BROKERS AND THE INSURANCE OF NON-VERIFIABLE LOSSES

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I. INTRODUCTION

Consider how the insurance industry responded to 9/11. It is unclear whether many of the losses at the World Trade Centre 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 9/11 and after seem to span terrorism and war. Indeed the U.S. president has continued to refer to the post-9/11 environment as a war situation and the response has engaged the country in actual wars. Despite some ambiguity in whether the 9/11 events were covered, leaders in the insurance industry almost immediately 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 (2001) have labeled this the "loss of certainty effect" and Kenneth Abraham (2001) has talked of the "de facto big claims exclusion". One reason for such disputes is that large claims threaten insurer solvency and such offers may be seen to resemble workouts in which distressed non-insurance firms negotiate with creditors. But the issue here is with the willingness, not the ability, to

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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 (e.g. 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 socio-political 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 will work as follows. Many losses can be anticipated and enforceable insurance policies 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.[1] 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 "hold-up" problem. The nature and the 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.

The size of the "hold-up" 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 make an offer of a payment on the non-verifiable loss. Another type of relationship specific investment is in loss control. The insurer might provide safety-engineering services to the policyholder that enables the latter 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 cancelled.

The second form of the hold-up resembles a performance bond. The parties may put their reputation at stake on the continuation of the contract. In insurance, many commercial contracts are brokered. The brokerage industry is highly concentrated with three brokers, Marsh McLennan, Aon 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

[1] 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 Nothwestern and KLM chose to rely on single support operations, which increases the costs of a hold-up and so gives them an incentive to work together more effectively.

withdrawal of the policy in question, but the broker can bargain with its whole book of business with the insurer. Of course, both parties might hostage their reputation 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 non-existing losses. However, we will see that the optimal reputation investment from the policyholder might well turn out to be zero.

The hold-up problem is central to the incomplete contracts literature (Grossman and Hart, 1986; see Hart Oliver, 1995, for a summary). 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" (r.s.i.) and "hold-up". If owners, *A* and *B*, of different assets plan to engage in joint production and party *A* makes a non-verifiable r.s.i., 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 which empowers party *B* who can now "hold-up" *A*, (i.e., *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 sub optimal initial investment. The property rights literature proceeds to examine different ownership structures. For example, to minimize the *ex-ante* inefficiencies from hold-up, each party may be allocated ownership, and thus control, over those assets most sensitive to his (her) own investments.

In the property rights literature, the parties typically engage in joint production with non-verifiable investments and hold-up is an unfortunate bi-product of the production. The *ex-post* bargaining is efficient, but the *ex-ante* investment is not. In our incomplete insurance model, the hold-up 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 task therefore becomes how to construct the verifiable loss contract and how to determine the r.s.i. and 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 (2003 a and b). 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 non-contractible 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 trade-off 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 hold-up and, if so, on the force of that hold-up. Moreover, we bifurcate risk into contractible and non-contractible and are concerned with the impact of the latter on optimal coverage of the former. In one important sense our analysis falls short of Anderlini, Felli and Postlewaite. Whereas they derive the efficient court rules, we have taken 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 hold-up in their selection of broker. Nevertheless, an obvious extension of our approach would be to endogenize the strategies of brokers.

II. EX-POST BARGAINING OVER NON-VERIFIABLE LOSSES

a. 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 had not been 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 mentioned in the introduction, 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 reputation of insurers.

Although we suggested that hold-up of insurers can be fueled by relationship specific investments and by the prospect of reputation losses, we will focus on the role of reputation throughout the rest of the paper. In the 9/11 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 considered less desirable by insurers. 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 reputations 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 will 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.

b. 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 loss types in a legally enforceable document.[2] 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 still be transferable. The problem is with writing the enforceable contract. We will assume that, even though such losses are non-verifiable, they can be observed after the fact by relevant parties (i.e., by the insurer, the insured and 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[3] but it 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.[4] 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

[2] 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, they cover everything that is not included. The latter does provide 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.

[3] 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.

[4] 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.

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 the insurer is risk neutral and the policyholder is risk averse with utility $u(.)$. The initial wealth of the policyholder is w_0.

The Nash bargain for non-verifiable losses thus solves.

$$(1) \qquad \text{MAX}_b \; Z(b) = \left(\Pi + R_i - b\right)\left(u(w+b)-u(w-R_p)\right) \qquad \text{where } w = w_0-P-v-n+\alpha n$$

In the following results we will 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 will be underestimating b* by a constant.

The optimality conditions are:

$$(2) \qquad Z'(b) = \left(\Pi + R_i - b\right)u'(w+b) - \left(u(w+b)-u(w-R_p)\right)=0$$

$$(3) \qquad Z''(b) = \left(\Pi + R_i - b\right)u''(w+b) - 2u'(w+b) < 0$$

SPECIAL CASES

Case 1. R_p is constant; R_i is constant; Policyholder is Risk Neutral

This case is not too interesting in itself, but it is helpful to understanding how bargaining works. The Nash bargaining solution is

$$b^* = \tfrac{1}{2}(\prod + R_i - R_p) = constant$$

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 $Ri > Rp$ will the insurer end up making 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 thus the insurer has greater hold-up 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, then 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, then 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 non-existent 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 below in case 3.

Case 2. R_p is constant; R_i is constant; 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 $X\text{-}Y = u(w+b) - Y$. 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

$$u(w+b) - u(w-R_p) = (X-Y) + \lambda(\Omega(n)).$$

So, 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:

$$(4) \qquad b^* = \tfrac{1}{2}\left(\prod + R_i - R_p - \Omega(n)\right)$$

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

Notice that this increase in the policyholder's loss by $\frac{1}{2}\,\Omega(n)$ (and the insurer's hold-up) is expressed as a function of *n*. The properties of this hold-up depend on the properties of the utility function. For example, with constant absolute risk aversion, CARA, then $\Omega(n)$ is a constant, and b^* is also a constant.

Consider another possibility that the policyholder exhibits IARA. In the bottom right quadrant of Figure 2, the value of $\Omega(n)$ 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 downwards reflecting that the insurer can hold-up the policyholder to the tune of *½ Ω (n)*. In contrast, the policyholder can hold-up the insurer for $\frac{1}{2}R_i$. If we take $R_i = 4$, then *b** will follow the solid downwards sloping line in the top right quadrant. For any level of non-verifiable loss on the lower vertical axis, we can trace in a counter-clockwise direction (following the dotted lines) to derive a function *b(n)* in the top left quadrant. In figure 2, the downwards slope of *Ω (n)* produces a hedging loss function; i.e. *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 then *b=n*). Unfortunately, this result may not prevail with plausible policyholder risk preferences. If the policyholder's utility function exhibits DARA (decreasing absolute risk aversion), then anticipated *ex-post* bargaining may compound the policyholder's risk. Figure 3 shows that with an upward slope of *Ω (n)* the Nash bargain produces a gambling loss function; i.e. *b (n)* decreases with *n*

It seems clear 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 will allow the reputation stakes of the parties to be functionally related to the *n.*

Case 3. General case.

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

(5) $$R_i'(n) > R_p'(n) + \Omega'(n)$$

However, we can isolate a special case where there can, in principle, be full insurance of the non-verifiable loss. We will state this as a proposition.

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.*

Proof. Set the reputation loss function as follows

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

The unique solution to the FOC $Z'(b) = (R_i - b) \cdot u'(w_0\text{-}P\text{-}v\text{+}\alpha v\text{-}n\text{+}b) - (u(w_0\text{-}P\text{-}v\text{+}\alpha v\text{-}n\text{+}b) - u(w_0\text{-}P\text{-}v\text{+}\alpha v\text{-}n\text{-}R_p)) = 0$ 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)*, is 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* and/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.

III. OPTIMAL INSURANCE CONTRACTS

a. Brokers, Reputation, and Blackballing

Before looking at optimal *ex-ante* contracts, we examine the information assumptions and the role of brokers. 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 will be 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 that of the insurer. This profit sharing will encourage the broker to bring business that is profitable to the insurer. Brokers will have relationships with several (many) insurance companies and each insurer will have 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 seek compensating variations in price and/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 with a threat to withhold future business for misbehavior if they observe the misdeeds. Naturally, they will 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 impact 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 was one that would have been insurable had it been verifiable. The events of 9/11 were to some extent unanticipated, but they may be quite insurable in the future. However, though not specifically modeled here, there are some types of risk that 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 about an insurer that refused to make a settlement on a property insurance policy for the policyholder's business losses arising from 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 will also reflect 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 hold-up of insurers. Policyholder have some ability to influence the reputation commitments by themselves and 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 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 could 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 as just mentioned. 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 will in fact show that, for interesting results, information available to the broker has to be sufficient to make the reputation an increasing function of n.

b. Insurance Contracts with Ex-post Bargaining on Non-verifiable Losses

In Section II, reputation and other relationship specific investments led to a hold-up 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? And: 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 hold-up; 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 this combined premium is actuarially fair, i.e. $P = E(\alpha v)+E(b^*)$, 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 hold-up 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 will show that many interesting results can be derived using only insurer reputation. Thus, for simplicity we assume $R_p=0$.

1. Complete Insurance (CI)

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 will set benchmarks against which to measure the incomplete contract results.

If both losses, v and n, were contractible, the parties can write an insurance contract contingent on the realizations of each type of loss. The optimal coinsurance rates $\alpha_{CI}{}^{*}$ and $\beta_{CI}{}^{*}$ 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 will create value. With a fair insurance premium, the efficient contract fully insures all losses, i.e. $\alpha_{CI}{}^{*} = \beta_{CI}{}^{*} = 1$. If premiums include a loading (which increases with coverage), the optimal contract is partial insurance.

2. Without Nash-bargaining = Background Risk (BR)

The second case is where n is non-verifiable and non contractible 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, and/or under DARA and convex absolute risk aversion, the policyholder demands higher coverage compared to the situation where he does not face background risk (see e.g. Gollier, 2001, Chapter 9). With no loading, the optimal contract on v with independent background risk is full insurance: $\alpha_{BR}^* = 1$.

3. With Nash-bargaining (NB) – Fixed Reputational Losses

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

4. With Nash-bargaining (NB) – 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 thus there is no mechanism 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 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, i.e. $R_i(n) = \beta n$. 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; i.e., β will be large. For a small, or regional broker, the account will be smaller and the potential reputation loss also smaller; i.e., β will be small. Given a continuum of brokers, the policyholder can now exercise a choice over β as well as choosing the level of coinsurance α_{NB}. The optimal coinsurance rate α_{NB}^* and sensitivity β^* are determined by

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

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

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

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

We will 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, this allows the policyholder to 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, then 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.[5] We cannot be 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 $R_i'(n)>0$.

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

CONCLUSION

We define a particular role for brokers in potentially completing insurance markets with non-contractible risk. Brokers are the repositories of the reputation of insurers and policyholders. If non-verifiable losses occur which are in principle insurable (i.e., 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 over whether they do business in the brokerage market and in their choice of 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 on 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 were 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 with the functioning of the insurance market place. 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 factor in the claim settlement records of insurers (see Harrington and Niehaus, 2004, p. 504).

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Figure 1. Utility loss from contract termination: risk neutral and risk averse cases.

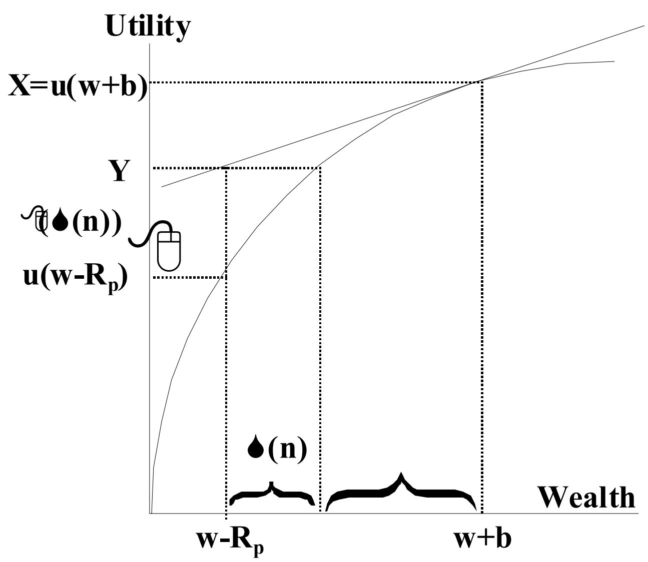

Figure 2. b*(n) increases with n if Ω'(n) <0; IARA.

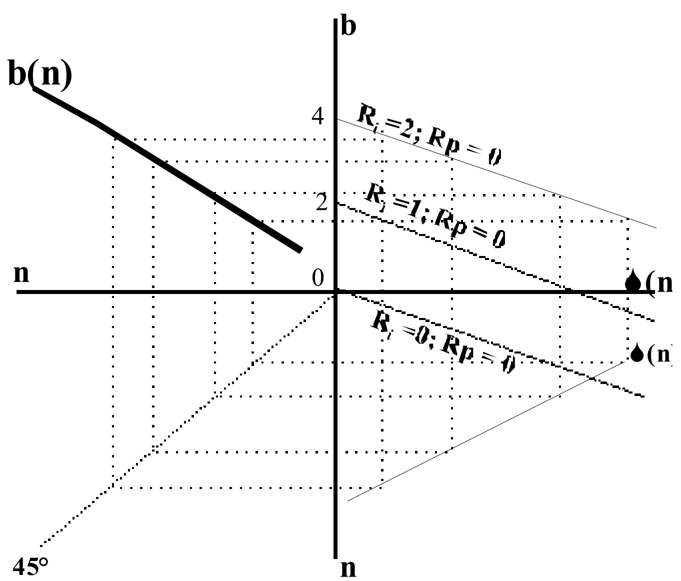

Figure 3. b*(n) decreases with n is Ω'(n) >0; DARA.