The Insurance is the Lemon: Failing to Index Contracts

Barney Hartman-Glaser (UCLA) Benjamin Hébert (Stanford and NBER)
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• 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 $a \in A$:
  - $a = \text{Good}, \ P(a = G) = \frac{1}{2}$
  - $a = \text{Bad}, \ P(a = B) = \frac{1}{2}$
  - $a$ 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. $\mu_0$ for low quality

- Preferences:

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

  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 $S_D$
• Let \( \theta(a, z) \) be the joint distribution of \( a \in A \) and \( z \in Z \)
• Lenders know \( \theta \); it is drawn from convex set \( \Theta \)
• 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 \( \Theta \) below
• “Behavioral” assumption
  • How index is related to house prices is not literally private
  • Borrowers just know less than lenders about this
• 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 $\theta$
- Next: two key conditions for the main result
Rich Type Space

Definition 1

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

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

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

Condition 1

The support of $\mu_0$:

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

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-”
**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 $\theta_0$ 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