is each of the three strategies likely to be the best one to follow? The "ignore insurance " strategy will be best if S is high and/or the individual thinks there is a good chance that insurance is overpriced relatively to the risk he faces. If the person thinks that the loading is likely to be low with little variance, the "buy insurance immediately" strategy will be best. A "search for information" strategy will be optimal if S is low and the individual thinks there is a wide range of premiums with a sufficient number of them highly attractive to him. He will then perceive that insurance will be a *good deal* sufficiently often to justify collecting information on p and z.

One of the primary messages from this model is that premiums themselves convey information about loss probabilities, especially if information about premiums is combined with information about insurance loadings or insurance profitability. A risk averse person who believes that insurance is not highly profitable and that competition forces insurers to be efficient in marketing insurance and paying claims, should feel confident that buying insurance at the market price will be utility increasing.

The empirical evidence does not support this conclusion. Rather it suggests that often (though not always) most individuals do not insure against low probability events for a wide variety of reasons that make searching for information an unattractive option. We now discuss some of them:

I Am Overcharged A person at risk may think that, even though insurance premiums are reasonable as a whole, she herself is always overcharged. She may feel that there is considerable variation in premiums for the same risk with some insurers charging a very high premium. Each person may believe that he or she will have the bad luck to buy from that seller, rather than from the average seller. In contrast to the optimism perceived by most individuals who perceive themselves to be better than the average driver (Svenson 1981), we hypothesize that many people are pessimistic when it comes to finding a good deal on insurance, feeling that they are more likely than average to be overcharged for coverage.

This feeling of being overcharged is reinforced when an insurance agent spends considerable time with a client trying to sell him a policy. The person may not unreasonably conclude that such costly effort by the agent signals that the premiums must be high relative to benefits, high enough to generate the commissions assumed to be responsible for the strong selling efforts. In this sense, vigorous efforts by agents to inform people about insurance plans may be self-defeating.

Lack of Interest in Probabilities Several studies show that individuals rarely seek out probability estimates in making their decisions, and that low probabilities are inherently difficult to process. Huber, Wider and Huber (1997) found that only 22 percent of subjects sought out probability information when evaluating several risky managerial decisions. Even when another group of respondents was given precise probability information, less than 20 percent mentioned the probability in their verbal protocols. When consumers are asked to justify their decisions about whether or not to purchase warranties for items such as stereos, computers and VCRs, they rarely list probability that the product needs repair as a reason for purchasing this protection (Hogarth and Kunreuther 1995).

The reason for the lack of interest by individuals in such information when it comes to purchasing protection is unclear to us. Most plausibly, people may not realize that knowledge of probabilities might help their decisions because they do not think about the likelihood of an event occurring when making a choice. Alternatively, they might feel that information about probabilities is already embodied in market prices quoted to them (and tailored to their circumstances). Those who decide to ignore insurance may believe that the price of coverage is too high relative to the risks they face without thinking about the chances of the disaster occurring to them.

For those individuals who do not utilize probabilities in making their decisions, they are likely to decide whether or not to buy coverage without incurring the type of search behavior postulated above. Turning to those individuals who following Alternative A, the health insurance area provides an illustration of why such behavior might occur. Studies of people who are not poor but who nevertheless ignore health insurance find that few of them undertook any search in making this decision. When asked what premiums they would be charged, their estimates tend to be both substantially incorrect and disproportionally higher than actual premiums, especially for higher-cost sharing policies. (California Health Care Foundation, 2000)[1]

Consider the group of individuals who follow Alternative C. They may decide to purchase immediately because they trust the market and/or want buy protection to gain peace of mind. This was the argument used by many individuals when asked why they

[1] There have not been comparable studies of the search behavior of people who did obtain insurance but, for the bulk of the population who obtain employment-based group health insurance as part of their job, searching among jobs based on health benefits is by no means universal; many people probably assume that a decent job will come with decent health insurance.

purchased a warranty to provide protection against a defect in a new stereo, computer or VCR (Hogarth and Kunreuther 1995).

Inability to Distinguish Between Low Probabilities There is considerable evidence that individuals are not able to distinguish between low probabilities. In a study by Kunreuther, Novemsky and Kahneman (in press) individuals were presented with either a probability characterizing the risks associated with the discharge of a hypothetical toxic chemical, Syntox. The chemical had the potential of causing fatalities to individuals living near the fictitious ABC chemical plant located on the outskirts of an urban center in New Jersey.

The participants were asked a set of questions regarding how risky they perceived the facility to be. To provide a reference point, respondents were given the probability of death from a car accident. In judging how safe the facility was perceived to be people were not able to distinguish between probabilities that varied from1 in 100,000 to 1 in 1 million to 1 in 10 million. If individuals cannot distinguish between low probabilities, they have little reason to search for this information in making their decisions regarding the purchase of insurance.

Individuals may have more of an interest in getting such data if they perceive the probability of an event as being sufficiently high for them to be able to understand its meaning and want to consider whether or not to protect themselves against its consequences. People have no difficulty understanding the probability of an event such as "a 5 in a toss of a die" or the chances of "two 5s when tossing two dice".

It Cannot Happen to Me There is also evidence that absolute probabilities seem to be edited to "a very small number" or zero for some individuals. In a laboratory experiment on purchasing insurance, McClelland, Schulze and Coursey (1993) found that many individuals bid $0 for coverage of a loss that was very small relative to their wealth, while others bid much more than the expected value. This implies that some respondents viewed the probability of a loss as if it were zero, so that they had no interest in protecting themselves against it. Studies associated with siting hazardous facilities arrive at a similar conclusion. For example, many homeowners residing in communities that are potential sites for nuclear waste facilities have a tendency to dismiss the risk as negligible (Oberholzer-Gee, 1998).

This "it cannot happen to me" attitude suggests that these individuals may be utilizing a threshold model of choice. Instead of weighing the outcome from an event by its perceived probability of occurrence, these individuals do not even consider the consequences from such events because they perceive the chances of their occurrence as below a critical threshold level of concern. They essentially treat these events as impossible, and hence have no reason to invest in insurance.. After a disaster, however, the potential for loss is much more concrete, so people tend to treat them not just as possible but probable, and are likely to consider buying insurance. This is an example of the availability bias whereby a person assesses the probability of an event by the ease with which the relevant mental operation of retrieval, construction or association can be carried out [(Tversky and Kahenman (1973)].

By introducing a search cost as part of the insurance purchasing decision, there will be some threshold subjective probability of the loss below which it will be rational to decide **not** to buy insurance. That is, if my cost of information or worry is $X for each possible insurable event, I will not bother to investigate insurance when I feel that the probability is low enough (even if not zero) that the expected value of the gain from searching and sometimes buying insurance is less than $X. In this case the person will follow the "ignore insurance" strategy. By increasing the chances of a negative event occurring, search can now be justified.

The Importance of Bundling Coverage

If one wants to increase the chances that individuals will buy insurance against a risky event or at least engage in a search for information, then bundling risks into a single policy may be an appropriate strategy. Rather than having flood coverage and earthquake insurance as separate policies, they could be combined into a homeowners (HO) policy.

The history of property-casualty insurance is interesting on this score. The first versions of such insurance distinguished specific perils from the standard fire coverage such as tornado, explosion, riot and hail. An Extended Coverage (EC) policy was developed in the 1930s to include protection against these and other perils to ones property. When first introduced the policy was purchased by few individuals and was even viewed as a luxury. However, after the 1938 hurricane in the Northeast, the first to hit New England in a century, many individuals wanted to purchase the EC endorsement and many banks required that it be added to fire insurance as a condition for a mortgage. (Kunreuther 1998). Today the EC policy is part of a standard HO policy. Insurers feel that adding coverage of additional perils added little to their expected losses but greatly improved the marketability of their products and banks found it to be attractive to protect their mortgages.

In theory, a person's desire to purchase insurance against a risky loss should not depend on the cause of the loss, only the amount of the loss and the aggregate probability that damage will occur. Thus if my house might suffer $100,000 damage from earthquake, wind, or fire, I should simply want to buy coverage against the damage from these events with a premium reflecting the probability of a loss from all these causes.

One would be reluctant to bundle coverage from several risks if there are differences in the chances of specific events or the potential losses due to moral hazard, adverse selection, or the cost of claims settlement. The following examples in the health insurance area illustrate this point. Moral hazard seems to be larger for discretionary expenditures such as outpatient mental health care or prescription drugs. As a result health insurance policies often exclude these types of expenses or apply higher levels of cost sharing (e.g. larger deductibles or coinsurance clauses) With respect to possible adverse selection problems, the fear that coverage of prescription drugs will attract

people with chronic illnesses has motivated many Medicare HMOs to drop or limit drug coverage. [2]

If insurers decide they want to bundle coverage, the demand for insurance should increase for the following reasons:

Desire for apparent zero risk Bundled coverage gives the insured the feeling of being covered for all risks. An individual is likely to be much happier knowing that insurance will provide protection against the hazards he or she faces rather than only some of them. We would predict that a comprehensive homeowners insurance policy that covers all the risks to ones residence would be extremely popular.

There is empirical evidence supporting this conjecture. We know that many people dislike deductibles even though it is normally optimal for risk averse individuals to choose policies with high deductibles if one is maximizing expected utility [Pashigian, Schkade and Menefee (1966)]. When Herbert Denenberg, then the Insurance Commissioner of Pennsylvania, tried to raise the minimum auto insurance deductible from $50 to $100, the resulting consumer outcry forced him to withdraw the request [(Cummins, McGill and Winkelvoss (1974)]. After a stay in the hospital where ones health insurance covers almost all the costs, it is not unusual to hear a person say that he or she wished that the policy had covered charges such as daily telephone expenses.

There are other studies suggesting that people are willing to pay more for zero risk than for larger risk reductions where there was still a chance of the negative event occurring. Consider an insect spray that costs $10 per bottle and results in 15 inhalation poisonings and 15 skin poisonings for every 10,000 bottles sold. Viscusi and Magat (1987) found that survey respondents would pay about $2 more for a spray with half the current risk and $8 more for a spray with no risk. The Delaney Clause that banned any chemicals that could cause cancer reflects this preference for zero risk. The 1980 Superfund law that concerns the cleanup of hazardous waste left in the ground favored complete risk reduction even though Breyer (1993) and others have argued that most cleanup costs are expended on the last 10% and that a 90% cleanup is adequate. Experimental evidence supports the public desire for zero risk with respect to the cleanup of landfills. (Baron, Gowda and Kunreuther 1993)

Increase in probability of loss For those individuals utilizing threshold models of choice, the probability of experiencing a loss from all causes may be sufficiently large so that the person will now want to pay attention to the consequences. Had insurance been unbundled she might have ignored all of the risks. An alternative rationale for a bundled insurance policy is that individuals can now distinguish between the likelihood of experiencing different losses as they change their insurance coverage because the probability of a loss is sufficiently high for them to understand its meaning.

Why Don't Insurers Bundle Coverage

[2] For a discussion of moral hazard and adverse selection in private drug insurance see Etheridge(1999).

If individuals would like to purchase a bundled insurance policy, then why don't insurers offer this type of protection? We do not have a good answer to this question based on a traditional economic model of the firm that assumes insurers' objective is to maximize expected profits with an ability to raise more capital should they suffer a major loss.

Safety First Considerations Insurance firms apparently feel that they cannot rely on the capital market to replenish their surplus should they suffer a major disaster. In fact, insurers empirical evidence suggests that they are quite concerned with the consequences of experiencing a large loss and hence utilize a safety first rule when determining what type of policies to offer.[3] In other words they are interested in maximizing profits subject to the following constraint related to their potential losses:

$$\text{Probability (Surplus + Premiums - Losses} < 0) \quad \text{á}^* \qquad (6)$$

where á* reflects the target ruin probability insolvency.

The lower á* the greater concern the insurer has with insolvency. To reduce its chances of insolvency it will want to raise premiums and/or reduce its coverage and offerings against the specific risks in question. One way to offer less coverage is to unbundle a policy. In other words, a homeowner will be able to purchase a homeowners (HO) policy that provides protection against fire but not against earthquake and flood damage.

In fact, the safety-first constraint discourages firms from offering a bundled policy whenever they feel that they have lost control on the number of policies actually sold. HO coverage falls into this category since it is required as a condition for a mortgage. If insurers bundled flood and earthquake coverage into an HO policy and could not control the size of the market, then they might find that equation (6) was violated: the losses from both each of these risks is highly correlated if an insurer has a number of policies in a given area (e.g. Los Angeles, CA which faces an earthquake problem and New Orleans, LA which has potential flooding problems).

The economies of scale associated with marketing policies in specific cities and the high monitoring costs of restricting agents from selling too many policies in a given areamay make it difficult to diversify the risk and avoid potentially large losses from a major disaster. To the extent that there is greater ability to spread risks across regions by marketing insurance on the Web one may find that bundled insurance will become more attractive to insurers.

Empirical Evidence The history of flood and earthquake insurance suggests that a safety-first constraint seems to be guiding insurers decisions with respect to marketing coverage. In 1897 an insurance company in Illinois inspired by floods in the previous two years on the Mississippi River first offered flood insurance in the United States. Although the river was peaceful in 1898, severe floods the following year created huge

[3] Stone (1973) suggested that insurers are interested in maximizing expected profits subject to two constraints representing survival of the firm and the stability of its operations. In discussions with underwriters today these constraints still play an important role in their decisions on what coverage to offer.

losses and even washed away the home office of the company. The next attempt at marketing flood coverage was in the mid 1920s but severe flooding in 1927 and 1928 led every responsible insurance company to discontinue this coverage (Manes 1938). In fact, insurers felt that the catastrophic nature of the loss made it an uninsurable event. Eventually this led to the federal government's introduction of the National Flood Insurance Program in 1968 where private insurers were not responsible for the risk.

Earthquake coverage has been widely available in California since 1916, although relatively few homeowners purchased coverage until a series of earthquake occurred in the 1970s and 1980s. In 1985 the California legislature passed a law requiring insurers writing homeowners' insurance on one to four family units to offer earthquake coverage on these structures Following the Northridge earthquake of 1994 earthquake insurance was viewed as a desirable commodity by many homeowners in California. The insurance companies reevaluated their earthquake exposures in the State and decided that they could not risk selling any more policies due to the potential for catastrophic losses. Given the 1985 law, 90 percent of the insurers had either stopped selling new homeowners' policies or had placed restrictions on them. As a result a state-run earthquake insurance company---the California Earthquake Authority (CEA)---was formed in 1996.

Informal empirical evidence from the homeowners' insurance market tells us some things about consumer choice and about bundling. Even when not required by a lender, most homeowners do purchase standard homeowners' coverage to protect their investment against losses from fire, theft, and wind (but not flood or earthquake). Such insurance appears on average to be only modestly profitable, and there is only moderate variation across firms in premiums for the same coverage. Perhaps more importantly, even with no subsidy to this market and loadings on the order of 30% or more of the premium, consumers still buy. Those who do not (one may hypothesize but should test) may simply be those with lower values of risk aversion.

In contrast, as is well known, in the absence of compulsion most homeowners do not buy flood or earthquake insurance. One reason for this behavior, as indicated above, is that the probability of damage from these types of disaster is perceived to be below a threshold level of concern until after a disaster occurs. Secondly, the profitability of such insurance is highly variable year by year or company by company due to the infrequency of these events and the catastrophic losses from these types of disasters. For an individual with moderately high search cost, the possibility that sometimes premiums may be very high relative to their perceived expected benefits might also discourage buying this type of insurance.

Prescriptive solutions

We now suggest some ways to encourage individuals to search for information about insurance premiums and prices while at the same time encouraging insurers to offer bundled policies. These two strategies go hand in glove.

Encouraging Individuals to Search for Information Providing information on probabilities in a form that will engender attention by consumers would help generate them to search. For example, "stretching the time frame" by telling people not the annual probability of a disaster (which may be low) but rather the expected number of accidents over a 25 or 50 year period seems to be more understandable and relevant to individuals. A person is more likely to search for information on flood insurance if he or she were told that the chances of one of more 100-year flood occurring during the next 25 years was greater than 1 in 5. The person may perceive the likelihood of this event to be above their threshold level of concern whereas the annual probability of .01 is perceived as too small to worry about.

Stone, Yates, and Parker (1994) find that people pay considerably more to reduce the risk of some adverse event if the likelihood is depicted as ratios of very small probabilities (e.g. the risk of an event occurring when one is protected is half of what it is when one is not protected) than if people are presented with two small probabilities (e.g. .000006 probability without protection and .000003 with protection). Studies by Slovic, Monahan and MacGregor (2000) have shown that even just multiplying the single-year risk– presenting it as 10 in 1,000 or 100 in 10,000 instead of 1 in 100 – makes it more likely that people will pay attention to the event. Most people feel small numbers can be easily dismissed, while large numbers get their attention.

Another kind of information that can promote either type of buying behavior would be data on the average value of loading or insurer profitability in the market and its variance. If in truth profits are low, administrative costs and loadings are at reasonable levels, then provision of information that insurance is a reasonably priced product may induce people to buy coverage without engaging in extensive search. If in contrast loadings actually vary substantially, then information about this fact may motivate search into finding a "best buy". Private organizations such as Consumers Union or public agencies like the state insurance commissioners office could reduce the search costs by providing this type of information. At a minimum, some moderation of the populist stance that insurers are price gougers might be helpful if premiums are, in fact, reasonable.

Search costs are affected by other characteristics of different markets. For instance, people appear to obtain information about prices and quality of products from friends and neighbors. Measures, such as the proportion of the population who have lived in the town for a long period of time, that are a proxy for the likelihood that people have friends with which to exchange information, do seem to explain the prices of some products (Pauly and Satterthwaite, 198x). NEED DATE. Encouraging people to discuss insurance programs with their friends and coworkers could possibly be appropriate public sector activities if this factor was indeed an important explanatory variable for reducing search costs and encouraging the purchase of insurance.

Encouraging firms to market bundled policies If there is a demand for a bundled insurance policy for the reasons stated above, then it is in the insurers interest to market these types of policies. Their reluctance to take these steps is due to their concern with possible insolvencies from a catastrophic loss.

One way to relax their safety-first constraint is to provide insurers with protection against a loss that exceeds a certain level. Traditionally indemnity contracts such as excess of loss reinsurance, has played this role. As an alternative or a complement to an indemnity contract, an insurer may now obtain needed funds should a severe disaster occur through an index-based or parametric catastrophe-linked bond (commonly known as a *cat bond*). A cat bond requires the investor to part with money upfront to be used by the firm if some type of triggering event (e.g. a severe earthquake or hurricane) occurs. In exchange for a relatively high return on this investment, the investor faces the possibility of losing either a portion or its entire principal. The amount paid out to the firm (*i.e.* the ceding company) is specified in advance of the triggering event. Many of the cat bonds issued today are tied to a disaster-severity index (*e.g.*, covering damage from a certain earthquake magnitude event within a specified region).[4] Since these parameters are independent of the firm's actual losses, payments can be made to the insurer immediately after the disaster occurs rather than being subject to the time delay necessary to compute actual losses, as in the case of indemnity contracts.

By offering these sources of funds to insurers, it may be feasible for them to bundle risks with catastrophic potential into one policy thereby increasing demand for this protection. In order for insurers to want to even consider this action they will want to be able to charge premiums based on risk. To the extent that state regulatory actions make it difficult for them to do this for certain risks, then they would prefer to **not** bundle those events with correlated losses in their policies. Within limits, it may be better to allow an insurer writing a policy that includes windstorm coverage to raise premiums following a disaster rather than forbid or restrict premium increases.

The experience in Florida following Hurricane Andrew illustrates insurers concerns in this regard. A number of companies indicated their intent to either reduce their writings of HO coverage or leave the Florida market entirely because they felt the rates they were allowed to charge were inadequate. The Florida Department of Insurance then imposed a moratorium on the cancellation and nonrenewal of residential properties for one year. They then instituted a phaseout period for another 3 years, where insurers could not cancel more than 5 percent of their property owners' policies statewide in any given year. (Lecomte and Gahagan 1998). Of course, even without regulation insurers may decide to exclude some causes as they react to occasional large losses because they fear that raising premiums and keeping the peril in the policy may cause more erosion of whatever goodwill they might have than simply dropping the coverage.

Conclusions

When a subset of already low probability events that are highly correlated are separated from bundled or umbrella coverage and are offered as an add-on coverage that requires a positive decision on the part of the consumer to accept then consumers frequently don't bother to investigate this coverage.

[4] For more details on the structure of recent cat bonds, see Insurance Services Office (1999) and Standard & Poors (2000).

One story that we have postulated is that these events are perceived to have such a low chance of occurring that they are not worth worrying about. A related explanation is that these coverages are perceived by consumers to be priced at "rip off" levels at certain times (e.g. immediately after a disaster) so that individuals don't bother to investigate the coverage. In other words, suppliers behave in ways that are themselves somewhat irrational. This causes consumers to face relatively high transactions costs for very low probability events. Consumers then respond by not bothering to investigate a type of coverage that they may reasonably believe to be overpriced (at least in some time periods) and which will not much affect their overall expected utility whether they have it or not. In other words, irrationality breeds irrationality.

At a prescriptive level we belief that better information about probabilities as well as the nature of insurer profits and their pricing decisions could help to motivate better insurance purchasing behavior. At present, this kind of information is not generally available with ease, and so the insurance buying decision process can be so complex and confusing, that people may eschew either search or purchase for high-consequence event that are rare.

The buyer's problem is exacerbated by outbreaks of irrational or at least surprising pricing behavior by insurers selling coverage against events that are both rare and highly correlated. Improvements here could begin either on the demand side or on the supply side, and there would probably be effects that would spread from one side of the market to the other. Better information on how this process functions would itself be of considerable value.

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