Insuring Non-Verifiable Losses

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1 Non-verifiability in insurance relations

- Enforceability of contracts is an important issue in insurance relations
  - Policyholders are concerned about possibility that insurer reneges on promised claims payment
  - Policyholder’s possibility to switch to another insurer and insurer’s concern for its reputation provide incentives to honor claims payments as intended in contract

- Insurance contracts have to distinguish between losses, costs, and investments that should be insured and those that should not
  - Repair and maintenance of buildings
  - Failed product placements
  - Finance marketing campaign to counter competitive threats
• Policyholders and insurers often have mutual understanding ex ante of what should be insured and what should not be insured.

• Difficult for outsiders to verify ex post which part of the losses the insurance parties wished to insure.

• Insurance contracts must be self-enforcing (incentive-compatible)
  – Otherwise contracting parties have no incentives to ex post truthfully reveal the original intentions of the contract.
Examples

- Insurance of office building or factory
  - Limited to costs of replacement
  - Costs are not well defined until replacement (changes in environmental and safety standards)
  - Difficult to disentangle replacement cost from investment cost

- ReputationGuard offered by Chartis
  - Covers “proactive costs and response costs resulting from reputation threat and reputation attacks”
  - No explicit criteria on occurrence of event and on usage of consulting services
  - Policy includes upper limit, deductible, and coinsurance
• Chubb Insurance
  – Reputation of ensuring that policyholders are adequately compensated and happy with claims settlements
  – Policy language is restrictive in coverage with mutual understanding that ambiguity over amount of coverage is resolved in policyholder’s favor
  – Independent agents and brokers

• Speed of claims settlement is crucial issue for corporate policyholders to protect against financial distress
  – Difficult to enforce if insurer can haggle over terms of the contract

• Reinsurance relies on continued business relation, trust, and reputation
  – Contracts do not specify underwriting and claims settlement practice to be adopted by primary insurer
2 Results

- One-period insurance policy with deductible and upper limit is optimal self-enforcing contract if losses are non-verifiable or if claims are difficult to enforce in a court.

- Mechanism
  - Threat of losing future business induces insurer to honor claims
  - Insurer earns a rent that determines maximum willingness to pay
  - Upper policy limit reduces the required rent
  - Deductible equalizes policyholder’s wealth across loss realizations
- Novel explanation for contracts that are widespread (liability and corporate insurance)

- These contracts are robust to
  - Policyholders’ concern that insurers may defect on their promise to pay reliably and quickly
  - Multi-period contracting

- Joint contracting with group of policyholders improves risk allocation
  - Role of insurance broker to implicitly implement joint contract

- New insights and predictions about determinants of insurance
Related literature

- Standard insurance with deductible as optimal contract
  - Verifiable losses and proportional loading: Arrow (1963), Raviv (1979)
  - Moral hazard, adverse selection Holmström (1979)

- Upper limit policy as optimal contract
  - Moral hazard if option to rebuild home has positive value Garrat and Marshall (1996)
Related literature

- Large literature on relational (self-enforcing) contracts
  - Financial contracting
    Bolton and Scharfstein (1990), Hart and Moore (1998)
  - Subjective performance evaluation and incentive contracts
  - Unobservable product quality
    Klein and Leffler (1981)
  - Risk sharing in less developed countries
  - Risk sharing in labor markets
    Thomas and Worrall (1988)
3 The Model

- Infinitely many periods, discount rate $r$

- Risk-averse policyholder(s) and risk-neutral insurers

- In each period, policyholder has initial wealth $w_0$ and random loss $L$ with realization $\ell \in [0, \bar{\ell}]$

- The loss is not verifiable: contract on $\ell$ cannot be enforced in court

- Insurance market is competitive: maximize policyholder’s expected utility (in each period)
Sequence of events in each period

- Insurers simultaneously quote a one-period insurance contract \( \{ P, I(\ell) \} \) with \( I(\ell) \geq 0 \) for all \( \ell \in [0, \bar{\ell}] \)

- Each policyholder chooses a contract

- Each policyholder incurs loss \( \ell \), which is observed by the insurer

- Insurer chooses transfer to the policyholder

- Policyholder consumes end of period wealth \( w(\ell) = w_0 - \ell - P + I(\ell) \)
Non-verifiable losses

- Insurance contract has to be self-enforcing (incentive-compatible)
  - If insurer honors the contract, policyholder renews coverage
  - If insurer shirks, policyholder chooses different insurer

- Insurer’s incentive compatibility constraint:

\[
I(\ell) \leq \frac{P - E[I(L)]}{r} \quad \text{for all } \ell
\]

PV of rent from future business

- In a competitive insurance market, the constraint binds for

\[
\max_{\ell \in [0, \ell]} I(\ell) \equiv I^{\max}
\]
Thus,

\[ P = \underbrace{E[I(L)]}_{\text{fair premium}} + \underbrace{rI_{\text{max}}}_{\text{rent to satisfy IC}} \]

- Insurer’s rent is proportional to the maximum claims payment
- Insurance coverage below \( I_{\text{max}} \) is possible at a fair premium
• Optimization problem

\[
\max_{(P,I(\cdot),I_{\max})} E[u(w(L))] \\
\text{s.t.} \\
P \geq E[I(L)] + rI_{\max} \\
\text{and} \\
0 \leq I(\ell) \leq I_{\max} \text{ for all } \ell \in [0,\ell]
\]
Structure of optimal contract

- Piece-wise linear $I^*(\ell) = \min \left\{ (\ell - D^*)^+, I^{\max*} \right\}$

- Strictly positive deductible, $D^* > 0$, and upper limit, $I^{\max*} < \ell - D^*$

Intuition – starting with full insurance

- Upper limit reduces the rent required to satisfy incentive compatibility

- Marginal utility when loss is fully insured is lower than marginal utility when loss exceeds upper limit

- Deductible reduces premium and transfers wealth from (to) states with low (high) marginal utility
Patience, financial distress, and the level of insurance

- Interest rate $r$ plays critical role for maximum claims payment
  - Measure of patience
  - Probability that business relation ends due to exogenous reason (e.g., bankruptcy)

- No insurance is optimal for interest rates exceeding some threshold

- Below this threshold and assuming CARA, $D^*$ is strictly increasing and $D^* + I_{\text{max}}^*$ is strictly decreasing in $r$

- Highly levered or distressed firms choose lower level of insurance
Multi-period contracting

- Multi-period contract can be written on claims payment (enforceable)

- In case of large losses, increase indemnity payment today in exchange for larger premiums in the future

- To increase indemnity payment today by a given amount the present value of future premium has to increase by same amount

- Mechanism equivalent to borrowing and using single-period contracts

- Multi-period contract locks policyholder into the relation which reduces bargaining power and insurer’s willingness to pay

- Given the cost of renewal commitment, one-period insurance policies are optimal with separated possibility to borrow against future income in capital market
4 Joint contracting

- Insurance of non-verifiable losses works because rent gives policyholder bargaining power
  - Insurer pays because of threat to withdraw business

- Group of policyholders can improve efficiency by joint threat of terminating business
  - Assume some policyholders have losses in excess of their individual upper limit and others have losses below the upper limit
  - Coverage of policyholders with very high losses can be increased without increasing the required (total) rent
• Joint insurance contracts for $n$ homogeneous policyholders specifies indemnity payment, $I_j(\ell^n)$ for $\ell^n = (\ell_1, ..., \ell_n) \in [0, \bar{\ell}]^n$, to each policyholder $j = 1, ..., n$

  − Homogeneity implies $L^n = (L_1, ..., L_n)$ is exchangeable

• Broker observes loss realization of and claims payment to all policyholders and coordinates action

  − If insurer pays $I_j(\ell^n)$ to each policyholder $j = 1, ..., n$, broker recommends renewing coverage to each policyholder

  − If insurer shirks on one policyholder, broker recommends switching to rival insurer to all policyholders
• Insurer’s incentive compatibility constraint:
\[
\sum_{j=1}^{n} I_j (\ell^n) \leq \frac{nP - E \left[ \sum_{j=1}^{n} I_j (L^n) \right]}{r} \quad \text{for all } \ell^n \in [0, \bar{\ell}]^n
\]

• In a competitive insurance market, the constraint binds for
\[
\max_{\ell^n \in [0, \bar{\ell}]} \sum_{j=1}^{n} I_j (\ell^n) \equiv I_n^{\max}
\]

• Thus,
\[
nP = E \left[ \sum_{j=1}^{n} I_j (L^n) \right] + rI_n^{\max}
\]
• Optimization problem

\[
\max_{(P,(I_j(\cdot)))_{j=1,\ldots,n},I_{n}^{\text{max}}} \sum_{j=1}^{n} E[u(w(L^n))]
\]

s.t.

\[
nP \geq E\left[\sum_{j=1}^{n} I_j(L^n)\right] + rI_{n}^{\text{max}}
\]

and

\[
0 \leq I_j(\ell^n) \text{ and } \sum_{j=1}^{n} I_j(\ell^n) \leq I_{n}^{\text{max}}
\]

for all \( \ell^n \in [0, \bar{\ell}]^n \) and \( j = 1, \ldots, n \).
• Optimal joint contract is equivalent to an insurance contract with individual deductible, \( D^* > 0 \), and a joint upper limit, \( I_n^{\text{max}*} < n(\bar{\ell} - D^*) \)

• Optimal individual allocation can be implemented by

\[
I_j^*(\ell^n) = \begin{cases} 
(\ell_j - D^*)^+ & \text{if } \sum_{j=1}^{n} (\ell_j - D^*)^+ \leq I_n^{\text{max}*} \\
(\ell_j - D(\ell^n))^+ & \text{otherwise}
\end{cases}
\]

where \( D(\ell^n) \) is given by \( \sum_{j=1}^{n} (\ell_j - D(\ell^n))^+ = I_n^{\text{max}*} \).
• Intuition
  – If joint upper limit is binding, joint contracting allows for improved allocation of transfer to policyholders
  – Even if joint upper limit is not binding, joint upper policy limit allows for a more efficient use of the total rent
  – Individual deductible reduces premium and has same benefit as with individual contracting

• Role of broker
  – Coordination of policyholders’ actions and knowledge of policyholders’ losses
  – External intermediary is necessary - insurer has no incentive to use knowledge of policyholders’ losses to their benefit
5 Empirical predictions and evidence

- Rent is proportional to the maximum claims payment
  - High-severity-low-frequency events are particularly costly to insure
  - Consistent with high prices in reinsurance market for catastrophe risk

- Rent is increasing with financial distress of the client
  - Insurance is more expensive for firms that have financial problems
  - Consistent with the fact that large catastrophic losses tend to increase reinsurance premiums and reduce quantities
• Threat of losing future business is less critical if insurer’s capacity to underwrite is limited
  – Well capitalized insurers value business relation more highly and have higher willingness to pay
  – Consistent with the fact that insurers hold capital in excess of regulatory requirement
6 Conclusion

- Prospect of future business allows for risk sharing when losses are observable by policyholders and insurers but not verifiable.

- Optimal contract can be implemented by one-period insurance contract with deductible and upper limit.

- Insurance brokers can improve risk sharing for a group of policyholders by implementing contracts with joint upper limit.