Brokers and the Insurance of Non-Verifiable Losses

NEIL A. DOHERTY
ALEXANDER MUERMANN

Consider how the insurance industry responded to the events of September 11, 2001. It is unclear whether many of the losses at the World Trade Center were really covered under insurance policies. While many policies anticipated some level of terrorist activity and this was covered (or not excluded), most policies excluded acts of war. The events of September 11 and after seem to span terrorism and war. Indeed the U.S. president has continued to refer to the post–September 11 environment as a war situation, and the response has engaged the country in actual wars. Despite some ambiguity in whether the September 11 events were covered, leaders in the insurance industry quickly announced that they would not fight these claims. No doubt reputation and patriotism fed into this decision.

Now, compare this anecdote with the following. Several observers have noticed a recent and, supposedly, disturbing trend in insurance markets. Apparently, insurers are now more likely to dispute large claims, to offer less than 100 cents on the dollar, or to try to get away without paying. Richard and Barbara Stewart have labeled this the "loss of certainty effect," and Kenneth Abraham has talked of the "de facto big claims exclusion."[1] One reason for such disputes is that large claims threaten the solvency of the insurer, and such offers may be seen to resemble workouts in which distressed noninsurance firms negotiate with creditors. But the issue here is

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1. Abraham (2002); Stewart and Stewart (2001).

with the willingness, not the ability, to pay. These writers see the "big claims exclusion" as degradation of the insurance market because risk-averse consumers will place a lower value on such uncertain insurance. Indeed, they see a potential downward spiral of the insurance market if this practice continues.

The loss of certainty may be characterized as ex post bargaining over a settlement rather than a straightforward appeal to the policy conditions. Yet such bargaining should not be a surprise when claims are unusual and it is unclear whether they are really covered. For example, it is a matter of real dispute whether many environmental losses (for example, for cleanup of Superfund sites) are really covered and, if so, how the many policies in force over the long gestation period of such losses should contribute. Indeed, losses of this nature and duration were probably not anticipated when the policies were written, and therefore the policy wording is simply unclear.

Incomplete contract theory provides a very different view of these trends. In a world with rapidly evolving technology and shifting sociopolitical institutions, we might expect to be exposed to new types of losses. As with more traditional losses, there may be a comparative advantage in the transfer of such risk from individuals and firms to insurers and reinsurers whose capital and portfolio structure enables them to absorb such unknown losses at lower cost. But the novelty of these losses presents a problem. If the nature of losses cannot be anticipated with any precision (or if the variety of such potential losses is wide), then it may simply be infeasible to write enforceable contracts to share risk. Can we, then, find a way of arranging the affairs of individuals and potential insurers such that there is sharing of risk, despite the absence of enforceable insurance?

Our model works as follows. Many losses can be anticipated, and enforceable insurance policies can be written against these losses. Let us call such losses *verifiable*. Insurers establish a relationship to cover the verifiable losses, and a contract is written. However, the parties supplement this contract by creating a "forfeit," should the relationship break down. The idea of the forfeit is that because the parties both have something to lose, this will encourage bargaining over the *non-verifiable* loss even though it is not formally covered in the policy. This is the familiar "holdup" problem. The nature and size of the forfeit are set in place ex ante such that the conditions for an ex post bargaining allocation of future non-verifiable losses can be anticipated. In this way, a mechanism is set in place to share the non-verifiable losses.[2]

The size of the holdup is an ex ante decision variable and can take two general forms. First, the parties can make relationship-specific investments. For example, the insurer might make an investment in information about its potential policyholder. This information is specific to the particular policyholder, and if the contract breaks down the insurer loses the benefit of this information. This provides an incentive for the insurer to offer a payment on the non-verifiable loss. Another type of relationship-specific investment is in loss control. The insurer might provide safety-engineering services that enable the policyholder to reduce its expected loss. The insurer continues to reap the benefit into the future as long as the policy continues, again giving an incentive to contribute to non-verifiable losses rather than have the contract canceled.

The second form of the holdup resembles a performance bond. The parties may stake their reputations on the continuation of the contract. In insurance, many commercial contracts are brokered. The brokerage industry is highly concentrated, with three brokers—Aon, Marsh McLennan, and Willis—dominating market. This means that information about contracts and performance is not confined to the parties in question but is effectively disseminated in the market. Thus, to preserve its reputation, the insurer is willing to bargain over a non-verifiable loss even though it is not formally covered. Failure by an insurer to make a reasonable offer to settle may lead the broker to question offering new business to that insurer or may lead the broker to make offsetting demands in the price and conditions of future business. We are not limiting this threat to a withdrawal of the policy in question; the broker can bargain with its whole book of business with the insurer. Of course, both parties might hold hostage their reputations and make relationship-specific investments. If only the reputation of the insurer is at stake, the policyholder can blackmail the insurer to pay for trivial or nonexistent losses. However, the optimal reputation investment from the policyholder might well turn out to be zero.

2. The idea of a forfeit is an example of what has been colorfully referred to as the "ugly princess hostage" (Schelling 1960; Williamson 1985). An example noted by Holmstrom and Roberts (1998) is that Northwestern and KLM chose to rely on single support operations, which increases the costs of a holdup and so gives them an incentive to work together more effectively.

The holdup problem is central to the incomplete contracts literature.[3] This has been applied mainly to explain property rights and the boundaries of a firm. The central concepts in this theory are relationship-specific investments and holdup. If owners, *A* and *B*, of different assets plan to engage in joint production and party *A* makes a non-verifiable relationship-specific investment, this investment will only reap a return if the joint production with *B* continues. Because the investment is non-verifiable, the parties cannot write a contract conditional on this investment. This creates a dependency that empowers party *B*, who can now hold up party *A* (that is, *B* can force a renegotiation of terms against the threat of withdrawing from the relationship). The anticipation of ex post bargaining over output leads *A* to make a suboptimal initial investment. The property rights literature proceeds to examine different ownership structures. For example, to minimize the ex ante inefficiencies from holdup, each party may be allocated ownership, and thus control, over those assets most sensitive to its own investments.

In the property rights literature, the parties typically engage in joint production with non-verifiable investments, and holdup is an unfortunate by-product of the production. The ex post bargaining is efficient, but the ex ante investment is not. In our incomplete insurance model, the holdup is created to transfer a risk that is not contractible. Moreover, although there is some transfer of risk through ex post bargaining, the distribution of the verifiable loss is not efficient. The tasks therefore become how to construct the verifiable loss contract and how to determine the relationship-specific investment and the forfeits to maximize the joint efficiency of the sharing of both verifiable and non-verifiable losses.

Our paper is related to a recent pair of papers by Anderlini, Felli, and Postlewaite.[4] They consider an arrangement for delivery of a widget from a buyer to a seller. A contract can be written for foreseen events, but the cost of producing the widget is subject to a noncontractible risk, and the buyer chooses a relationship-specific investment. They show how court rules, which can alternatively uphold or void the contract, can improve the tradeoff between efficiency and risk sharing. The main differences with our paper, apart from our specific focus on insurance, is that we select a market institution (brokers rather than a court) to motivate ex post risk sharing and that the parties have some ex ante choice in whether they will face a holdup

3. Grossman and Hart (1986); see Hart (1995) for a summary.

4. Anderlini, Felli, and Postlewaite (2003a, 2003b).

and, if so, in the force of that holdup. Moreover, we bifurcate risk into contractible and noncontractible and are concerned with the impact of the latter on optimal coverage of the former. In one important sense, our analysis falls short of that of Anderlini, Felli, and Postlewaite. Whereas they derive the efficient court rules, we take the broker's role as passive. We salvage this passive role for brokers by allowing heterogeneity and allowing parties to choose the desired level of holdup in their selection of a broker. Nevertheless, an obvious extension of our approach would be to endogenize the strategies of brokers.

Bargaining over Non-Verifiable Losses

In this section, we examine the ex post bargaining process over non-verifiable losses.

The Effect of Profitability and Reputation on Ex Post Bargaining

Imagine the following circumstances. Some unanticipated loss has just occurred. The circumstances of the loss are quite unusual and, although there is a policy covering other anticipated losses, this event simply was not anticipated and does not appear to be specifically covered (nor may it be specifically excluded). Is it reasonable to expect that the insurer will negotiate to make a payment to the policyholder? In the case of the World Trade Center, insurers generally did not appeal to the war exclusion and held that losses were covered. The extraordinary visibility of the loss, and the public declaration that losses would be covered, had clear implications for the reputations of insurers.

Although we have suggested that holdup of insurers can be fueled by relationship-specific investments and by the prospect of reputation losses, we focus on the role of reputation throughout the rest of the paper. In the September 11 incident, the reputation boost for insurers in publicly announcing coverage was probably significant. Insurers were able to join in the expression of solidarity and patriotism that swept the country. Moreover, in a situation where there was likely to be a governmental response to distribute the costs, insurers were able to purchase goodwill. This might have deflected alternative public policy that insurers considered to be less desirable. For example, the loss might have been recovered by an expansion of the tort system or by direct taxation of insurers.

In less visible losses, reputation might also play an important role. The insurer that generates a reputation for generosity in settling claims might be able to attract business on more favorable terms. This benefit will be magnified in the highly concentrated brokered market. Claims settlements will be known to the broker and can be influential in the broker's placement of new business. Thus, in offering to pay a claim that is not clearly covered, the insurer might consider the profitability of the whole account with the broker, not just that from the policy. But this is a two-way street. Brokers also value their reputation with insurers. The pricing and terms of policies can reflect the broker's record for bringing good business. A policyholder that is aggressive in seeking payment for trivial, undeserving, and uncovered losses, or in building up losses, will also gain a reputation with the broker. The broker might be reluctant to jeopardize its reputation with insurers for such troublesome clients.

When contracts are brokered, information about settlements is disseminated widely, and the reputation impact of claims practices is amplified. However, we argue that reputation can be a decision variable. The parties can choose whether brokers are involved and, if so, which brokers. In the absence of brokers, the reputation boost, or penalty, for claims settlements will be small. With small regional brokers, the reputation consequences will be concentrated but limited. With large national and international brokers, the leverage of reputation can be enormous.

Nash Bargaining

We consider losses to be verifiable (non-verifiable) if an enforceable contract can (cannot) be written on such events. The potential range of losses to which we are exposed is enormous, and it may be costly, impractical, or even impossible to specify such types of loss in a legally enforceable document.[5] The fact that losses cannot be specified in advance does not necessarily exclude the possibility that the insurer might have a comparative advantage in bearing these losses. If such losses are diversifiable, they might

5. Some policies specify the perils and losses that are covered. If a loss occurs that is not specified, then it is not covered. Other policies work in the opposite direction, covering everything that is not included. The latter provides a structure for including the unanticipated, but does so at a cost—it is open ended and becomes very difficult to price. Moreover, having such open policies complicates the insurer's financial and risk management.

still be transferable. The problem is with writing the enforceable contract. We assume that even though such losses are non-verifiable, they can be observed after the fact by relevant parties (that is, by the insurer, the insured, and the broker).

Insurance policies are written that cover verifiable losses, denoted v. We assume a simple form in which a portion α of the loss is insured. Proportional insurance is not necessarily optimal,[6] but it is simple to model and does not affect the main insights about the disposition of non-verifiable losses. However, the policies do not cover, or are sufficiently vague about, non-verifiable losses, denoted n. Insurance contracts are written for a single period for a premium, P, but are potentially renewable into the future. If the contract is renewed, the insurer will receive an expected profit, Π, from future business, and the policyholders will receive an expected benefit, $h(\Pi)$, from the continued business.[7] Losses n and v are independently distributed according to density functions $g(n)$ and $f(v)$, and realizations occur at the end of the period. According to policy conditions, the insurer pays type v losses. But if a type n loss occurs, the insurer and policyholder engage in Nash bargaining to reach a settlement. In the absence of a settlement, the policy is terminated, and the parties suffer reputation losses measured as R_i for the insurer and R_p for the policyholder.

In the Nash bargain over non-verifiable losses, the settlement maximizes the product of the gains to the parties from continuing the relationship. This results in an equal division of the total gains from continuation. If the bargaining is successful and the relationship persists, the insurer makes future profit Π, avoids a reputation loss of R_i, but has to make a settlement of b. For the policyholder, continuation secures a bargained settlement of b and avoids a reputation loss of R_p. To motivate a comparative advantage in bearing risk, we assume that the insurer is risk neutral and the policyholder is risk averse with utility function $u(.)$. The initial wealth of the policyholder is w_0.

The Nash bargain for non-verifiable losses thus solves:

$$MAX_b Z(b) = (\Pi + R_i - b)\,[u(w + b) - u(w - R_p)], \tag{1}$$

where $w = w_0 - P - v - n + \alpha n$.

The optimality conditions are as follows:

6. Raviv (1979) shows that deductible policies are optimal if contracts are complete, the transaction cost is linear in the amount of insurance coverage, and there is no background risk.

7. The benefit to the insured is specified relative to the next best alternative, which is canceling the policy and taking a new policy with a rival insurer.

$$(2) \quad Z'(b) = (\prod + R_i - b)\,[u'(w + b)] - [u(w + b) - u(w - R_p)] = 0,$$

and

$$(3) \quad Z''(b) = (\prod + R_i - b)\,[u''(w + b)] - 2u'(w + b) < 0.$$

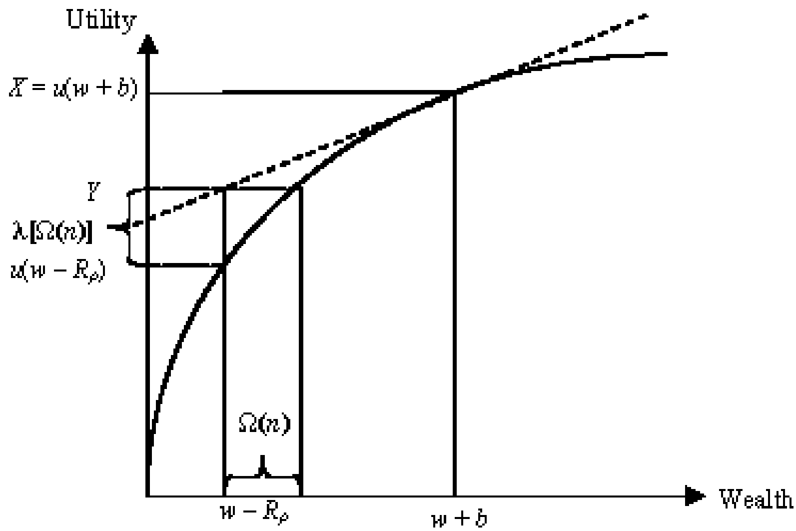
In the following results we suppress the influence of future profit. Unless it is related to the realization of n, its effect on b^* is similar to that of R_i. We underestimate b^* by a constant.

Case 1

In case 1, we assume that R_p is constant, R_i is constant, and the policyholder is risk neutral. This case is not too interesting in itself, but it is helpful for understanding how bargaining works. The Nash bargaining solution is $b^* = \frac{1}{2}(R_i - R_p) = constant$. This result shows clearly that the payout depends on the balance of bargaining power between the parties. The insurer can hold up the policyholder based on the latter's potential loss of reputation, R_p. And the policyholder can hold up the insurer based on the insurer's reputation stake, R_i. Only if $R_i > R_p$ will the insurer make a positive payment to the policyholder. The bargained payout can be quite perverse. If $R_i < R_p$, the payout is negative because the policyholder has more to lose than the insurer and the insurer has greater holdup power. From a risk-sharing point of view, this does not matter in this case because the policyholder is risk neutral. Also notice that if R_i and R_p are not functions of n, the settlement, b^*, will also be independent of n. Thus ex post bargaining will not reduce risk to the policyholder. Clearly, if ex post bargaining is to have any useful hedge properties, then b^* must increase with n.

Notice also that if R_p is constant, the policyholder can hold up the insurer even if no non-verifiable loss has occurred. This is simply a blackmail situation: "Pay me or I will cancel the contract, the broker will know, and your reputation will suffer." If the broker only observes the contract breakdown, this "blackmail" may be plausible. However, if the broker observes the non-verifiable loss, then it is unlikely to blackball the insurer that refuses to pay for a nonexistent loss. In this case, R_p can be an increasing function of b: either a step function or more continuously increasing in b. The increasing function is dealt with in case 3.

Figure 1. Utility Loss from Contract Termination: Risk-Neutral and Risk-Averse Cases



Case 2

In case 2, we assume that R_p is constant, R_i is constant, and the policyholder is risk averse. The solution for the optimal bargain is implicit in equation (2). The change from case 1 lies in the risk aversion of the policyholder. To see how this affects bargaining, consider figure 1.

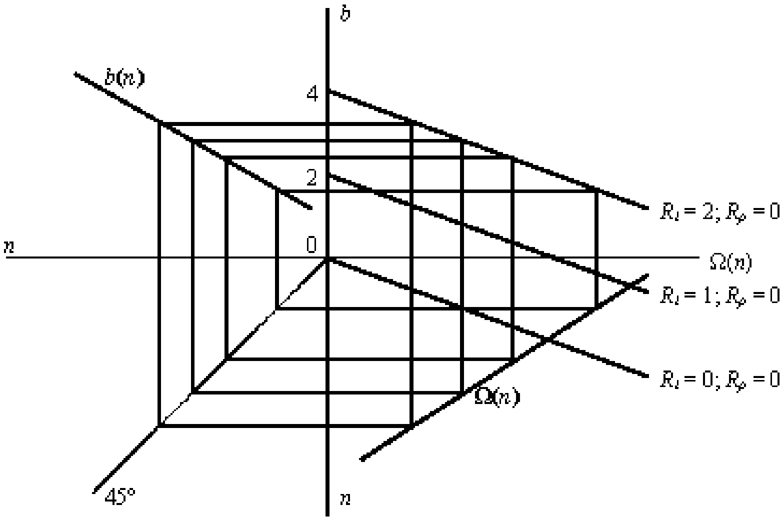
With policyholder risk neutrality, the utility curve is shown as the dashed line. Thus the utility loss from a breakdown of bargaining and contract termination is $X - Y = u(w + b) - Y$. The slope does not matter since utility is determined up to linear transformation. Now consider that the policyholder is risk averse, as shown by the concave utility function. The total utility loss is now as follows: $u(w + b) - u(w - R_p) = (X - Y) + \lambda[\Omega(n)]$.

We can think of the Nash bargain as a sharing of the total losses from termination, including $\Omega(n)$. So the Nash bargaining solution can be stated as

$$b^* = \tfrac{1}{2}[R_i - R_p - \Omega(n)]. \quad (4)$$

Thus the policyholder's risk aversion reduces her bargaining power and reduces the bargained settlement by $\tfrac{1}{2}\Omega(n)$. This result is rather unfortunate because one would expect that the efficient ex post transfer from a risk-neutral insurer would *increase* with the policyholder's risk aversion.

Figure 2. Increasing Absolute Risk Aversion (IARA)[a]



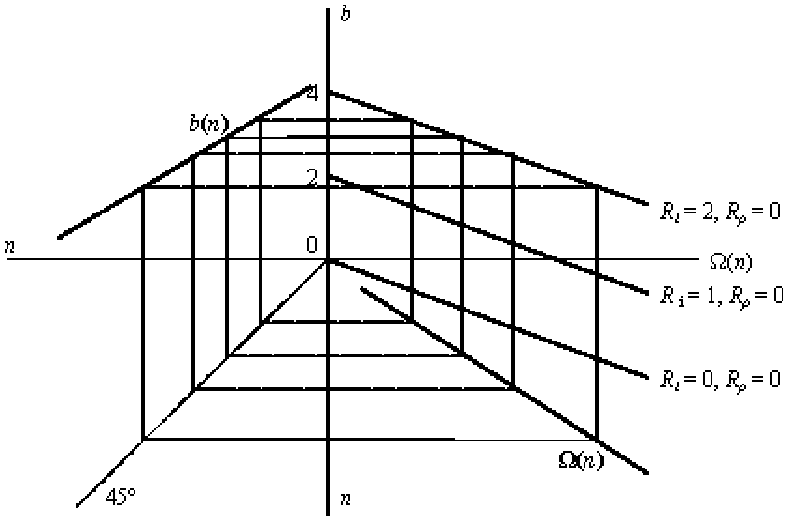
a. $b^*(n)$ increases with n if $\Omega'(n) < 0$.

Notice that this increase in the policyholder's loss by ½Ω*(n)* (and the insurer's holdup) is expressed as a function of *n*. The properties of this holdup depend on the properties of the utility function. For example, with constant absolute risk aversion (CARA), Ω*(n)* is a constant and *b** is also a constant.

Consider another possibility: the policyholder exhibits increasing absolute risk aversion (IARA). In the bottom right quadrant of figure 2, the value of Ω*(n)* is shown to be decreasing with *n.* The top right quadrant shows values of *b** derived from equation 2, with $R_p = 0$, and $R_i = 0, 2, 4$. Notice that these all slope downward, reflecting that the insurer can hold up the policyholder to the tune of ½Ω*(n).* In contrast, the policyholder can hold up the insurer for ½R_i. If we take $R_i = 4$, then *b** will follow the solid downward-sloping line in the top right quadrant. For any level of non-verifiable loss on the lower vertical axis, we can trace in a counterclockwise direction (following the dotted lines) to derive a function *b(n)* in the top left quadrant. In figure 2, the downward slope of Ω*(n)* produces a hedging loss function; that is, *b(n)* is increasing with *n.*

If Nash bargaining is to result in a useful hedge, clearly *b** must increase with *n* (in the limit, of course, if the non-verifiable loss is to be fully hedged, $b^*(m) = n$). Unfortunately, this result may not prevail with plausible policyholder risk preferences. If the policyholder's utility function exhibits

Figure 3. Decreasing Absolute Risk Aversion (DARA)[a]



a. $b^*(n)$ decreases with *n* if $\Omega'(n) < 0$.

decreasing absolute risk aversion (DARA), then anticipated ex post bargaining may compound the policyholder's risk. Figure 3 shows that, with an upward slope of $\Omega(n)$, the Nash bargain produces a gambling loss function; that is, $b(n)$ decreases with *n.*

It seems clear that we cannot rely on risk preferences alone to produce a bargained risk transfer from the risk-averse policyholder to the risk-neutral insurer. In the general case considered now, we allow the reputation stakes of the parties to be functionally related to *n.*

Case 3

From these two specific cases, we can interpret the general case. We simply state the main results. The intuition should be apparent from the previous reasoning. First, in order to ensure a hedging bargain function, that is, $b'(n) > 0$, for all risk-averse utility functions, it is necessary either for the insurer's reputation loss to increase with *n* or for the policyholder's reputation loss to decrease with *n*. Returning to equation 4, we can isolate the conditions for $b'(n) > 0$. That is,

$$R_i'(n) > R_p'(n) + \Omega'(n). \tag{5}$$

However, we can isolate a special case where, in principle, full insurance of the non-verifiable loss is possible. We state this as Proposition 1: if the reputation loss to the insurer is a function of the size of both types of losses, then there exists a reputation loss function to the insurer such that Nash bargaining generates full coverage of the non-verifiable loss to the policyholder.

The proof is as follows. Set the reputation loss function as

$$R_i(v,n) = n + \frac{u(w_0 - P - v + \alpha v) - u(w_0 - P - v + \alpha v - n - R_p)}{u'\,(w_0 - P - v + \alpha v)}.$$

The unique solution to the first-order condition $Z'(b) = (R_i - b) \cdot u'(w_0 - P - v + \alpha v - n + b) - [u(w_0 - P - v + \alpha v - n + b) - u(w_0 - P - v + \alpha v - n - R_p)] = 0$ is then $b^* = n$.

Summary

Before considering the optimal ex ante contract, it is of interest to know whether the *anticipated* bargained settlements, *b(n)*, are increasing in the non-verifiable loss. Only in this case will the anticipated bargains hedge the risk-averse policyholder's loss. The bargained payout, b, reflects the balance of both parties' reputation investments and the properties of the policyholder's utility function. Risk aversion alone is not sufficient to produce a hedge, $b'(n) > 0$. For example, with CARA and constant reputation values, $b(n)$ is constant and results in no risk transfer. And with DARA, $b'(n) < 0$, and ex post bargaining thus increases the policyholder's risk. The general problem is that risk aversion weakens the policyholder's bargaining power and, ceteris paribus, lowers the settlements. Alternatively, a hedge of non-verifiable losses can be generated if the reputation loss of the insurer increases in n or the reputation of the policyholder decreases in n. For example, if $R_i'(n) > 0$, the policyholder's bargaining power increases with n, enabling her to hold up for larger settlements, the larger the non-verifiable loss.

Optimal Insurance Contracts

Before looking at optimal ex ante contracts, we examine the information assumptions and the role of brokers.

Brokers, Reputation, and Blackballing

A policyholder can approach an insurance broker to help formulate an insurance strategy and place insurance with appropriate carriers. As an agent for the policyholder, the broker is concerned with issues such as the terms and conditions of the policy, the price, the insurer's financial condition, and its reputation for fair treatment, especially in paying claims. The issue of legal agency is clouded somewhat by the fact that the broker's commission often is paid by the insurer as a percentage of the premium income. Moreover, insurers often supplement this commission by a profit-sharing arrangement that aligns the broker's interests with those of the insurer. This profit sharing encourages the broker to bring business that is profitable to the insurer. Brokers have relationships with several (many) insurance companies, and each insurer has a portfolio of business with each broker. Indeed, insurers compete for the best business in the design of these profit-sharing plans.

The intermediation role of the broker highlights the importance of reputation. If insurers gain a reputation for being difficult in settling claims, then brokers will tend to divert business to other insurers or will seek compensating variations in price or policy conditions. Thus a negative reputation can be costly. In our model, we specifically consider that the termination of a contract due to the breakdown of ex post Nash bargaining will lead to a reputation penalty.

In imposing a penalty on an insurer, the broker must use its information, its judgment, and its bargaining power. Brokers can only sanction insurers by threatening to withhold future business for misbehavior if they observe the misdeeds. Naturally, they know whether a policy has been terminated. Proposition 1 showed that there exists a reputation function such that bargaining over non-verifiable losses will result in a perfect hedge. However, for this function to be operational, brokers would have to observe n (as well as v). We can imagine weaker information assumptions. The broker may know that a loss has occurred but may not be able to quantify it. For example, the event can affect the policyholder's future profits, and estimation of these profits requires considerable judgment.

Judgment also plays another important role. The point of this paper is to examine whether efficient risk sharing can occur by means of ex post bargaining. The important issue is whether the non-verifiable loss is one that would have been insurable had it been verifiable. The events of September 11 were to some extent unanticipated, but they may be quite insurable in the future. However, though not specifically modeled here, some types of risk probably should not be transferred through insurance. For example, the transfer of core business risk creates an obvious moral hazard problem. We would not expect the broker to be unhappy with an insurer that refuses to make a settlement on a property insurance policy for business losses arising from the policyholder's poor marketing, bad management, or poor sales through bad product design. Thus the imposition of a reputation penalty should indeed depend on the type of non-verifiable loss, and this requires judgment by the broker.

The size of the reputation penalty also reflects the broker's bargaining power. Brokers are not homogeneous; some have small books and some large. Making a national broker unhappy by mishandling a claim may have more severe consequences for an insurer than making a regional broker unhappy. This heterogeneity implies that consumers have some degree of ex ante choice over the potential holdup of insurers. Policyholders have some ability to influence the reputation commitments made by themselves and by insurers and thereby have some control over the bargaining function, $b(n)$.

In discussing the role of reputation penalties, it is important to bear in mind that if the information assumptions are very strong (all losses are observed by all parties) and the judgments to be made are trivial (all parties can verify ex post which losses should have been insurable had they been anticipated), then there is no real problem to address; the insurer and policyholder can contract ex ante on all losses. We are stopping short of this in two dimensions. First, judgments on the insurability of losses are not trivial. Second, while we examine the effects of conditioning reputation on fully observed non-verifiable losses, we also examine reputation functions based on weaker information. We show that for interesting results, information available to the broker has to be sufficient to make the reputation an increasing function of n.

Insurance Contracts with Ex Post Bargaining on Non-Verifiable Losses

In the previous section, reputation and other relationship-specific investments led to a holdup in which the parties could bargain over non-verifiable losses. The investment was necessary to the sharing of non-verifiable losses. The questions to be addressed now are: Would the parties, particularly the insurer, make such investments? How will this affect the optimal level of insurance on verifiable losses?

The timing of our model is this. The parties decide whether to use a broker and, if so, which broker to use. The choice of broker indirectly makes the degree of reputation at stake a choice variable. In the simplest case, with one broker or identical brokers, we can think of this as a binary choice over reputation. If no broker is chosen, no reputation is offered for holdup; if a broker is chosen, then exogenous reputation functions, $R_i(n)$ and $R_p(n)$, are in effect chosen. At the other extreme, consider a continuum of brokers all having differing client bases, differing sizes, and differing reputations for using claim settlement to influence the placement of future business. Unbounded variation in these dimensions implies that reputation can be a continuous choice variable.

First, the policyholder chooses a broker, and the broker selects an insurer in a competitive insurance market. The risk-neutral insurer demands a price to sell insurance and to stake its reputation to induce payment against non-verifiable losses. We assume that this combined premium is actuarially fair, that is, $P = E(\alpha v) + E(b^*)$, where α is the level of coinsurance chosen by the policyholder. Losses are realized and payments made either by enforcement of the contract (type v losses) or by bargaining (type n losses). But if the bargaining breaks down, brokers implicitly impose penalties by means of their future selection of clients (policyholders) and the placement of business across insurers.

Notice that assuming a fair price implies that the costs of brokering are zero. This is clearly unrealistic, but it allows us to cut through the complexity and identify the mechanisms by which non-verifiable risk can be transferred. Throughout, we assume that v and n are independently distributed. Finally, it will be clear that the more interesting source of holdup stems from the insurer's reputation, which allows the policyholder to make a recovery in the face of non-verifiable losses. The policyholder's own reputation will limit the size and structure of the recovery. In what follows, we show that many interesting results can be derived using only insurer reputation. Thus, for simplicity, we assume $R_p = 0$.

Before looking at incomplete insurance contracts, it is helpful to look at how traditional models of optimal insurance might address the issue of non-verifiable losses. This serves to set benchmarks against which to measure the incomplete contract results.

Complete Insurance

If both losses—v and n—are contractible, the parties can write an insurance contract contingent on the realizations of each type of loss. The optimal coinsurance rates, α_{CI}^* and β_{CI}^*, with respect to loss v and n are then determined by

$$MAX_{0 \leq \alpha,\, \beta \leq 1}\ E\{u[w_0 - \alpha E(v) - \beta E(n) - v + \alpha v - n + \beta n]\}.$$

Because all losses are verifiable and contractible, there is no distinction between types v and n losses. Consequently, an insurance contract between a risk-averse policyholder and a risk-neutral insurer creates value. With a fair insurance premium, the efficient contract fully insures all losses, that is, $\alpha_{CI}^* = \beta_{CI}^* = 1$. If premiums include a loading (which increases with coverage), the optimal contract is partial insurance.

Without Nash Bargaining: Background Risk

The second case is where n is non-verifiable and noncontractible and no transfer is generated (by bargaining, litigation, arbitration, or other mechanisms) between the insurer and policyholder relative to this loss. Thus type n losses become a background risk against which the parties can contract to insure the type v losses. The optimal coinsurance rate, α_{BR}^*, with respect to loss v is determined by

$$MAX_{0 \leq \alpha \leq 1}\ E\{u[w_0 - \alpha E(v) - v + \alpha v - n]\}.$$

This situation is equivalent to the demand for insurance in the presence of an independent background risk (uninsurable risk). The result is that, either under DARA and decreasing absolute prudence or under DARA and convex absolute risk aversion, the policyholder demands higher coverage than he would if he did not face background risk.[8] With no loading, the optimal contract on v with independent background risk is full insurance: $\alpha_{BR}^* = 1$.

With Nash Bargaining: Fixed Reputational Losses

The results of this section follow simply and intuitively from the results of Nash bargaining. Recall that when the insurer's reputation loss is unrelated

8. See, for example, Gollier (2001, ch. 9).

to n, the potential for a bargained settlement to act as a hedge against non-verifiable losses depends on the properties of the policyholder's utility function. With CARA, $b(n)$ is constant and, since it is prepriced, there is no risk, or wealth, transfer. With DARA, $b(n)$ is decreasing in n (as shown in figure 3). This actually increases the risk to the policyholder. Clearly, the policyholder would not like this. Thus the policyholder would choose not to go through a broker, and there would be no reputation investment by the insurer. This case would now degenerate to the background risk case with no Nash bargaining, and the policyholder would fully insure the verifiable loss.

Finally, with IARA, the Nash bargaining can increase with n, as shown in figure 2. Thus establishing a reputation investment by brokering the contract will provide some hedging capacity for non-verifiable losses. However, this case is unlikely, as IARA has little empirical support.

With Nash Bargaining: Proportional Reputation Losses

The results so far suggest that with plausible risk preferences, CARA or DARA, and constant reputation value, ex post Nash bargaining will not arise and there is no mechanism with which to hedge the non-verifiable losses. Thus the most interesting case arises when the insurer's reputation loss increases with n. We can imagine various versions of this. The simplest would be a step function: reputation loss is zero if the contract is terminated, with $n = 0$; the reputation loss is a positive constant if the contract breaks down, with $n > 0$. With more fine-tuning, b^* might be a continuously increasing function of n. We address the latter case.

Suppose that all brokers can observe v and will choose to blackball insurers who fail to reach bargained settlements on non-verifiable losses. For any broker, we assume that reputation loss of the insurer is proportional to the size of the non-verifiable loss, that is, $R_i(n) = \beta n$. Moreover, suppose that brokers differ in the size of their accounts with different insurers. For example, a national or international broker is likely to have a large portfolio of business with any given insurer. Thus the broker wields considerable power over that insurer, and the reputation loss from contract breakdown can be considerable; that is, β will be large. For a small or regional broker, the account will be smaller and the potential reputation loss also smaller; that is, β will be small. Given a continuum of brokers, the policyholder can now exercise a choice over β as well as over the level of coinsurance, β_{NB}. The optimal coinsurance rate, β_{NB}^*, and sensitivity, β^*, are determined by

$$MAX_{0 \leq \alpha,\, \beta \leq 1}\, E\{u[w_0 - \alpha E(v) - E(b^*) - v + \alpha v - n + b^*]\}, \text{ and}$$

$$s.t.\ Z'(b^*) = 0 \leftrightarrow (\beta n - b^*) \cdot u'[w(\alpha) + b^*] - \{u[w(\alpha) + b^*] - u[w(\alpha)]\} = 0,$$

where $w(\alpha) = w_0 - \alpha E(v) - E(b^*) - v + \alpha v - n$.

Proposition 2 is as follows: when the insurer's reputation loss is proportional to n, it is optimal for the policyholder to go through a brokered market; that is, $\beta^* > 0$ and $\alpha = \alpha_{NB}{}^*$.

We do not present the proof here, but the intuition should follow from the previous discussion. The important issue is that because reputation loss increases with n, the policyholder can bargain for larger settlements, the larger is the non-verifiable loss. Thus ex post bargaining can provide an appropriate hedge against such losses.

There are some special cases and qualifications. We have examined the proportional reputation function here. Other possibilities arise. Recall from proposition 1 that, if the reputation function has a certain form, the Nash bargaining solution will equal the non-verifiable loss, $b^* = n$. While this form is complex, the implications for the contract design are straightforward. Because the non-verifiable loss is effectively fully insured and the premium is assumed to be fair, full insurance is optimal. Thus if this function is available from a broker, the policyholder will select this broker, the expected cost of the bargain will be factored into the premium, and the policyholder will fully insure the verifiable loss.

These two cases (proportional reputation and full insurance) are not exhaustive.[9] We cannot make a general assertion that an increasing reputation function, $R_i'(n) > 0$, will lead to the selection of a brokered relationship. The problem is that DARA and $R_i'(n) > 0$ have opposing effects on the sign of $b'(n)$. It does, however, follow that with CARA or DARA, $R_i'(n) > 0$ is a necessary condition for $b'(n) > 0$. Thus assuming CARA or DARA, it follows that a necessary condition for the policyholder to select the broker is $R_i'(n) > 0$.

Conclusion

We define a particular role for brokers in potentially completing insurance markets with noncontractible risk. Brokers are the repositories of the

9. Other cases have not been examined. For example, we mention that reputation might be a step function of n; $R_i(0) = 0$; $R_i(n > 0) > 0$.

reputation of insurers and policyholders. If non-verifiable losses occur that are, in principle, insurable (that is, had they been foreseeable, they would have been insurable), the parties can bargain over a settlement. By its subsequent behavior, the broker can influence the outcome of this bargaining. For example, if an insurer fails to reach a satisfactory bargain with its policyholder, the broker might be less inclined to place future business with that insurer. Thus the policyholder can hold up the insurer against this reputation cost. Ex ante, policyholders have some degree of choice in whether they do business in the brokerage market and in their selection of a broker. This, in turn, permits them some degree of control over their prospective bargaining position with their insurer and thus some control over the transfer of non-verifiable risk.

The extent to which ex post Nash bargaining permits effective hedging rests on the information available, the utility function of the policyholder, and the structure of the reputation cost function. In principle, there exists a reputation function that would induce a full transfer of non-verifiable risk though Nash bargaining. But this function is complex and requires the broker to have sufficient market clout and full knowledge of realized losses and of the policyholder's risk preferences. Of course, by making the assumptions too strong, we can always argue that the losses are contractible. With weaker assumptions, there can still be risk transfer. However, this requires that the reputation function be positively related to the size of the non-verifiable loss.

We are also able to determine the limits on such risk sharing of non-verifiable losses. If the broker is unable to condition the reputation of the insurer on the occurrence or size of the non-verifiable loss, then Nash bargaining will *increase* the policyholder's risk. However, it would seem an unlikely set of circumstances. The stylized model with increasing reputation costs does seem to correspond to the functioning of the insurance marketplace. Brokers usually have some access to loss estimates, they do indeed shop around risks, and no doubt policyholders do take refuge behind the bargaining clout of their brokers when it comes to negotiating unusual claims. And brokers do place business, not only according to price, policy conditions, and solvency but also according to the claim settlement records of insurers.[10]

10. See Harrington and Niehaus (2003, p. 504).

Discussion

Bill Murray of Chubb suggested a closer examination of the role of the broker. In reality brokers, rather than acting disinterestedly, generally act on different motivations. In many cases, they receive compensation from the insurers to whom they present business and with whom they sometimes have profit-sharing arrangements. The status of a broker's compensation may partly influence where the broker chooses to place business. The paper seems to suggest that the insured should always act through a large national broker, who can provide greater clout in the market and have a greater effect on the insurer's reputational interest; in reality, however, regional brokers thrive. Moderate or midsize companies may receive greater attention from regional brokers. Murray was impressed to see a mathematical justification for reputation, something his corporation values but has difficulty quantifying in self-evaluations.

Richard Zeckhauser of Harvard University highlighted the role of the broker as an arbitrator and reputation spreader. Market participants probably want an outcome that they would consider "fair" or "anticipated," rather than the Nash equilibrium solution, which disadvantages the risk averse. He suggested modifying the model to give the insured analytic ability to distinguish by reputation the "fair" insurer from the hard bargainer. The Better Business Bureau and eBay are two examples of the demand for reputation spreading. Mike O'Malley of Chubb agreed, adding that a broker concerned with reputation constitutes a three-party game. In reality brokers do not always act as impartial arbiters. Thanking Zeckhauser for his suggestion, Neil Doherty expressed interest in modifying the model to allow firms to develop reputation by volunteering a settlement beyond the Nash bargaining solution. Developing the model into a three-way bargaining game seems necessary to develop the study further. Although legally it maybe difficult to establish that brokers act as agents for the insurer, receiving compensation from the insurer certainly points to an agency relationship with the insurance corporation.

Richard Darrig of the Automobile Insurers' Bureau suggested that fairly priced future contracts ought to have future profits set to zero. The loss then should not be forgone profits, but sunk costs in capital or expenses. He also suggested that reputation can be thought of as franchise value, which would allow a firm to command higher prices in the market. Finally, rather than setting $\beta_n = 0$ in failed bargaining, some negative value representing an unpleasant outcome for one side or the other should be reflected in the equation. Doherty responded that zero profit makes sense in a competitive market without an intertemporal aspect to product pricing. Making relationship-specific investments that are recouped in the future distributes profit over time and provides some leverage in bargaining.

Howard Kunreuther of the Wharton School pointed out that insurance firms rely on deductibles to screen out unverifiable claims that may be the result of moral hazard. The importance of the deductible warrants further investigation, and verifiability must be defined more clearly. The challenge of verification may be in the severity of the loss or in whether the cause of the loss was an event covered by the policy. Also a client may evaluate the decision between firms of differing reputation depending on the client's own opportunity cost of litigation. Doherty clarified that "verifiable" in the context of this paper indicates not that loss actually occurred and is quantifiable, but that the event causing the loss is specified in the contract. An event unspecified in the contract constitutes a non-verifiable claim.

Robert Litan of Brookings expressed his belief in the paper's relevance to large commercial insurance. Although individuals may have recourse to a regulator, they hardly have bargaining power. Knowing what percentage of claims are litigated or arbitrated rather than just unilaterally declared would give a greater sense of the magnitude of the issue. There may be more to the choice of broker than the reputation staked: the degree of choice, for example. Finally, considering that most settlements are the result of negotiation rather than arbitration, Nash modeling probably provides the best real-world approximation.

Responding to comments, Doherty continued. Having an expectation of future bargaining would certainly increase premiums, but beyond that it may provide a means of completing a market that could not be covered by normal contracting mechanisms. Recent papers by Richard and Barbara Stewart and Ken Abraham suggest that the insurance industry may implode due to the ex post opportunism of insurers. Making consumers uncertain of a payout to which they feel entitled will reduce demand-increasing financial pressure on the industry and susceptibility to ex post opportunism. The paper seeks to cast bargaining in a more positive light.

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