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Insurance Decision-Making and Market Behavior

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Abstract

Considerable evidence suggests that many people for whom insurance is worth purchasing do not have coverage and others who appear not to need financial protection against certain events actually have purchased coverage. There are certain types of events for which one might expect to see insurance widely marketed that are viewed today by insurers as uninsurable and there are other policies one might not expect to be successfully marketed that exist on a relatively large scale. In addition, evidence suggests that cost-effective preventive measures are sometimes not rewarded by insurers in ways that could change their clients' behavior. These examples reveal that insurance purchasing and marketing activities do not always produce results that are in the best interest of individuals at risk. *Insurance Decision-Making and Market Behavior* discusses such behavior with the intent of categorizing these insurance "anomalies". It represents a first step in constructing a theory of insurance decision-making to explain behavior that does not conform to standard economic models of choice and decision-making. Finally, the authors propose a set of prescriptive solutions for improving insurance decision-making.

1

Introduction

Economists view insurance markets as a special case of markets for contingent claims based on the state-preference approach developed by Arrow (1953) and Debreu (1953). A contingent claim is a formal contract between two parties whereby one of the parties (the insured) purchases a ticket from another party (the insurer), which can be redeemed for money if certain states of nature occur. The ticket is more commonly referred to as an insurance policy, its cost is the insurance premium and the states of nature are the events which are covered by it such as a fire causing damage to one's property.

Insurance affects individuals prior to specific events occurring because the insurer must collect premiums. It then pays people in the event of losses suffered from events covered by the policy. Effective preventive measures on the part of insured people sometimes lower the premium, if the insurer can observe them at low cost. For example, if an insured homeowner invests in a mitigation measure that reduces the potential losses from an earthquake, and if that investment could be observed, then a competitive insurer that has the freedom to set rates based on risk has a financial incentive to lower the annual premium for earthquake coverage compared to the premium charged if there had

been no mitigation. The benefits in the form of lower expected losses have to be sufficiently large that it is cost-effective for the insurer to incur the transaction costs of varying the premium based on mitigation behavior.

Considerable empirical evidence suggests that many individuals for whom insurance is a worthwhile purchase do not have coverage. For example, flood insurance even when heavily subsidized is not purchased by many homeowners until after they suffer damage from a disaster. Many residents in Louisiana and Mississippi only discovered that they were not covered for flood damage after Hurricane Katrina, with some allegedly under the misimpression that they were protected by their homeowner's policy. A standard homeowner's policy, normally required as a condition for a mortgage, provides protection against damage from fire, hail, storms, tornadoes and wind damage, but not from rising water due to floods and hurricanes. Homeowners in flood-prone areas are eligible to purchase such a policy through the National Flood Insurance Program (NFIP), a public program administrated by the Federal Emergency Management Agency (FEMA) that was established in 1968. In the Louisiana parishes affected by Katrina the percentage of homeowners with flood insurance ranged from 57.7% in St. Bernard's to 7.3% in Tangipahoa. Only 40% of the residents (owners and renters) in Orleans parish had flood insurance (Insurance Information Institute, 2005).

It is hard to verify what people believed before the fact since it will often be in their interest after a disaster to claim that they thought they were covered. Limited data exist on beliefs about coverage prior to the event. It is also difficult to know what insurance agents told prospective buyers, above and beyond specific insurance contract language. In a field survey of homeowners residing in disaster-prone areas in the United States, Kunreuther et al. (1978) found that 60% of the uninsured homeowners interviewed had no idea that they could cover their house against flood or earthquake damage. Some homeowners in Mississippi allege that insurance agents led them to believe that they had coverage against flooding damage from hurricanes such as Katrina.

Others who appear not to need financial protection against certain events actually have purchased coverage. For example, many consumers will buy a warranty on a new piece of electronic equipment or appliance

that pays for only small repair costs and even annual servicing, at a premium which is extremely high relative to the cost of buying a replacement. For example, extended protection plans are offered at USD 70 for two years, USD 120 for three years and USD 300 for five years on a camcorder which sells for as little as USD 180 (Cutler and Zeckhauser, 2004). Some people buy these but, of course, many do not.

Neither of these examples is totally conclusive: some uninsured homeowners may not be very risk averse and some appliance buyers worried about product failures may choose warranties even at a high price. But the circumstantial evidence suggests that "more than a few" people do things that are not expected if they were both rational (in a sense to be defined more carefully below) and well informed. One or both conditions for efficient markets may be absent.

On the supply side, certain types of events for which one might expect to see insurance widely marketed are viewed today by insurers as uninsurable unless there is public sector involvement. For example, following the Northridge, CA earthquake in 1994 insurers concluded that they could not continue to provide coverage to residents in the state. This led to the formation of the California Earthquake Authority, a state-run program (Roth Jr., 1998). Novel insurance policies where there is likely to be considerable interest by consumers have not been marketed by private insurers. For example, Shiller (2003) has proposed home equity insurance as a way to protect property owners against adverse changes in the market values of their house. He notes that data exist to construct such a product that could be attractive to homeowners and profitable to insurers.

Other policies that one might *not* expect to be successfully marketed do indeed exist on a relatively large scale. Health and life insurers often guarantee buyers that they will be allowed to renew coverage at premiums which are not affected by any adverse changes in their health; this "guaranteed renewability at class average premiums" in principle provides a solution to risk segmentation (and perhaps adverse selection, described in Section 5.1) which many experts think to be insurmountable problems in competitive insurance markets. Finally, evidence suggests that cost-effective preventive measures are sometimes rewarded by insurers in ways that could change their clients' behavior.

For example, some insurers offer lower insurance premiums for buying a car with airbags or automatic seat belts. But insurers do not discount health insurance premiums for joggers or reduce premiums for windstorm coverage for homeowners who engage in mitigation.

The above examples reveal that insurance purchasing and marketing activities do not always produce results that are in the best interest of individuals at risk. This paper discusses such behavior with the intent of categorizing these anomalies. It represents a first step in constructing a theory of insurance decision-making to explain behavior that does not conform to standard economic models of choice and decision-making. In this sense it differs from the very insightful paper by Cutler and Zeckhauser (2004) that also discusses selected kinds of anomalies related to insurance but makes no effort to develop a framework for describing or categorizing a wide range of them.

Our approach to the problem is first to discuss benchmark models of demand for insurance and supply of coverage in a world where there is perfect information and no transaction costs between parties. Buyers of insurance are assumed to maximize a conventional von Neumann–Morgenstern utility function (1947); choices made in accordance with such a function are defined as "rational." We will assume that all people are risk averse, but we place no a priori limits on risk aversion. This implies that people could pay premiums very much in excess of their expected claim payments and still be called rational. The assumption of risk averse individuals also implies that (1) if the premium is below the actuarially fair value, rational people definitely should buy insurance. On the other hand, (2) a rational person should not pay a premium greater than the maximum claim that could be received from the insured event.

Insurers are assumed initially to maximize expected profit. This means that they would not require a premium in excess of their expected costs in order to be willing to supply insurance.[1] If given the opportunity they would be eager to collect premiums higher than that amount. These benchmark models enable us to develop a positive

[1] We are assuming the expected costs include the marketing and administrative costs associated with a policy.

theory of demand and supply of insurance that will incorporate other factors such as information imperfections, biases and simplified choice models used by individuals, effort and attention costs, and multi-attribute preferences, insurer market power, and insolvency concerns by firms or capital suppliers.

We then introduce a set of anomalies related to insurance behavior that shows when and how the assumptions in the benchmark positive models of choice appear to be violated. We define an anomaly on the demand side where those individuals at risk should want to buy coverage but do not and where those who do purchase coverage should have decided to forego this protection. An anomaly on the supply side has an analogous interpretation. In some cases insurers should want to offer coverage but do not and in others they do offer protection but it is unclear why they are providing a policy. There is obviously the possibility of the less stark anomaly in which people purchase insurance but buy either more or less coverage than is rational. Determining whether behavior is anomalous requires knowing the strength of risk aversion and the administrative cost of supplying insurance which is often difficult to measure.

The most serious challenge is to develop a positive theory of choice that can explain these anomalies in a simple way – as opposed to developing an ad hoc explanation for every strange form of behavior that we observe. This is, to put it mildly, a daunting task, but one that we begin here. The concluding section of the paper proposes a set of prescriptive solutions for improving insurance decision-making by addressing the above anomalies. These solutions may require government to take on one or more of the following roles: act as a partner with the private sector; serve as a key party enforcing certain standards and/or require insurance protection when individuals would not voluntarily purchase coverage.

2

Benchmark Models of Choice

This section develops benchmark models of choice for those demanding insurance protection and those supplying coverage. The analysis is intentionally kept simple since the points we are trying to illustrate do not require complicated models. Simpler models may also enable other social scientists that have little patience with formal mathematical analysis to provide insights as to why people behave as they do. These insights are important if we are to provide prescriptive solutions that are likely to work in practice.

2.1 Demand for insurance

There is a large literature on the demand for insurance coverage that has been spawned by the state-preference approach and the theory of contingent claims developed by Arrow (1953) and Debreu (1953). We will use the elements of their approach to develop a benchmark model of demand for insurance using problems with two states of nature (e.g. flood or no flood).

Consider a consumer or firm where there is some probability p (e.g. 1 in 100) of suffering a loss L (e.g. USD 50,000) from some event (e.g. fire). Insurance firms are assumed to know p and L and set a premium z

per dollar coverage which reflects the administrative costs per dollar of coverage (c) and the annual chances of a loss occurring (p). Hence $z = c + p$.

Consumers are assumed to be risk averse, have wealth (W), and maximize their expected utility [$E(U)$]. Demand for insurance for any given value of z is determined by finding the amount of insurance (I) which maximizes $E[U(I)]$:

$$E[U(I)] = pU(W - L + I - zI) + (1 - p)U(W - zI) \qquad (2.1)$$
$$\text{subject to } 0 \leq I \leq L$$

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

Let I^* equal the optimal amount of insurance. We know that if there are no administrative costs so that $c = 0$, then $z = p$ and the consumer is charged an actuarially fair premium. In this case there is demand for full coverage (benefits just equal the amount of loss) so that $I^* = L$. This implies that the utility in both states of nature (disaster; no disaster) is identical. In other words the consumer is indifferent as to whether there is or is not a disaster. Note that, in this case, we know what the quantity of benefits that will be demanded by a risk averse person at the actuarially fair premium should be regardless of the strength of risk aversion; we know one point on every rational risk averse person's demand curve for insurance. Of course, the amount of coverage that will be demanded at premiums above and below the actuarially fair level will depend on the degree of risk aversion – the shape of buyers' utility functions and the distribution of different levels of risk aversion. Hence, it will be more difficult in such cases to judge whether people are behaving rationally or not.

The implicit assumption in the analysis so far is that the money received from the insurance claim can be used to replace the loss, L. In other words, there is no sentimental value attached to the items that are destroyed or lost by the disaster. If there were such attachment and money would compensate for the disappointment of experiencing the loss, then the individual may value the item by more than the L dollars required to replace it.

Should c be positive, then $z > p$ and $I^* < L$. In this case the higher premium per dollar of additional coverage relative to the chances of

a loss makes it optimal to purchase less than full insurance coverage (Mossin, 1968). This situation would occur if the consumer has some type of deductible as part of the insurance policy so he pays for the first portion of his losses before the insurer pays any claims. However, since there is a wide variety of ways in which coverage can differ from full coverage, there will be a need to develop some explanations for the forms which deviations from full coverage will take. There will always be a premium sufficiently high so that the person will not want to buy any insurance coverage at all and essentially self-insure against a loss.

2.2 Supply of insurance

Insurers who supply coverage to those at risk are initially assumed to maximize expected profits. If instead the insurer is also concerned about the variability of profits, the ideal case that forms the basis for the benchmark model of choice is where each of the risks is relatively small and independent of each other. If the insurer has a large enough number of policies, then the law of large numbers makes it highly unlikely that the insurer will suffer an extremely large loss relative to the premiums collected.

Fire and automobile collision coverage are examples of risks that satisfy the law of large numbers since losses are normally independent of one another.[1] To illustrate its application in the context of a fire risk, suppose that an insurer wants to determine the accuracy of the estimated loss from fires for a group of identical homes valued at USD 100,000, each of which has a 1/1,000 annual chance of being completely destroyed by fire. If only one fire can occur in each home during a year and if it does then the house is destroyed, the expected annual loss for each home would be USD 100 (i.e. 1/1000 $\times$ USD 100,000). As the number of fire insurance policies (n) increases, the variance of the expected annual loss per policy or mean will decrease in proportion to n. As a general rule, it is not necessary to issue a very large number of policies to reduce the variability of expected annual losses per policy to a very small number if the risks are independent of each other.

[1] The Oakland fire of October 20, 1991 is a notable exception with 1941 single-unit dwellings totally destroyed and 2069 partially damaged for a total insured loss of USD 1.7 billion.

To illustrate the benchmark model of choice consider a set of identical individuals in our two state model of choice, each of whom would like to purchase insurance to protect themselves against a risk which occurs with probability p and causes a loss L. The insurer's expected claims if it sells n policies are npL. The insurer's objective is to determine a premium z which covers its administrative costs (c) and its expected loss, so that expected profits $[E(\pi)]$ are 0. If the firm sells n policies, this implies that the optimal premium (z^*) is determined by:

$$E(\pi) = z^* In - [ncI + npI] = 0, \quad \text{so that } z^* = c + p \tag{2.2}$$

Should the insurer's risks in the above example be highly correlated, then its loss distribution will *not* conform to the law of large numbers, although its expected claims will still be npI. For the extreme case of perfectly correlated losses, the insurer would either suffer no claims with probability $(1 - p)$ or claims totaling nI with probability p. An illustration of this case would be an insurer who provides earthquake coverage only to homes in a district of Los Angeles so that if an earthquake occurred all of them would suffer damage of L. Another somewhat different example would be coverage against mass toxic torts, where the legal system forces a set of losses to move together no matter what the true causes in nature may be.

When the insurer's objective is to maximize expected profits, then it would behave no differently if its risks were independent, partially or perfectly correlated. Its expected claims remain the same (i.e. npI) and this is the only loss that matters when setting premiums. Hence it will still charge $z^* = c + p$.

2.3 Role of government

In the benchmark models of choice for the demand and supply of insurance there is no role that government would need to play because markets are assumed to satisfy the conditions for perfect competition. This means that there is complete knowledge by both consumers and insurers with respect to the risk, so there is no need for any outside group to provide information to the relevant parties. Costless entry and exit of firms exist so that no firm is making excessive profits.

Since there is perfect information on the risk, insurers do not face problems of adverse selection where they cannot distinguish the high risks from the low risks. They also are not subject to moral hazard where the insureds behave differently (e.g. are more careless) when they have coverage because the informed insurer would know when they are careless and adjust premiums accordingly. If information is incomplete, either of these conditions may lead to market failure and there is a possibility that government intervention will improve efficiency as we will show when we turn to a positive theory of demand and supply. The possibility is more likely to turn into reality if the government can find ways to make changes that are potentially mutually beneficial (efficiency-improving) and there are political reasons that motivate legislative bodies to make those changes.

3

A Positive Theory of Demand for Insurance

The above benchmark model of demand postulates a world where collecting and processing of the relevant information is costless to consumers, risk is perceived accurately by all and the individual is assumed to choose the amount of insurance that maximizes her expected utility. As long as people are risk averse, they are willing to pay a premium greater than or equal to the expected value of losses from a set of uncertain events against which they will be covered. The maximum amount that an individual will be willing to pay for coverage depends on his degree of risk aversion. In this section we develop the elements of a positive theory of choice of insurance that relaxes some of the above assumptions. We will use this positive theory to address demand anomalies in insurance behavior that have been puzzling to economists. More detailed models illustrating the positive theory of demand can be found in a set of papers in Dionne (1992) and Dionne and Harrington (1992).

3.1 Features of a positive theory on the demand side

There are several reasons why actual behavior may deviate from the benchmark model of choice. First, individuals for whom insurance may

be a financially attractive investment may be reluctant or unable to collect the information they need to make decisions due to the time, effort and costs associated with the process. In addition, individuals may not process information in ways that are assumed in the benchmark model. Some examples of this *misprocessing behavior* includes: misperception of the risks (e.g. underestimating risks), using simplified decision rules (e.g. threshold models of choice) and reluctance to consider new alternatives (e.g. status quo bias). Individuals may also face *budget constraints* and other restrictions that influence their actions in ways that lead to behavior that differs from the above benchmark model of choice.

Individuals make a rough a priori estimate of the impact of purchasing insurance on their wellbeing. This requires that they think both about the probability of loss and the amount of loss in relation to the cost of coverage. Individuals will not be willing to invest the time and energy in gathering information on the risks and price of insurance if one or more of the following conditions hold:

- the probability of a loss is perceived to be extremely low
- the amount of loss is perceived to be small relative to existing wealth
- the premiums are likely to be considerably in excess of expected benefits of purchasing insurance

Another feature of behavior that has not been considered in the benchmark model of choice is the nature of *preference formations*. There may be non-financial attributes in a person's utility function such as emotional concerns (e.g. worry, love) and/or regret and disappointment associated with specific outcomes. Each of these features is now explored in more detail.

3.1.1 Misperception of risks

Most insurance relates to events with a low probability of occurrence that by definition is not a usual part of the human experience. Hence there are likely to be misperceptions associated with the risk that may lead individuals to purchase non-optimal insurance or no insurance

at all. Suppose that p' and L' represent the perceived probability and loss associated with an accident or disaster. The expected utility model introduced in (2.1) now becomes:

$$E[(U(I)] = p'U(W - L' + I - zI) + (1 - p')U(W - zI). \qquad (3.1)$$

If $p' < p$ and/or $L' < L$, then an individual may have no incentive to purchase insurance at a given premium z. Of course, a person could perceive the risks to be higher than the scientific estimates, in which case full insurance or even more than full insurance (if it can be bought) is likely to be an attractive option if an individual maximizes expected utility.

3.1.2 Costs of obtaining information

How do prior beliefs about the relationship of premiums to benefits come into play? There are search costs associated with obtaining information on the insurance premiums, that may deter individuals from even considering the purchase of coverage. To introduce search costs into the model one could think of an individual comparing two situations:

Situation 1: Do not search for information on the premium or available coverage and remain uninsured. A person's expected utility in this situation based on her own perception of the risk would be characterized by equation (2.1) with $I = 0$ and p' and L' replacing p and L respectively:

$$E[(U(0)] = p'U(W - L') + (1 - p')U(W). \qquad (3.2)$$

Situation 2: Incur a search cost S to obtain information on the premium and then determine how much coverage one would want to have. To keep the analysis simple assume that individuals have a prior estimate (z') of the lowest premium they will find after a search.[1] The expected utility associated with undertaking this search and purchasing

[1] The more formal Bayesian analysis would specify a prior distribution of anticipated premiums, each with a subjective probability on the part of the individual.

insurance would be:

$$E[(U(I)] = p'U(W - L' + I - z'I - S) + (1 - p')U(W - z'I - S). \tag{3.3}$$

If $E[U(0)]$ from (3.2) $> E[U(I)]$ from (3.3), then a person will be uninsured because she does not want to incur search costs. An individual is unlikely to incur the search cost if p' and/or L' are low, z' is high and/or S is high. In other words, overestimation of the premium and a high cost of obtaining information on premiums and available coverage from an insurer will lead a person to not even consider insurance, particularly if he or she underestimates the risks associated with a disaster.[2]

One way to reduce search costs is to rely on convenient and inexpensive sources of information such as friends and neighbors. Often a person learns about the availability of a product through an informal conversation at a party or social event so that the search cost S is effectively zero. The following example illustrates this point. In a pretest of a survey instrument in earthquake-prone areas in California, a homeowner responded to one of the questions by saying that he did not have earthquake insurance because he did not need it. A friend who was listening to the interview could not resist commenting that he himself had purchased such insurance a couple of years before and that it was readily available. The respondent was amazed and asked his friend about the cost of such coverage. Upon hearing that coverage was "quite reasonable" he indicated, "I am going to have to look into earthquake insurance myself" (Kunreuther et al., 1978).

This example illustrates a situation where a person was only willing to consider purchasing insurance because he learned (costlessly) that the premium was considered to be reasonable, even though a precise figure was not given to him. An additional factor that may have influenced his decision was the discovery that one of his neighbors had purchased insurance. On a more general level, one factor that may influence consumer decisions that is *not* part of a benchmark model of choice is social norms (Sunstein, 1996).

[2] A more detailed and more general discussion of when an individual may decide to search or not search for insurance can be found in Kunreuther and Pauly (2004).

3.1.3 Status quo bias

There is considerable empirical evidence that individuals are reluctant to move away from the status quo even though there may be substantial benefits to them from doing so (Samuelson and Zeckhauser, 1988). One explanation for this behavior is *loss aversion*: the magnitude of pain associated with a potential loss due to changing behavior is greater than the amount of pleasure that will be experienced from an equivalent gain (Tversky and Kahneman, 1991). There is also considerable empirical evidence from controlled laboratory studies that individuals make decisions by comparing *changes* in their financial position from specific actions rather than determining the impact of these actions on their *final* wealth as postulated by expected utility theory. Furthermore individuals have been found to be risk prone in the loss domain and risk averse in gains (Kahneman and Tversky, 1979).

There is also empirical evidence that increases in the probability of a loss are regarded as of more concern to people than decreases in loss probabilities in motivating changes in protective behavior. One of the most dramatic examples of this effect was a field study conducted by Viscusi et al. (1987). Respondents in a shopping mall were shown a fictitious can of insecticide and were told that the current risk levels were 15 injuries per 10,000 bottles sold. The mean willingness to pay to eliminate the risks from the bottle was USD 3.78. When asked the price reduction that they would require if the risk were increased by 1/10,000 over 75% of the respondents indicated they would refuse to buy the product at any price.

Some of these concepts have been more formally incorporated in the value function of prospect theory (Kahneman and Tversky, 1979). If one were to utilize the concept of a value function $[V(x)]$ rather than a utility function $U(x)$ to characterize individual behavior then equations (3.2) and (3.3) would become:

$$E[(V(0)] = p'V(-L') + (1 - p')\,V(0) \tag{3.4}$$

and

$$E[(V(I)] = p'V(-L' + I - z'I - S) + (1 - p')\,V(-z'I - S). \tag{3.5}$$

The introduction of a value function is likely to make insurance even less attractive than if one utilized a utility function since the decision on whether to purchase coverage involves comparisons of terms in the loss domain where a person is assumed to be risk-prone. Unless individuals perceive the probability or losses from an event to be higher than the insurer does, there will be no economic reason to purchase coverage. Prospect theory explains insurance purchase behavior by assuming that small probabilities are overweighed.[3]

3.1.4 Threshold models of choice

There are just so many things that a person can worry about during the course of his daily activities. Given the time and attention associated with thinking about different events, it is not unreasonable for individuals to utilize simple heuristics to tune out or ignore certain situations. Negative events, which are associated with insurance purchase decisions, are prime candidates for this category since they are unpleasant to think about. Some individuals utilize a threshold model of choice whereby events with a very small chance of occurrence are ignored. More specifically, if the perceived probability (p') of an event with some perceived loss L' is below some critical level (p^*), then the person assumes that *nothing seriously bad will happen to me.*

This behavior could be captured by the following simple model of choice for some given perceived loss (L'):

> If $p' \leq p^*$, then assume $p' = 0$.
> If $p' > p^*$, then consider p' to be the perceived probability of the event occurring.

Another reason for utilizing a threshold p^* for considering insurance is that the difference in my subjective expected utility caused by whether I am insured against some rare event or not is very small for reasonable ranges of the probability. Suppose there is some information or decision-making cost to purchasing insurance, and people

[3] The weighting function of prospect theory has a discontinuity when probabilities are extremely low. This implies that these probabilities are treated as if they are zero in which case there would be no interest in purchasing insurance.

think there is some chance that insurance if offered will have so high a loading cost to cover administrative expenses that it ought not to be purchased. There will be some probability p^* below which it will be rational to decide not to consider buying insurance due to search costs (Kunreuther and Pauly, 2004).

Suppose my cost of search is USD X. Then I will not bother to investigate insurance if my perceived probability is low enough (even if not zero) that the expected gain from obtaining information on insurance premiums and coverage and sometimes buying coverage is less than USD X. Of course, if I were reassured that insurance premiums are never excessive relative to my expected benefits of insurance, I would go to the other extreme and buy such coverage without investigating or questioning whether or not it is a good deal. We suspect that most people do not have this much faith in insurance pricing practices to take this route.

3.1.5 Budget constraints

Another reason that some individuals may not purchase insurance is that they feel they are constrained by their current income flow or available liquidity, and that they do not have easily available funds for investment in protection against low probability events. In focus group interviews to determine factors influencing decisions on whether to buy flood or earthquake coverage one uninsured worker responded to the question "How does one decide on how much to pay for insurance?" as follows:

> A blue-collar worker doesn't just run up there with USD 200 [the insurance premium] and buy a policy. The world knows that 90% of us live from payday to payday ... He can't come up with that much cash all of a sudden and turn around and meet all his other obligations. (Kunreuther et al., 1978, p. 113)

Of course, if the asset is only monetary, it is irrational to say that "I cannot afford insurance" that would protect against the loss of the asset. If I cannot afford insurance, I cannot "afford" to hold the asset

at its current level and in its current form. I would be better off using some of the value of the asset to pay for insurance rather than run the risk of losing the asset entirely.

However, if the asset is illiquid (like a home) the person may not be willing to incur the transactions cost of borrowing against the value of the asset in order to pay for insurance. More generally, the phenomenon of "unaffordability" arises (if it arises at all) when the asset in question is more than just a part of the person's wealth. For example, an owner occupied house also provides utility from consumption since the family enjoys the pleasures of living in it on a daily basis. If the property were bought solely for investment purposes, it would not be rational for a risk averse person to make such a large purchase so that he could not afford insurance to protect the structure.

One reason that individuals may not buy insurance is that they allocate their planned expenditures of income into different mental accounts that constrain how much they are willing to spend on certain activities (Thaler, 1985). If a family has an account labeled "expenditures on protective activities" and is already committed to spending considerable funds on required insurance (e.g. homeowners, automobile, life, medical), it may feel that it has exhausted its insurance budget and will not want to buy coverage for events such as earthquake or flood. In addition the family may limit the amount it spends on required coverage by taking the cheapest policy and/or not taking the highest limits of catastrophic coverage.

The budget constraint for investing in protective measures may extend to higher income individuals if they set up separate mental accounts for different expenditures. Thaler (1999) suggests that dividing spending into budget categories facilitates making rational tradeoffs between competing use of funds and acts as a self-control device. He points out that poorer families tend to have budgets defined over periods of a week or a month while wealthier families are likely to use annual budgets. Heath and Soll (1996) provide further evidence on the role of budget categories by showing how actual expenses are tracked against these budgets.

The idea of borrowing today to expand one's budget in order to buy coverage which will avoid a large loss tomorrow may not be part

of some consumers' mental accounting procedures. Bundorf and Pauly (2006) show, for example, that many people who do not have health insurance appear to have sufficient income and assets that they could buy coverage and still have enough left over to pay other expenses. They may be using this "budgeting" decision process to avoid buying a health care policy.

3.1.6 Nature of preference formation

The benchmark model of insurance decision-making has a single attribute in its utility function – final wealth. A person makes a choice about paying a small premium to protect himself against a large financial loss by comparing utilities associated with the impact of different outcomes on his wealth. In recent years there has been an interest in extending this model by introducing other considerations and feelings into a person's utility function such as regret (Bell, 1982; Loomes and Sugden, 1982; Braun and Muermann, 2004) as well as disappointment and elation (Bell, 1985).

These attributes describe how a person feels should one event occur rather than another. In the context of the simple two state example introduced above, an individual would regret having paid a premium for insurance if the state of nature "no disaster" was the operative one. The person regrets wasting her money, and so may avoid insurance in order to avoid feeling disappointed. Conversely, if the person did not buy insurance and the state of nature "disaster" emerged, then she would regret not having a policy. The impact on individuals' decisions are a function of the probability of the event leading to regret and the magnitude of the amount that one has foregone because of making the "wrong" decision *ex post*. That is, the consumer's choice in this model depends on how bad the regret is in each of the contrasting states and how likely each is to occur.

Similar scenarios and analyses could be constructed for operationalizing disappointment and elation. These additional "feelings" will affect insurance purchasing if they change the marginal utility of wealth or money.

More recently there has been an interest by economists and psychologists in looking at the role of affect and feeling as contrasted with thinking on individual decision-making (Loewenstein, 2000; Romer, 2000). For example, do emotions such as love, fear and anxiety play a role in people's decisions to purchase insurance? A series of controlled experiments undertaken by Hsee and Kunreuther (2000) examined whether a person's love of an object, such as a vase or painting, influenced how much he or she was willing to pay for coverage or spend time collecting a claim payment if the object was damaged or destroyed. They found that individuals were willing to pay considerably more for insurance and exert much more time to collect a claim payment for the exact same object if they were informed that they loved the object rather than being told they had no special feeling for it.

This behavior is not consistent with what might have expected from a benchmark model of choice. However, it is consistent with Adam Smith's observation about human nature in *The Theory of Moral Sentiments*. Smith writes:

> A man grows fond of a snuff-box, of a pen-knife, of a staff which he has long made use of, and conceives something like real love and affection for them. If he breaks or loses them, he is vexed all out of proportion to the value of the damage. The house which we have long lived in, the tree whose verdure and shade we have long enjoyed, are both looked upon with a sort of respect that seems due to such benefactors. The decay of the one, or the ruin of the other, affects us with a kind of melancholy though we should sustain no loss by it. (Smith, 1966, pp. 136–137)

Similarly, one might expect an individual to pay more for insurance if they feared a specific event (e.g. their car or painting being stolen; their house being damaged from an earthquake) than if they were not very concerned about the event occurring.

One way to explain the role of feelings and emotions on individual decisions to purchase insurance is to introduce other attributes

into the utility or value function besides monetary impacts and assume that they have an impact on the marginal utility of money in the event of the worrisome loss. Suppose we were interested in how love or fear influenced the decision to purchase insurance. In the context of equations (3.4) and (3.5) we could introduce a second attribute (x) which reflects emotional concerns as part of the person's value function. For example suppose we focused on whether a person would be willing to purchase theft insurance and how much he would be willing to pay for coverage. If $x = 0$, then the individual would not be fearful of a burglary to their house; if $x = 1$, they would be worried about such an event occurring. The choice as to whether or not to purchase insurance coverage would then be:

$$E[(V(0)] = p'V(-L', x) + (1 - p')V(0, x) \tag{3.6}$$

or

$$E[(V(I)] = p'V(-L' + I - z'I - S, x) + (1 - p')\,V(-z'I - S, x) \tag{3.7}$$

If $x = 1$ and the marginal utility of money was increased by having insurance, one would predict more interest in searching for coverage and more substantial coverage at a fixed premium per dollar, z. That is, if receiving higher insurance payments would make the person feel better after a highly feared burglary actually occurred, insurance would be more likely to be purchased. Hsee and Kunreuther explain this interest in insurance for items that they love as the need for consolation. In other words, one's decision to make an insurance claim for a lost object depends not only on the monetary value of the compensation, but also on the amount of pain one experiences due to the loss.

In effect, this approach attaches an additional value to the object and asks what would be rational insurance purchasing when the loss of the object means more than just the loss of its monetary value. In contrast to this "adjusted value" approach, which still uses what is fundamentally an economic calculus, there are some studies that postulate a different psychological state when a loss occurs, so that no balancing of costs and benefits occurs. Such behavior is consistent with the

"risk as feelings" approach of Loewenstein et al. (2001) and the affect heuristic characterized by Slovic et al. (2002).

There are some empirical studies that support such a model. Experimental findings of Rottenstreich and Hsee (2001) and Sunstein (2003) indicate that people focus on the badness of the outcome rather than on its probability when they have strong emotional feelings attached to the event. Schade et al. (2006) show that consumers who demand insurance coverage are those who are most concerned about the outcome. This concern may be generated by past experience with an event as shown by empirical studies on purchasing flood or earthquake insurance (Kunreuther et al., 1978; Palm, 1995). In the case of terrorism risk, a national field survey conducted in November 2001 revealed that Americans living within 100 miles of the World Trade Center felt a greater personal risk from terror than if they lived further away (Fischhoff et al., 2003). This may explain the large demand for terrorism insurance coverage immediately after September 11 even at extremely high premiums (General Accounting Office, 2002; Wharton Risk Center, 2005).

3.2 Incorporating features into a positive model of consumer choice

Based on the above features of behavior we suggest the following sequential model of the demand for insurance for some perceived loss L':
Stage 1: If $p' \leq p^*$ then an individual will perceive the event as sufficiently small that she will treat it as if "it will not happen to me". In this case $E[V(0)] > E[V(I)]$ where $I > 0$.
Stage 2: If $p' > p^*$ then an individual may be willing to consider purchasing insurance coverage but may decide **not** to do so for several reasons:

- Search costs (S) are too high. In this case discussions with friends or neighbors about the availability of coverage and its price may reduce these costs.
- There are no strong feelings about the item at risk (e.g. loving ones house subject to earthquake damage) and/or about the event itself (e.g. fear of an earthquake).

- The perceived probability of the event (p') and/or the magnitude of damage (L') are sufficiently low relative to the prior estimate of the insurance premium (z').

The well-known failure of people to buy subsidized flood insurance prior to the occurrence of a disaster (Kunreuther et al., 1978) can be ascribed to a combination of all three of these reasons.
Stage 3: If the individual decides to purchase protection she will utilize a value function and choose the amount of coverage which maximizes $E[V(I)]$ given by (3.7), substituting the actual premium (z) for the prior estimate z'.

3.3 Testable hypotheses

The above positive theory yields the following testable hypotheses with respect to consumer demand for insurance protection:

H1: *Individuals are more likely to purchase insurance coverage after an event occurs because it leads to an increase in p'. As the time from the last event increases, then some people will cancel their policies because p' decreases.*

The basis for this hypothesis is the availability heuristic of Tversky and Kahneman (1973) whereby a person's estimate of the probability of an event happening is based on her familiarity with it. A recent event will be salient in a person's mind and therefore leads to an increase in her estimate of p'. Over time the event's salience and familiarity decrease so that p' also falls.

H2: *As more people purchase insurance, a person will be more likely to buy it.*

The basis for this hypothesis is the greater chance that one will learn about coverage from a friend or neighbor who has purchased a policy. In other words, the more people who have coverage, the lower the expected search cost associated with getting information on the availability, pricing and terms of an insurance policy.

H3: *The more affection an individual has for an item and/or the greater the fear of the event causing damage, the more likely he will insure it at existing premiums.*

The basis for this hypothesis is that there are other factors such as consolation and peace of mind that lead individuals to want to buy insurance independent of the likelihood and dollar losses associated with the insured event.

4

Anomalies on the Demand Side

This section indicates anomalies on the demand (D) side based on the positive model of choice and provides an explanation as to why they occur.

4.1 Anomaly 1D: Preference for low deductibles

Description of Anomaly: When thinking about their insurance contracts, individuals often like to have low deductibles. The lower the deductible, the higher the chance the insurance company will pay something back in exchange for their premium contribution.

Individuals behave as though a low-deductible contract is more attractive than a high-deductible policy. In fact, the higher premium associated with the lower deductible reflects a higher loading cost than for high-deductible policies due to the administrative expenses associated with processing claims. People thus overpay to provide protection against losses that are quite small relative to their wealth that they could easily cover with out of pocket payments.

Cutler and Zeckhauser (2004) examined decisions with respect to auto insurance (in Boston and Miami) and homeowner's insurance (in Philadelphia and Orlando). They found that 60 to 90% of the

individuals in each of these cities selected a USD 500 deductible. In a study of deductible choices by 50,000 homeowners using a data set provided by an insurance company, Sydnor (2006) found that 83% of customers chose a deductible lower than the maximum available one. A prototypical homeowner paid USD 100 to reduce the deductible from USD 1000 to USD 500. With claim rates under 5% the expected benefit from the additional coverage was worth less than USD 25 (Sydnor, 2006). These policyholders could have saved from USD 91 to USD 264 on the annual premium by choosing a USD 1000 deductible instead. The maximum benefit from choosing the lower deductible rather than the higher one is USD 500. The probability that an individual has an automobile accident in a given year in the United States is only about 5%. Hence if the loss from an automobile accident were USD 1000 or more, the expected benefit from the lower deductible for auto insurance would be USD 25. (The probability of having an accident where the damages fall between USD 500 and USD 1000 results in an expected benefit of less than USD 25.) In effect, by choosing a lower deductible, people pay higher premiums for coverage worth in financial terms much less than the higher premium for this additional coverage. Similarly, the probability of any claim on a homeowner's policy in any given year is only about 7%, so the average benefit from taking the lower homeowner's insurance deductible is at most USD 35. Yet deductibles taken for this coverage are also often quite low with additional premiums well in excess of USD 35.

Explanations of Anomaly: It appears that some people view insurance as an investment when they purchase a policy. The best chance that they have of getting some return is to take the smallest deductible. That what they pay greatly exceeds the expected "return" on this investment does not discourage them from seeking such policies.

Another possible explanation is a status quo bias, given the transaction costs associated with changing the terms of coverage. Although it generally makes sense to increase a deductible when inflation is occurring, many people do not get around to making this adjustment and maintain the deductible that they chose when first buying their policy. Some homeowners' insurance policies are trying to deal with this phenomenon by making the deductible a percentage of the coverage

(e.g. 10%) rather than a dollar amount (e.g. USD 500). This feature will automatically raise the deductible amount when the policy limits increase to reflect the higher value of one's house. One question that has not been investigated empirically is what proportion of homeowners would favor a percentage deductible rather than a fixed dollar amount if given the choice? For those who favor a dollar amount, how many would increase the deductible as the value of their home increases?

4.2 Anomaly 2D: Unwillingness to make small claims above their deductible

Description of Anomaly: After purchasing a policy people are sometimes unwilling to make small claims above their deductible level (Braun et al., 2006). Thus if damage to one's car is $800 and a person has a $500 deductible she will not make a claim for $300. She is behaving as if the deductible on her insurance policy was $800 or higher.

One reason for having this higher *pseudodeductible* is a fear that one's insurance premium will increase as a result of filing a claim. This is most pronounced in automobile insurance where, unless the car is totaled or sustains major damage, many insured individuals will incur the costs above the deductible with their own funds. Such behavior seems to occur even when next year's premium is not expected to increase or not increase by as much as the claim itself.

Explanation of Anomaly: This behavior appears to reflect the separation of the decision as to what type of coverage to purchase from the decision on how much to collect after suffering a loss. Some people do not consider the time dimension and portfolio nature of their decisions – what they do today has an impact on their expenditures tomorrow. Data from a large personal lines insurance company on decisions with respect to collecting claims on homeowners' policies supports this hypothesis (Braun et al., 2006). Of course, some consumers may explicitly inquire from their agent or insurance company the extent to which future premiums depends on claims experience. They are likely to find out that auto insurance premiums are experience-rated so that past claims do play a role in determining what insurers will charge the policyholder in the future and whether the insurance will be renewed.

There is an alternative explanation for this behavior but one which does not represent informed behavior. Suppose as an insured person I believe that my insurer's experience rating rule is to bump up all premiums based in part on *any* claim, not just on the amount of the claim, or to cancel coverage if there are many claims, even if they are all small. Then if my deductible is USD 500 and my claim is USD 600, I won't file if I think my lifetime discounted premium stream may rise by more than USD 100. Yet I may prefer a USD 500 deductible to a USD 1000 deductible if I would rather suffer a smaller loss should I total the car and decide to make a claim. Of course, one may wonder why people buy insurance from insurers who they think will punish them for making claims. Moreover, to the extent that people do not file claims, that makes the premium lowering effects of deductibles larger, and therefore makes policies with deductibles more attractive.

4.3 Anomaly 3D: Preferences for policies with rebates when a no rebate policy is more financially attractive

Description of Anomaly: There is experimental evidence that individuals prefer policies with rebates even if the expected value of the policy is lower than one where there is no rebate.

Consider the following two comprehensive and collision automobile insurance policies: Policy 1 has a USD 600 deductible and costs USD 1000. Policy 2 has no deductible and will give you a rebate of USD 600 at the end of the year minus the amount the company paid for your claims during the year. If claims exceed USD 600 then there is **no** rebate. Policy 2 costs USD 1600. It should be clear that Policy 1 is always more attractive than Policy 2 due to the time value of money. Under policy 2, the buyer in effect makes a loan of USD 600 to the insurance company at the beginning of the year, which is repaid without interest at the end of the year or when a claim is made. Yet when 187 subjects at the University of Pennsylvania were asked whether they would purchase Policy 1, only 44% said "Yes". When the same individuals were asked whether they would purchase Policy 2, 68% said "Yes" (Johnson et al., 1993).

Explanation of Anomaly: The apparent attractiveness of rebates can be explained by the value function in prospect theory. If individuals are

loss averse they will view the deductible as very unattractive to them since they are responsible for the first portion of their losses – the portion on the steepest part of the value function in the loss domain. On the other hand, if the premium is increased this will not have as large a negative impact as the positive gain associated with a rebate at the end of the period.

4.4 Anomaly 4D: Limited interest in catastrophic coverage (e.g. major medical, floods)

Description of Anomaly: When it comes to protecting oneself against events that may have a major financial impact, but a low probability of occurrence, individuals often do not take out insurance. They behave as if these events "will not happen to me."

Explanation of Anomaly: This behavior implies some type of threshold model of choice, where if $p' \leq p^*$ then one assumes $p' = 0$. One way of explaining this tendency to disregard such events is by focusing on the limited time and attention for processing information and making choices. Events that have a small chance of happening are ones that are likely to be disregarded. In addition, if people prefer not to think about negative events or ones that they fear, then they will have even more reason *not* to want to open up some Pandora's boxes of horrors. An alternative explanation is that individuals do not want to incur the search costs associated with getting information about the event (i.e. risk information) as well as the costs and types of coverage available.

A third explanation is that many people at risk assume someone else will pay for the costs associated with a sufficiently adverse event, as evidenced by the disaster relief provided by the federal government after Hurricane Katrina to uninsured disaster victims for losses they suffered. On August 29 in response to Governor Kathleen Blanco's request, the President declared a "major disaster", allotting more federal funds to aid in rescue and recovery. By September 8, Congress had already approved USD 52 billion in aid to victims of Hurricane Katrina (Kunreuther, 2006b). Federal disaster assistance may create a type of Samaritan's dilemma: providing assistance *ex post* (after hardship) reduces parties' incentives to manage risk or obtain insurance *ex ante* (before

hardship occurs). However, the governmental payments (in this case and in all others) are not guaranteed to be forthcoming, and are definitely not guaranteed to fully cover each person's loss. So there is still some residual risk, and still some demand for mitigation and insurance.

The empirical evidence on the role of disaster relief suggests that individuals or communities have **not** based their protective decisions on the expectation of future disaster relief. Kunreuther et al. (1978) found that most homeowners in earthquake and hurricane prone areas did not expect to receive aid from the federal government following a disaster. Burby et al. (1991) found that local governments that received disaster relief undertook more efforts to reduce losses from future disasters than those that did not. This behavior seems counter-intuitive and the reasons for it are not fully understood. It will be interesting to see whether Hurricane Katrina changes this view given the highly publicized commitment by the Bush administration to provide billions of dollars in disaster relief to victims. Whether or not individuals incorporate an expectation of disaster assistance in their pre-disaster planning process, a driving force with respect to the actual provision of government relief is the occurrence of disasters where the losses are large (Moss, 2002).

4.5 Anomaly 5D: Influence of emotions on insurance purchase and claim decisions

Description of Anomaly: People appear willing to put considerably more time into making an insurance claim for a stolen or damaged object (e.g. a painting) that is treasured, than for an identical object that is not special. Some people seem to want to purchase insurance to deal with their peace of mind and anxiety.

Explanation of Anomaly: This behavior implies that one may view an insurance payment as some form of consolation for the loss and that the utility of the payment increases with affection for the object. When individuals say they purchase insurance *for peace of mind*, the rationale would appear to be relieving anxiety about the impact of the loss on their well being, rather than focusing on the risk of a loss and the need for financial protection.

4.6 Anomaly 6D: Purchase of insurance is more likely to occur after a disaster rather than prior to its occurrence

Description of Anomaly: Individuals are often more interested in buying earthquake insurance coverage after a disaster occurs rather than prior to the event. This is true even though premiums are usually higher afterwards and people generally indicate that the probability is now lower than before the event. Perhaps they had heard that the quake had relieved some of the tectonic stress, or perhaps they make the common mistake in believing that events have a high probability when they are "due" but a lower probability afterwards. Similar behavior has been observed after floods and hurricanes.

Explanation of Anomaly: There are at least two alternative explanations for this behavior. The event may now be more salient in people's minds due to the availability bias and/or there is more concern by individuals about the event and a desire to invest in protection. This latter form of behavior is consistent with field studies in communities in California affected by the 1989 Loma Prieta earthquake where Palm (1995) found that "worry that an earthquake will destroy my house or cause major damage in the future" was the most important determinant in a homeowner's decision to purchase earthquake insurance.

4.7 Anomaly 7D: Purchase of flight insurance even though life insurance is a better deal

Description of Anomaly: Some individuals who are planning to fly may purchase flight insurance even though its price relative to expected benefits is higher than for the comparable amount of term life insurance (Eisner and Strotz, 1961).

This anomaly illustrates a broader phenomenon indicating that insurance against "named events" is sometimes more attractive than general insurance. In a controlled experiments a group consisting mostly of university-hospital employees received one of three versions of a questionnaire related to purchasing a flight insurance policy. One third of the respondents were asked how much they would pay for $100,000 worth of life insurance in case of death from a plane crash

due to *any reason*. Another group was asked how much they would pay for the same amount of insurance if death was due to any *act of terrorism* and a third group was asked how much they would pay if they were covered from death due to *any non-terrorism related mechanical failure*. The mean premiums paid by the second and third groups were $14.12 and $10.31 respectively while those who were covered for any reason had a mean premium of $12.03. In other words, the sum of the premiums for the two named events was more than twice the amount subjects were willing to pay for any type of plane crash (Johnson et al., 1993).

The vast majority of air travelers do not buy flight insurance. However, there must be enough buyers to make setting up booths worthwhile. (However, flight insurance at Philadelphia International Airport is sold only at foreign exchange booths [a common setting for bad deals relative to exchange rates in banks], and does not warrant a separate stand.)

Explanation of Anomaly: There appear to be several reasons for this behavior which cannot be explained by a benchmark model of choice;

The presence of flight insurance counters at the airport makes the event of flying more salient than otherwise and reduces the transaction costs of purchasing a policy. There may also be a heightened concern for providing financial security for loved ones at the time one flies and flight insurance offers an opportunity to take specific action to relieve this anxiety. By buying life insurance in advance of the trip one would have a difficult time linking the event "plane crash" with insurance.

Paying a dollar premium leads individuals to focus on the coverage amounts of an insurance policy should the plane crash rather than on the probability of such an event. The high ratio of coverage level to premium (e.g. USD 500,000 in coverage for USD 50) makes this insurance appear attractive, even though this ratio implies that the probability of a plane crash that would make this coverage actuarially fair is 1/10,000 – a much higher probability than the statistical data on plane crashes indicate.[1]

[1] More detailed information on flight insurance can be found at: http://www.travelguard.com/agentlink/PCODE/InitializeProducts.asp?rnd=15635176327101457&

4.8 Anomaly 8D: Insurance purchase because of social norms

Description of Anomaly: Individuals may buy insurance because they know others who have purchased a policy. They do not obtain detailed information in their conversations with friends or neighbors on the cost of coverage or the risk associated with the specific event. If the friends are well informed, this is rational behavior but, in fact, their friends may know very little about these figures. This implies that one reason for purchasing insurance is that other people are doing so.

Explanation of Anomaly: One rational reason that people may want to buy insurance such as flood coverage if they learn that others are buying it is the fear that there will be few uninsured disaster victims. If they are one of the imprudent uninsured, they may fear that no financial relief will be forthcoming. Individuals may also think (correctly or incorrectly) that their friends have similar preferences to them and have already gone to the trouble of gathering information – so it makes sense to copy them. In this sense friends and neighbors reduce the search costs of obtaining information on the risk and the policy terms. There may also be a sense of embarrassment that one does not have protection when one learns that others do.

4.9 Anomaly 9D: Framing a problem in terms of insurance rather than a loss increases demand for coverage

Description of Anomaly: If one asks an individual whether she would pay USD 140 to protect herself against an event with probability $p = 1/100$ and $L =$ USD 10,000, many people will say "no". On the other hand, if one frames the same problem as purchasing an insurance policy which costs USD 140, a much higher percentage of people will say "yes".

Explanation of Anomaly: The word "purchasing insurance" has a positive ring, implying an investment that offers protection. If one is

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agentlinkasp=yes&timeid=1457**1457&strAgentLinkasp=yes&loggedin=68328&ta_acr=68328&status=5&pcode=FGDummy=D&dbCountry!D=1&dbSateID=39. Dated August 10, 2005. (February 14, 2006).

told that he is "paying USD 140 for protection", this suggests a cost which has a negative connotation (Hershey and Schoemaker, 1980).

4.10 Anomaly 10D: Cancellation of flood insurance if one hasn't collected on one's policy over time

Description of Anomaly: Homeowners who have purchased flood insurance and not collected on their policy after a few years will not renew their policy (Kunreuther et al., 1985). This finding is particularly striking since the National Flood Insurance Program requires that homes located in Special Flood Hazard Areas purchase insurance as a condition for federally-backed mortgages.

To determine the extent of this behavior, the Federal Emergency Management Agency (FEMA) examined applications for disaster assistance from 1549 victims of a flood in August 1998 in Northern Vermont and found that 84% in special flood hazard areas did not have insurance, 45% of whom were required to purchase it. A study by Geotrac revealed that more than one-third of the properties damaged in a 1999 flood in Grand Forks, North Dakota were non-compliant with the mandatory insurance purchase requirement (Tobin and Calfee, 2005).[2]

Explanation of Anomaly: This behavior is consistent with people's view that insurance should be treated as an investment. If they have not collected on their policy they feel that the premiums paid over the past few years have been wasted and cancel their policy. A simple explanation is that avoiding financial anxiety and justifying their actions to themselves and others are both important attributes in their value function. Some individuals may not be able to justify continuing to pay for insurance if they are not concerned with the consequences of a future flood. Finally some individuals may treat a string of flood-free years as evidence that the probability of a future flood in their area is now lower than immediately after a flood occurred.

[2] With the passage of the 1994 National Flood Insurance Reform Act lenders who fail to enforce the flood insurance requirement can be fined up to USD 350. Prior to that time no penalties were imposed.

5

A Positive Theory of Supply

The benchmark model of supply postulates an ideal world where competitive insurance firms have perfect information on the risks they are insuring against and that they can costlessly change their premiums to reflect changes in either the probability and/or consequences from events for which they are providing coverage. Furthermore insurance firms are assumed to have access to the capital markets for any needed funds should they suffer a large loss that exceeds their net worth.

For these reasons firms are assumed to be risk neutral and choose actions that maximize their expected profits. Under this model firms should also be willing to supply unlimited amounts of insurance to those at risk, charging premiums that are just high enough to cover their expected claims plus their administrative costs. Actual behavior of firms may differ from this ideal world for several reasons:

- Firms may not have perfect information on the pool of individuals seeking insurance. To the extent that those demanding coverage have better information on their risks than those providing insurance, there will be *asymmetric information*

between buyers and sellers. This can create problems of *adverse selection*, as will be discussed below, in which insurers are unwilling to supply unlimited amounts of coverage and are unable to tailor premiums that reflect each individual's risk level.

- Once coverage is sold to individuals, the insurers may not be in a position to monitor and control behavior. To the extent that insured individuals behave in a way that increases the chances of a loss occurring and the insurer is not aware of these actions, then the insurer faces a problem of *moral hazard.*
- Insurers may not have easy access to additional capital should they suffer catastrophic losses and therefore may not try to maximize expected profits. If there is asymmetry of information between outside investors who provide capital and inside managers who control its use, then Greenwald and Stiglitz (1990) show that managers who are rewarded with a share of the profits but suffer a large penalty in case the firm suffers insolvency will behave as if they are risk averse. For example, suppose an insurance underwriter is concerned with his future employment opportunities should his firm be declared insolvent. He may then limit the amount of coverage for a particular risk or charge higher premiums than otherwise if he perceives the risks in his portfolio to be highly correlated.

We now examine how these three features affect decision-making within the firm. Insurance firms have two decisions to make with respect to providing protection against a specific risk: the premium they should set and the extent of coverage they should offer to those demanding insurance. We still assume that firms are operating in a purely competitive environment and want to maximize expected profits. Now, however, they may be forced to raise their premiums above the value of z^* given in equation (2.2) due to problems of information asymmetry and concerns with the costs of insolvency.

5.1 Adverse selection

Suppose there are two risk types, good and bad, and the insurer cannot distinguish between them. If the insurer sets a premium based on the average probability of a loss, using the entire population as a basis for this estimate, only the poor risk types are likely to buy coverage and the insurer will lose money on each policy sold. This situation is referred to as *adverse selection*.[1]

The assumption underlying adverse selection is that purchasers of insurance have an informational advantage by knowing their *risk type*. Insurers, on the other hand, must invest considerable expense to collect information to distinguish between risks. To illustrate, suppose some homes have a low probability of suffering damage, (the good risks), and others have a higher probability (the poor risks). The good risks stand a 1 in 10 probability of loss and the poor risks, a 3 in 10 probability. For simplicity, assume that the loss is USD 100 for both groups and that there are an equal number of potentially insurable individuals in each risk class. Since there is an equal number in both risk classes, the expected loss for a random individual in the population is USD 20.

If the insurer charges an actuarially fair premium across the entire population, only the poor-risk class would normally purchase coverage, since their expected loss is USD 30 ($0.3 \times$ USD 100), and they would be pleased to pay only USD 20 for the insurance. The good risks have an expected loss of USD 10 ($0.1 \times$ USD 100), so they would have to be extremely risk averse to be interested in paying USD 20 for coverage. If only the poor risks purchase coverage, the insurer will suffer an expected loss of $-$USD 10, (i.e. USD 20 $-$ USD 30), on every policy it sells, due to an inability to distinguish good from bad risks. The good risks will end up without insurance.

5.2 Moral hazard

Suppose an insured individual behaves in a manner which increases the expected loss from what it was prior to the purchase of insurance

[1] For more detailed discussion of adverse selection see Rothschild and Stiglitz (1976).

(Pauly, 1968; Zeckhauser, 1970; Pauly, 1983). Furthermore suppose that the insurer cannot determine that the policyholder has changed his behavior in this way. When there is this type of asymmetric information between buyer and seller, one has the condition known as *moral hazard*.

There are good reasons for the presence of moral hazard. Moral hazard might increase the probability of the loss, because the insured individual has less incentive to take the same amount of care as when she was uninsured, knowing that if there is an accident or disaster, she has protection. The insurer may not be able to detect these types of behavior. It is costly and often extremely difficult to monitor and control a person's actions and determine whether she is behaving differently after purchasing insurance. Similarly it may not be possible without extensive auditing to determine if a person decides to collect more on a policy than he or she deserves by making false claims.

The numerical example used to illustrate adverse selection can also demonstrate moral hazard. Suppose there were only good risks who face a probability of $p = 0.1$ before they purchase insurance coverage and behave more carelessly after they have bought protection so the probability rises to $p = 0.3$. If the insurance company does not know that moral hazard exists, it will sell policies at a price of USD 10 to reflect the estimated actuarial loss ($0.1 \times$ USD 100). The actual loss will be USD 30 since p increases to 0.3. Therefore, the firm will lose USD 20 on each policy it sells. In the next period it will probably raise its premium to account for the higher claims – so people will eventually have to pay for the results of their carelessness. But there is no reason for any single individual to behave more carefully, since the insurer will (by assumption) not be able to tell and so the premium will remain high for all policyholders.

There is another kind of moral hazard that occurs when the insured can change the amount of loss conditional on occurrence of the loss producing event. The most common example of this is health insurance. Even if I cannot change the probability that I get a cold, I may be more likely to visit a doctor and seek a prescription if I have insurance than if I do not.

The anomaly in these cases is not the existence of moral hazard, since that reflects rational behavior in response to incentives. The anomaly is the reluctance of some people to buy insurance that

contains provisions intended to limit or restrict the extent of moral hazard. In the case of health insurance, for example, either moderately high patient cost-sharing or managed care can control moral hazard, and yet many consumers (and public policymakers) regard either kind of insurance as undesirable. They continue to choose generous coverage, and continue to express surprise when costs and premiums turn out to be high, failing to see the connection between the coverage and the costs.

5.3 Deviations from expected profit maximization

Suppose the management of an insurance firm is risk averse and there are costs to them associated with bankruptcy. Then they will want the firm to charge higher premiums than implied by the expected losses due to the possibility of catastrophes, even when their shareholders can costlessly eliminate this risk through their own portfolio diversification. In other words, higher premiums will be charged on the basis of portfolio risk not individual policy risk.[2]

Rather than maximizing expected profits, insurers are also likely to be ambiguity averse in that they are concerned with the uncertainty regarding the probability of a loss occurring. Actuaries and underwriters both utilize heuristics that reflect these concerns. Consider the case of estimating the premium for wind damage to homes in New Orleans from future hurricanes. Actuaries first use their best estimates of the likelihood of hurricanes of different intensities to determine an expected annual loss to the property and contents of a particular residence. They then increase this figure to reflect the amount of perceived ambiguity in the probability and/or the uncertainty in the loss.

Underwriters utilize the actuary's recommended premium as a reference point and then focus first on the impact of a major disaster on the probability of insolvency or some prespecified loss of surplus to determine an appropriate premium to charge. In some states there is a premium on file with the state insurance department that guides their actions. Underwriters then consider the impact that marketing

[2] These arguments also may explain the demand for reinsurance by property/liability companies (Mayers and Smith, 1990). Doherty and Tinic (1982) have argued that demand for reinsurance is generated by insurers anticipating policyholders' aversion to bankruptcy.

coverage at different feasible premium levels will have on the number of policies sold and the firm's expected profits (Kunreuther, 1989).

Roy (1952) first proposed a safety-first model to characterize this type of firm behavior. In the context of insurance, such a model explicitly concerns itself with insolvency when determining the maximum amount of coverage the insurer should offer and the premiums to charge. Stone (1973) formalized these concepts by suggesting that an underwriter who wants to determine the conditions for a specific risk to be insurable will first focus on keeping the probability of insolvency below some threshold level (q^*).

A safety-first model explicitly concerns itself with insolvency when determining the maximum amount of coverage the insurer should offer and the premiums to charge. In contrast, an expected utility maximization model recognizes that firms are risk averse, so that premiums will have to be higher to reflect the chances of a catastrophic loss. It does **not** explicitly focus on keeping the probability of insolvency below some prespecified level. Risks with more uncertain losses or greater ambiguity regarding the probability of occurrence will cause underwriters to want to charge higher premiums for a given portfolio of risks. The situation will be most pronounced for highly correlated losses, such as earthquake policies sold in one region of California.

Let Y be a random variable representing the total loss from the insurer's current portfolio of risks and A = the insurer's total assets. If the underwriter is considering whether to provide coverage for a risk in which the firm expects to sell m policies, each of which can create a loss L, then a safety first model implies that the underwriter will recommend a premium z^* so that:

$$\sum_{j=1}^{m} \Big\{ \text{Probability}[(Y + jL) > (A + mz^*)] \Big\} < q^*, \tag{5.1}$$

where q^* is a preassigned probability that reflects the threshold insolvency probability that the firm is willing to tolerate. As m decreases and/or the correlation between losses decreases, the insurer will require a lower premium z^* to satisfy (5.1). We will label equation (5.1) as the insurer's *survivability constraint.*

The empirical evidence based on surveys of underwriters supports the hypothesis that insurers will set higher premiums when faced with ambiguous probabilities and uncertain losses rather than a well-specified risk. A questionnaire was mailed to underwriters of primary insurance companies and reinsurance firms asking them to specify the prices which they would charge to insure a factory against property damage from a severe earthquake under the following four different cases: Case 1: well-specified probabilities (p) and known losses (L); Case 2: ambiguous probabilities (Ap) and known losses (L); Case 3: well-specified probabilities (p) and uncertain losses (UL) and Case 4: ambiguous probabilities (Ap) and uncertain losses (UL). For the non-ambiguous case, the probability of the earthquake (p) was set at either 0.01 or 0.001 and the loss should the event occur (L) was specified at either USD 1 million or USD 10 million (Kunreuther et al., 1995).

Table 5.1 shows the ratio of the other three cases relative to the non-ambiguous case (p, L) for the four different scenarios, which were distributed, randomly to underwriters in primary insurance companies. For the highly ambiguous case ($Ap,\ UL$), the premiums were between 1.43 to 1.77 times higher than if underwriters priced a non-ambiguous risk. The ratios for the other two cases were always above 1, but less than the ($Ap,\ UL$) case.

A complementary strategy that insurers can follow to deal with their survivability constraint is to restrict the number of policies they offer. They can do this by raising the premium (z) so that demand for coverage is decreased and/or not offering insurance to certain potential customers. Terrorism risk provides an example of how insurers followed this strategy. Terrorism is a case where the likelihood of an attack is extremely ambiguous since there are limited historical and scientific data on terrorism and the actions taken by terrorists may change depending upon what protective measures are taken by those at risk. In the context of Roy's safety first model, insurers utilize deterministic scenarios to determine how much coverage they are willing to offer. In particular, they are concerned with not having more than some aggregate exposure (AE) from a terrorist attack relative to their policyholders' surplus (SU). Specifying a maximum AE/SU ratio based on a scenario, such as a 5-ton truck bomb exploding in a metropolitan

Table 5.1 Ratios of Underwriters' Premiums for Ambiguous or Uncertain Earthquake Risks Relative to Well-Specified Risks (p = probability and L = loss)

SCENARIO	CASES				
	1	2	3	4	
	Well specified p Certain L	Ambiguous p Certain L	Well specified p Uncertain L	Ambiguous p Uncertain L	N
$p = 0.005$ $L =$ USD 1 million	1	1.28	1.19	1.77	17
$p = 0.005$ $L =$ USD 10 million	1	1.31	1.29	1.59	8
$p = 0.01$ $L =$ USD 1 million	1	1.19	1.21	1.50	23
$p = 0.01$ $L =$ USD 10 million	1	1.38	1.15	1.43	6

Ratios are based on mean premiums across number of respondents for each scenario.
N = number of respondents
Source: Kunreuther et al. (1995)

area, suggests that insurers are concerned with their survivability constraint and only consider the likelihood of an attack in a very indirect way when making their decisions on how much terrorism coverage to offer (Wharton Risk Center, 2005).

While many insurers fear going bankrupt, they do not all take such precautions to prevent it from happening. Indeed, as with anything else, there is an optimal risk of bankruptcy in the fully rational model which involves trading the costs of avoiding bankruptcy against the cost of bankruptcy itself, and some reason to believe that solvency regulation may err on the side of excessive caution (Smallwood and Munch, 1980). Born (2001) provides a more recent discussion as to why some insurers do not put safety first, why they make such choices, and what the consequences are.

6

Anomalies on the Supply Side

This section indicates the type of anomalies that exist on the supply (S) side and why they occur. We consider four possible reasons for deviation from benchmark supply behavior: (1) regulation prevents the emergence of a market outcome; the anomaly is only "apparent"; (2) inability of firm owners to control behavior by managers leads to deviations in firm behavior from the benchmark outcome; (3) the decision processes and heuristics used by suppliers do indeed diverge from the behavior postulated in the benchmark model; (4) the deviations in supply behavior from the benchmark model are actually attributable to demand-side factors. We now consider some supply anomalies that have been identified in the literature:

6.1 Anomaly 1S: Insurers overweight recent losses in setting future rates

Description of Anomaly: Even if a Bayesian updating procedure is used to set rates, recent disasters have had an unexplainably large impact on rates. After Hurricane Andrew insurers lobbied and received higher rates, even though there was no scientific evidence that this disaster

was more severe than scientists expected it to be or that its occurrence meant that such disasters were more likely in the future.

Explanation of Anomaly: This may be partially explained by the system of state rate regulation and the need for insurers to use specific events to lobby for a rate increase. In the case of Florida there is evidence that rates in high-risk areas of the state are highly subsidized by other parts of the state (Grace et al., 2003). Hence there would be good reason to use a recent disaster to show the need for a rate increase particularly if losses from the event were severe. In this case, the anomaly appears to be caused in part by the requirements of regulation, reflecting, in a sense, the overweighting of recent events in decision-making by government regulators. A comparison of supply behavior in more or less strictly regulated states might help to distinguish the two alternative hypotheses.

6.2 Anomaly 2S: Market success of individual health insurance with guaranteed renewability

Description of Anomaly: Economic theory strongly suggests that efficiency would be improved if people could buy insurance that would protect them against future premium increases in the event of a costly chronic illness. Even before regulations changed, more than 80% of the individual insurance policies sold in the US carried guaranteed renewability protection, in which the insurer guaranteed not to raise any individual's premium selectively, and to raise premiums for any one buyer only if premiums were raised for all buyers in the same (initial) underwriting class. Yet theory strongly suggests that those who remain low risks should defect, making such a policy impossible to sustain.

Explanations of Anomaly: One obvious explanation of the stability of guaranteed renewability is that the gain to a low risk individual from dropping out and finding a new policy at a slightly better premium is too small to make the effort. This is to be contrasted with the case of small group insurance, in which lower transactions costs do appear to cause lower risk groups to drop out of guaranteed renewability insurance programs, so that this feature does not emerge (Harrington and Niehaus, 1999).

In the individual case, the willingness of insurers to supply insurance and achieve an equilibrium in a situation in which the literature suggests that they should be unable to do so may also arise from transactions or decision-making costs on the part of demanders. The same type of inertia and inattention that sometimes results in failure of insurance markets to emerge, as noted in the demand section, may sometimes preserve them as well. That is, strict attention to advantageous insurance purchasing by low risks could lead to serious adverse selection and even a death spiral. But if the low risk buyers are slow to react to premiums that rise above their expected benefits, the market may remain.

Further analysis shows that it is not necessary to invoke such transactions costs to generate a stable path of premiums under guaranteed renewability. It turns out that there is a path of premiums which make it rational for both high *and* low risks to continue purchasing coverage; this "incentive compatible" premium schedule rises modestly as age increases a person's expected expense, and appears to be both efficient and financially feasible under plausible assumptions (Herring and Pauly, 2006). The intuition is that in every period both high and low risks are willing to pay what is in essence a two-part premium, one part for coverage of a low risk's expected expense in that period, and the other part paying for the expected lifetime discounted additional premiums for people who become high risks. Thus, since the premium in each period is attractive to low risks (and therefore necessarily also attractive to high risks), no one drops out, and the guaranteed renewable insurance continues to be purchased. Approximately 80% of individual health insurance in the United States contained this feature even when it was not required by law, and the pattern of premiums people pay for individual insurance follows the "front loading" consistent with guaranteed renewability (Pauly and Herring, 1999; Herring and Pauly, 2006).

6.3 Anomaly 3S: Limited impact of financial instruments in securitizing insurance risk

Description of Anomaly: Catastrophe bonds, the payouts of which are tied to the occurrence of natural disasters, offer insurers and corporate

entities the ability to hedge events that could otherwise impair their operations to the point of insolvency. At the same time, they offer investors a unique opportunity to enhance their portfolios with an asset that provides a high yielding return that is uncorrelated with the market. Despite the attractive nature of these investments, spreads in this market remain considerably higher than the spreads for comparable speculative grade debt. Furthermore there have been fewer bonds issued than had been anticipated by the investment bankers.

Explanation of Anomaly: The high spreads are not just a consequence of investor unfamiliarity with a new asset but instead signal some deeper issues that need to be resolved before the cat bond market can fully develop. It appears that ambiguity aversion, myopic loss aversion, and fixed costs of education can account for the reluctance of institutional investors to enter this market. Worry as to the impact of a catastrophic loss on the performance of the cat bonds may be an additional factor to consider (Bantwal and Kunreuther, 2000). Here there does appear to be a true divergence of behavior from that postulated by the benchmark model.

6.4 Anomaly 4S: Reinsurance prices decline as time between last major disaster increases

Description of Anomaly: It appears that reinsurance is priced in part on the basis of the amount of capital that the reinsurers have available. When they have excess capacity they are interested in lowering the price of reinsurance.

Explanation of Anomaly: This may have a behavioral explanation (e.g. overweighting most recent observations in estimating probabilities), or a rational one (e.g. capital constraints become less binding after years without a loss). The requirement that reinsurers produce recent data to justify reserves might be part of the explanation. Even when the managers of the reinsurance firm might feel comfortable charging a lower price, they may need data to convince capital suppliers that the price is reasonable. However, there may also be deviations from expected utility maximizing behavior on the parts of insurers or

suppliers of capital as they judge probability or riskiness based on the salience or timing of loss producing events.

6.5 Anomaly 5S: Insurers do not provide premium discounts when individuals adopt loss protective measures in disaster-prone areas

Description of Anomaly: Insurers often do not encourage property owners to adopt loss prevention measures by offering premium discounts to those who invest in mitigation even though these measures will reduce their claim payments in the future.

Explanation of Anomaly: For some risks such as wind damage from hurricanes, the reluctance of insurers to reduce premiums for those adopting mitigation measures is due to their being forced by the regulators to charge highly subsidized rates in hazard-prone areas. Hence each firm prefers that the policyholder cancel their insurance rather than continue with the company. For this reason insurers do not provide premium incentives for adopting mitigation measures if they think that a lower premium conditional on mitigation will encourage more people to buy coverage. This apparent anomaly can therefore be traced to regulation.

7

Prescriptive Implications

We now assume that sometimes demanders or insurers will make decisions inconsistent with the benchmark models. If this occurs, what (if anything) should be done about it, and by whom? And can we expect the entity that ought to take corrective action to do so?

We think that corrective actions are politically likely on some occasions, but not on others. The answer to the question as to when corrective action will be taken depends in part on the reason for the inconsistency, and in part on other aspects of the situation. In what follows we sketch some ideas to distinguish the politically likely from the practically impossible.

We begin with some basic categorization of reasons for inconsistency with the benchmark model of choice. A key issue is whether the behavior on the part of consumers or firms arises from information imperfections, real transactions cost, or from deviations of preferences from those postulated in the benchmark case. Our conclusions can be summarized on these three cases as follows:

(1) If the cause of the deviation from benchmark behavior is information imperfections, the solution for the government either is (a) to provide the information or (b) to mandate

or incentivize the action that would have occurred if the agent(s) had been properly informed. Whether doing so will be politically feasible or cost-effective depends on whether citizens are aware that they are imperfectly informed and how expensive it is to communicate this information to them.

(2) If the cause is transactions costs, steps to reduce them in efficient ways should be taken. One should not necessarily assume that information technology or other similar strategies will lower transactions costs enough to cover insurers' own costs, or that the government (as opposed to buyers or sellers of insurance) should pay those costs. However, markets do sometimes take steps to lower costs, even if the steps are small and slow. Probably the best example is automobile insurance, where the less costly "direct writing" method eventually displaced the more expensive (if more attentive) independent agent approach.

(3) If the cause is a preference structure different from that postulated in the benchmark case, the appropriate action depends on the model of government that is assumed. The appropriate role of government will be different if the public sector is given the task of maximizing welfare as defined in welfare economics, compared to giving it a paternalistic role. And the advice will be different still if real world governments are assumed to be prone to making mistakes or responding to distorted incentives.

In the model of a welfare-maximizing government, any of these three anomalies may call for corrective action by the public sector. However, it may be that governments that take these actions will fail to be supported by the electorate. Thus we need to inquire whether efficient corrective actions are politically feasible and, if they are not, what types of actions are possible. That is, the irrationalities in individual behavior may be mirrored in government policies when politicians must answer to voters who have such preferences.[1]

[1] For early examples of this argument, see Viscusi (1998) and Pauly et al. (1984).

We now consider each of the three reasons for inconsistencies with the benchmark model in more detail. We ask what would be an optimal public sector solution and whether, under some simple public choice models, the optimal solution might also be a political equilibrium.

7.1 A benchmark anecdote

Before we deal with these issues in the abstract, it might be helpful to recount a story about anomalous insurance choice in the public and private sectors that can serve as a useful realistic benchmark for our future discussion.

One of the key decisions in any insurance purchasing situation is how much coverage to buy. How high should deductibles and coinsurance be; should insurance be catastrophic or first dollar? With both positive administrative loading costs and moral hazard behavior, it will not be efficient in the EU model to have first dollar coverage (Arrow, 1953; Pauly, 1968). Instead, some portion of any loss needs to be retained by the individual.

This idea motivated economists advising the Clinton Administration's health care team to recommend a plan for the middle class with moderately high deductibles (USD 2000) and coinsurance.[2] The plan was to set a lower bound to the coverage that would be mandated; people could buy more coverage than the minimum mandated amount if they wished. An expert team developed evidence that this scheme (compared to a low deductible, low coinsurance standard policy like that typically offered by Blue Cross plans) could both save on medical care spending and on subsidy cost to the government. However, the standard Blue Cross policy was chosen. Sherry Glied takes up the story:

> The standard benefit team won with a simple argument: fewer than 20% of Americans would actually receive a medical benefit payment under the mandated catastrophic insurance policy in a given year ...

[2] The use of coinsurance, whereby the insured pays a fraction of any loss that occurs, produces an effect similar to a deductible.

> The economists at the meeting were startled ... Non-economists, though, frequently assert that it was a waste of money to buy an insurance policy they never used. To non-economists, health insurance is not entirely about risk; it is also a form of prepayment for services. (Glied, 1997)[3]

Of course, we also know that the standard benefit team's victory was Pyrrhic; the entire Clinton proposal, standard benefit plan and all, went down in a decisive defeat. But we do not know whether it would have been more well-received had it stuck with a catastrophic plan. The non-economist political analysts concluded that voters would not support an insurance plan unless almost everyone collected on their policy. As Glied concludes,

> Whatever the reason that people choose relatively complete and unmonitored insurance, (political experts) cannot ignore this preference.

But if such preferences for irrational behavior are decisive in the political arena, why bother to identify rational behavior? From the perspective of this paper, the reason we are concerned with benchmark models of choice and actual behavior is to understand why there are differences between the two and then determine if it is cost-effective to improve the process. We recognize that even in these situations it may not be politically feasible to take any action.

7.2 Prescriptions for violations of the benchmark model

We now turn to the three reasons why the benchmark model may not characterize actual behavior and suggest prescriptive solutions.

[3] Here is a more up-to-date version: Vice-President Gore to Senator Bradley in the debate leading up to the 2000 democratic nomination, "Bill, here's the problem. More than half of all seniors get nothing from (your drug coverage) plan but have to keep paying. That's just a fact."

7.2.1 Case 1: Information imperfections by buyer and/or seller

Agents in insurance markets are often not perfectly informed, either because obtaining information is costly or because they fail to seek optimal amounts of information. If the agent is a buyer of insurance, he may not have accurate knowledge of the loss probability or the distribution of losses. If the agent is a supplier of insurance, he may be similarly uninformed about the properties of the risky event (even when the buyer is informed). Buyers may not know the distribution of insurance prices in the market, or how to evaluate qualitative dimensions of coverage (e.g. speed of claims payment, ease of billing, strictness of claims review, rules for underwriting and updating premiums).

Poor information by buyers and sellers causes prices to rise above competitive levels, inappropriate amounts of insurance to be purchased, and adverse selection and moral hazard to occur. It is possible in some circumstances that the government may have access to more accurate information or can provide it at lower cost than can private markets. For example, some information about risks may have public good characteristics. That is, the cost of generating an accurate estimate of the probability of the next earthquake for the first buyer of information may be very high, but the cost of making that information available to millions of others could be minimal.

Alternatively, a government that also knew buyers' and sellers' preferences could determine what the optimal behavior should be – who should obtain what insurance, and what premium should be charged for it. The public sector could then use mandates, regulation or public insurance to achieve the optimal solution, thus avoiding the cost of providing information and guaranteeing the efficient outcome. The problem is that such well-informed governments are unlikely to exist.

Suppose we are in the happy circumstance in which government does have good information about all the relevant parameters. Would "ordering the right thing" be politically feasible? The answer is affirmative when citizens know they are ignorant relative to the government, and trust the government to do the right thing.

But does this ever occur? Are people who incorrectly treat low probability events as zero, or so far below their threshold level of concern that even subsidized insurance looks like a bad deal, aware that they are both ignorant and incorrect? Even if the answer is yes, would they trust government experts to decide what is true, and government officials to carry out what is good?

One factor that would affect the likelihood that voters would prefer choice by government experts would be the degree of variation in the socio-economic characteristics of individuals, and especially the degree of variation in their tastes for protection against risk. Collective decisions necessarily tend to be uniform, and therefore will deviate further from the optimum the greater the degree of variation by individuals in the group. In theory, an omniscient government could take account of variation in tastes, allowing the high level of coverage that would be optimal for very risk averse Tom, the moderate deductibles for mildly risk averse Diana, and the risk-loving Harry to take his chances. In reality, such differentiation is unlikely, although we are not aware of a rigorous theory that deals with how close the approximation is likely to be.

There can also be cases in which a majority that wishes to avoid complicated decision-making forces product uniformity on a minority; regulation or mandation of minimum or standard benefits may be politically supported even when it is highly inefficient for some individuals. Finally, government may play a paternalistic role. While such behavior is difficult to justify on theoretical grounds using welfare economics, it may be a desirable strategy to follow given real world considerations. Mandatory motorcycle helmets can be justified if health care costs to those injured are borne by the general taxpayers.

7.2.2 Case 2: Transactions costs

This case differs from the previous one in that all agents know the relevant information but are inhibited from acting on it because of costs of completing transactions. For example, it may be costly to write contracts, to specify and collect premiums, and to pay claims. In this case, voters should support government efforts to reduce these costs as long as the final outcome is one in which the expected benefits from

doing so exceed the government expenditures. This case seems to be the most optimistic one for support of government action.

One way to lower transactions costs would be to "bundle" low probability catastrophes. It should be less costly to sell and administer an all-hazards property insurance policy than to sell separate coverage for damage from fire, flood, wind, meteorite, etc. to the same property. The great bulk of homeowners' policies do in fact take the form of "open peril" or "all-peril" policies that cover damages from all causes except those specifically excluded. The exclusion of flood and earthquakes as perils arose, not from buyer demands to delete these causes, but from insurers' apprehension at covering correlated losses and their concern with being able to accurately price the risk. Were these causes not excluded, insurers might refuse to sell homeowners' coverage at all.[4]

Note that, while many information imperfections can be regarded as transactions costs, there are other expenditures which occur simply because resources are needed to complete contractual arrangements even when all parties have the relevant information. Our point here is that some transactions costs are qualitatively different from search costs or other costs due to information imperfections, and therefore require different kinds of government remedies to the extent such remedies exist.

7.2.3 Case 3: Alternative preferences or perceptions

This is the most difficult case since people who are properly informed still have beliefs or preferences different from the benchmark case (e.g. the "insurance as an investment" or "deductible aversion" mentioned earlier). It is often difficult to distinguish situations in which well-informed agents use decision models other than expected utility maximization from situations in which agents are expected utility maximizers but are imperfectly informed.

If most people have such "incorrect" but durable preferences, it seems useless to advocate government intervention in a democracy. As the anecdote related to medical benefit plans illustrates, the government will be forced to follow the desires of voters. Even if only

[4] See Kunreuther (2006a) for more details on the case for comprehensive disaster insurance.

a minority has such beliefs (e.g. helmetless motorcycle riders), their preferences may govern if the majority is indifferent or if the intense minority can affect the political choice.

There can be some collective actions that can deal with some alternative perceptions. If people differ in their beliefs about loss probabilities, a mutual insurance type of arrangement (public or private) may help (Pauly et al., 1984). If everyone in a number of communities in different flood plains disagree about the probability of a catastrophic flood, but agree that the probability is the same for all, everyone could gain by agreeing that they will (literally and figuratively) bail each other out should a flood strike some and not others. Of course, if each agent believes his area to be safer than the others, this will not work.

8

Conclusion

It is clear that there are many plausible circumstances in which individual choices and market outcomes appear to differ from those consistent with the standard theory of choice under uncertainty. While there are some insurance markets that do appear to be characterized by rational behavior by buyers and sellers, there are others where both appear to be behaving in different ways, or in which at least a sizeable minority do so. It is also clear that the ability of real world governments to decide that these anomalies are due to decision processes that ought to be corrected is limited.

Decisions that are complicated, decisions where emotion is present, decisions where data are lacking or ambiguous, decisions where buyers or sellers are poorly informed, and decisions about rare but high cost and highly correlated loss-producing events all seem to lead to anomalous behavior. The strongest thread linking these anomalies is perhaps associated with the mirror image: insurance associated with independent events that are important and easy to understand, where data on loss probabilities and losses are crisp and clear, seem to be free of anomalous behavior. Insurance markets for coverage of events that do not have these characteristics appear to work much less well.

There may be things the public sector, in principle, could do to help. But in a democratic collective decision process where the voters are the same misinformed persons as those consumers or insurance suppliers whose behavior is a target for alteration, the likelihood of change may be limited. Nevertheless, research directed at identifying anomalies through empirical observation and then pinpointing the reasons for this "irrationality" offers the greatest potential for improvement. Such research might pinpoint in advance those markets where problems are likely to arise, opening the possibility of initiating the discussion and education processes that might lead to better decisions. Perfection is not to be expected here, but improvement is always to be hoped for.

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