The Insurance is the Lemon: Failing to Index Contracts

Barney Hartman-Glaser (UCLA) Benjamin Hébert (Stanford and NBER)

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Introduction

- Many (almost all) contracts are not *indexed*
  - Example: residential mortgages
  - Indices: Case-Shiller, local wages/unemployment/rents, etc...
- There are indices available
  - Not based on individual borrower's outcomes
    - "external" not "internal"
- These indices could provide useful *insurance*
  - Borrower's marginal utility related to index
  - The *promises* aren't indexed
  - The *payment* is exposed to the index
- Why aren't contracts indexed?

Our Story

- Borrowers are not sure about the index
  - In particular, how the index maps to the actual risk
- Borrowers know the lenders know more
  - "Behavioral" assumption?
  - Bounded rationality?
- Borrowers fear "lemon" insurance
  - Costly insurance that isn't related to actual risks
- Lenders are risk-averse w.r.t. risks
  - "Lemon" insurance is the cheapest to provide

A Simple Example

- Borrower needs \$1 to invest in a project that will yield \$2.
- External state $a \in A$:
  - $a = G$ood, $P(a = G) = \frac{1}{2}$
  - $a = B$ad, $P(a = B) = \frac{1}{2}$
  - a is not contractible, nor observed before payoffs realized
- Contractible Index $z \in Z$:
  - Also takes on values $\{G, B\}$
  - Two kinds of index:
    - high quality: perfectly correlated with a,
    - low quality: independent of a.

Contracts, Lenders, and Preferences

- Two possible contracts:
  - Contingent (on index) contract $s_C(G) = \frac{8}{3}, \; s_C(B) = 0$
  - Non-contingent contract $s_N(G) = s_N(B) = 1$.
- Lenders:
  - $|L| \geq 3$ identical lenders simultaneously offer contracts
  - All lenders know if index is high or low quality
  - Borrower does not know, prior prob. μ_0 for low quality
- Preferences:

$$\text{Borrower: } \phi_B(s, a) = \left(\mathbb{1}\{a = G\} \frac{1}{2} + \mathbb{1}\{a = B\} \frac{3}{2} \right) (2 - s)$$

$$\text{Lenders: } \phi_L(s, a) = -1 + \left(\mathbb{1}\{a = G\} \frac{3}{4} + \mathbb{1}\{a = B\} \frac{5}{4} \right) s$$

Equilibria

- Concept: perfect Bayesian equilibrium.
- A "good" equilibrium with risk sharing:
  - All lenders offer contingent contract if index high quality, non-contingent if low
  - Off-path beliefs:
    - if $|L| - 1$ lenders offer non-contingent, believe low quality index
    - if $|L| - 1$ offer contingent, believe high quality index
- A "bad" equilibrium with no risk sharing:
  - All lenders offer non-contingent contract always
  - Off-path beliefs: if offered contingent contract, believe index is low quality

Why Multiple Equilibria?

- Both contracts break-even for lenders if index is high quality
- Contingent contract is profitable if index low quality
  - Lender risk-averse, demands risk-premium if index high quality
  - If index low-quality, this risk-premium is just profit
- Market for "contingency" is like "the market for lemons"
- But common type and competition can help:
  - $|L| \geq 3$ lenders sufficient for "good" equilibrium to exist
- Main part of the paper generalize this idea

Players, States, Times

- Time zero:
  - $|L| \geq 3$ lenders have financial resources
  - A borrower wants to raise $K > 0$ to invest in a project
  - Lenders will post contracts
  - Borrower picks one
- Time one:
  - External state $a \in A$
  - Index $z \in Z$
  - Idiosyncratic state $i \in I$
  - A and Z are finite, totally ordered: $\succ$ means "better"
  - Payoffs

Payoffs

- Contract $s \in S$; s_z is contract given index $z \in Z$
- Given contract $s \in S$, index $z \in Z$, and state $a \in A$:
  - Borrower's indirect util. function $\phi_B(s_z, a)$
  - Lender's indirect util. function $\phi_L(s_z, a)$
- What are these things?
  - Costly state verification (CSV)
  - Mortgage model in paper, utility functions
- CSV and mortgage models: debt optimal given $a \in A$
  - We require s_z be "ex-post efficient" (e.g. debt)
  - Call this set of contracts S_D

Types

- Let $\theta(a, z)$ be the joint distribution of $a \in A$ and $z \in Z$
- Lenders know θ; it is drawn from convex set Θ
- The borrowers have prior $\mu_0(\theta)$
- The marginals $p(a)$ and $q(z)$ are the same for all $\theta \in \Theta$
  - w.l.o.g. assume full support
- Will impose more assumptions on Θ below
- "Behavioral" assumption
  - How index is related to house prices is not literally private
  - Borrowers just know less than lenders about this

Markets

- Lenders simultaneously offer contracts
- Menu of contracts offered is signal, borrower updates
- Borrower chooses (or doesn't participate)
- Standard equilibrium definition
    - D1 refinement and one additional refinement
    - Refinements don't eliminate multiple eq.

Assumptions

- The "optimal non-contingent contract" s^* is feasible
  - Does not depend on index z
- The "full-information optimal contract" $\bar{s}(\theta)$ exists
  - and is not equal to s^* for all θ
- Next: two key conditions for the main result

Rich Type Space

Definition 1

θ' lower-orthant dominates θ ($\theta' \succcurlyeq \theta$) if, for all $\bar{a} \in A$ and $\bar{z} \in Z$,

$$\sum_{a \in A: a \preceq \bar{a}} \sum_{z \in Z: z \preceq \bar{z}} (\theta'(a,z) - \theta(a,z)) \geq 0.$$

- = super-modular ordering (Meyer and Strulovici [2012]).

Condition 1

The support of μ_0:

1. Includes in the uninformative type $\theta_0(a,z) = p(a)q(z)$.
2. Includes only positively interrelated types ($\theta \succcurlyeq \theta_0$).
3. Includes, for all θ s.t. $\mu(\theta) > 0$, all θ' s.t. $\theta \succcurlyeq \theta' \succcurlyeq \theta_0$.

Ordering

Condition 2

For all $d', d \in D$ with $d' > d$, $\phi_L(s_{d'}, a) - \phi_L(s_d, a)$ is weakly decreasing in a, and $U(s_{d'}, a; \lambda^*) - U(s_d, a; \lambda^*)$ increasing in a.

- $\phi_L(s_d, a)$ sub-modular and $U(s_d, a; \lambda^*)$ super-modular in (d, a)
- Marginal benefit to lender of promises monotone in a
  - Same ordering regardless of level of debt
- Marginal cost to borrower of promises monotone in a, same direction
  - Borrower and lender agree on which states are "good" and "bad"
- Borrower "more risk averse" than lender
  - Marginal social value of debt higher in good states
- Could switch "sub-" and "super-"

General Result

Proposition 1

The pure-strategy symmetric equilibrium $s(\theta) = \bar{s}(\theta)$ *exists,*

and

Proposition 2

Under conditions 2, and 1, there exists a symmetric pure-strategy equilibrium in which $s(\theta) = s^*$*.*

- Same intuition as in example
- "Catch-22" for lenders trying to break the equilibrium:
    - promises increasing in z are efficient, but profitable for θ_0 type
    - promises decreasing in z are inefficient
    - can't profitably separate with monotone (in z) promises
    - non-monotone contracts have same problem b/c of rich type space

Extensions

- Monopoly lender:
  - non-contingent eq. exists under similar conditions
  - "best" eq does not exist
- Profitable lending:
  - Population of borrowers
  - Decreasing returns to scale
  - Changes how D1 operates
  - Non-contingent eq. exists under similar conditions
- Borrower uncertain about marginal distribution of z
  - Result still holds for sufficiently rich type space

Conclusion

- Why aren't indexed contracts used?
- Because borrowers fear "lemon" insurance
- Multiple, ex-ante Pareto-ranked equilibria
- Security design example:
    - Indexed debt is best
    - non-indexed debt is an equilibrium

References

Margaret Meyer and Bruno Strulovici. Increasing interdependence of multivariate distributions. *Journal of Economic Theory*, 147 (4):1460–1489, 2012.