A Theory of Holdouts

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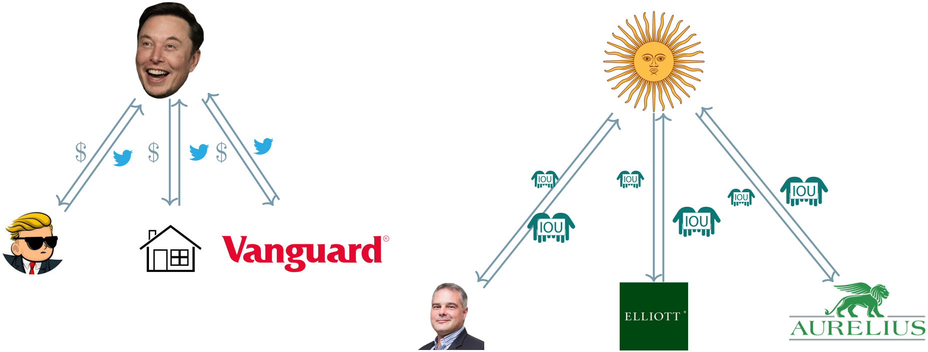
Exchange Offers and Holdout Problems



The Puzzle

The holdout problem is surprising as it has an "easy" solution:

- Contingent proposal requiring unanimity makes all agents pivotal
- Almost never used in practice

Instead, what we see systematically different solutions

- Corporate debt restructuring: Senior debt
- Takeovers: Cash and stock offers (except for freeze-outs)

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This Paper

Provides a unified framework for holdout problems

- Two types of players:
  - Agents endowed with outstanding securities
  - Principal, the residual claimant, offers new securities for old
- Two frictions:
  - Collective action problem among agents
  - Limited commitment (L.C.) of the principal

Results Preview

Full Commitment Benchmarks:

B1: Same new securities used in equilibrium independent of existing securities

B2: No role for policy intervention: Efficient outcome attained

Limited Commitment (L.C.) Results:

R1: Different new securities, depending on initial securities's payoff sensitivity

Key: Payoff sensitivity determines credibility of punishment

R2: Role of policy intervention: Increasing commitment can backfire

Key: You compete with your future self and commitment helps both

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New Mechanism from Generalization along 2 Dimensions

	Full Commitment	Limited Commitment
Specific Security	Classic Papers e.g., Grossman–Hart 80 (Cash)	No Optimal Contracting Pitchford–Wright 12 (Cash)
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Model

Setup

Players: N agents (A_i) and a principal (P)

Timing:

1. P offers new securities R_i in exchange for Old ones R_i^O (Claims on asset)
2. Each A_i *independently* chooses to accept ($h_i = 0$) or hold out ($h_i = 1$)
3. Given $\boldsymbol{h} = (h_1, \ldots, h_N)$, P chooses to honor at cost c or renegotiate

    If honored, asset value $v(\boldsymbol{h})$ realized; Everyone paid according to securities

    Else, repeat if P not committed

NB: Static when $\boldsymbol{R} = (R_1, \ldots, R_N)$ renego.-proof

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What do we mean by “securities”

Payoffs: Specific Securities

Suppose no new securities and all holdouts get $w \leq v$ collectively

Equity $\boldsymbol{\alpha} = (\alpha_1, \ldots, \alpha_N)$: A_i gets paid $\alpha_i w$

Debt $\boldsymbol{D} = (D_1, \ldots, D_N)$

w/o seniority : A_i gets paid $\min\left\{D_i, \frac{(1-h_i)\, D_i}{(\mathbf{1}-\boldsymbol{h})\cdot \boldsymbol{D}}\, w\right\}$

w/ seniority: A_i gets paid $\min\left\{D_i, w - \sum_{j \text{ senior to } i} (1-h_j)\, D_j\right\}$

But how to model general contracts that can be arbitrary?

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Payoffs: General Securities

Securities are *vector functions* mapping asset value & agents' securities to payoffs

$$\boldsymbol{R}\left(v, \boldsymbol{h}\right) \quad \mapsto \quad \mathbb{R}^N \qquad \textit{New securities}$$

$$\boldsymbol{R}^O\left(v, \boldsymbol{h} | \boldsymbol{R}\right) \quad \mapsto \quad \mathbb{R}^N \qquad \textit{Original securities}$$

A_i's payoff:

$$u_i := h_i R_i^{\mathrm{O}} + (1 - h_i) R_i$$

P's gross payoff:

$$J(\boldsymbol{h}|\boldsymbol{R}) := v(\boldsymbol{h}) - \left[\boldsymbol{h} \cdot \boldsymbol{R}^{\mathrm{O}} + (\boldsymbol{1} - \boldsymbol{h}) \cdot \boldsymbol{R}\right]$$

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Model: Weak Consistency

Weak consistency (cf. Aumann–Maschler 85, Moulin 00)

Holdout profile

$$R_i^{\mathrm{O}}(v, \boldsymbol{h} | \boldsymbol{R}) = R_i^{\mathrm{O}}\Big(v - \underbrace{(\boldsymbol{1} - \boldsymbol{h}) \cdot \boldsymbol{R}}_{=:x \text{ ("dilution")}}, \boldsymbol{h}\Big)$$

Eqm. asset value $v(\boldsymbol{h})$

NB: Could reverse R and R^O but size of "dilution" needs to be determined by R

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Holdout profile ($\boldsymbol{h}$)

Eqm. asset value $v(\boldsymbol{h})$ (v)

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Weak Consistency: Examples

I owe senior debt to S, junior debt to J, and offer new security to T(endering) agents

Allowed by Weak Consistency

- Offering T a payoff senior (or junior) to both J and S
- Offering T a payoff senior to J and junior to S

Ruled out by Weak Consistency

- Offering T a payoff junior to J and senior to S
- Offering P herself a claim senior to both J and S

P cannot selectively dilute $\implies$ cannot punish holdouts without punishing herself

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Model: Payoff Sensitivity

Def: How payoff $R_i^O(w, \boldsymbol{h})$ varies with diluted value $w := v - (\mathbf{1} - \boldsymbol{h}) \cdot \boldsymbol{R}$

Equity: A_i has an equity stake $\alpha_i \in (0, 1)$, then

$$R_i^{\mathrm{O}}(w, \boldsymbol{h}) = \alpha_i w \qquad \Longrightarrow \qquad \frac{\partial R_i^{\mathrm{O}}(w, \boldsymbol{h})}{\partial w} = \alpha_i < 1$$

Debt: A_i has debt with face value D_i then

$$R_i^{\mathrm{O}}(w, \boldsymbol{h}) = \min\{D_i, w\} \qquad \overset{\text{in default}}{\Longrightarrow} \qquad \frac{\partial R_i^{\mathrm{O}}(w, \boldsymbol{h})}{\partial w} = 1$$

Principal: The residual claimant

$$J(\boldsymbol{h}|\boldsymbol{R}) = w - \boldsymbol{h} \cdot \boldsymbol{R}^{\mathrm{O}} \qquad \Longrightarrow \qquad \frac{\partial J(\boldsymbol{h}|\boldsymbol{R})}{\partial w} = 1 - \sum_{i=1}^{N} \frac{\partial R_i^{\mathrm{O}}(w, \boldsymbol{h})}{\partial w} h_i$$

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Assumptions

A1 (Inefficient Holdouts): Weakly lower value when more agents hold out

$v(\boldsymbol{h})$ is weakly decreasing in $\boldsymbol{h}$

A2 (Payoff Regularity): Existing securities have "reasonable" payoffs

$w \mapsto \boldsymbol{h} \cdot \boldsymbol{R}^{\mathrm{O}}(w, \boldsymbol{h})$ is increasing and 1-Lipschitz $\forall\, \boldsymbol{h}$

A3 (Moderate Cost): Cost neither too large nor too small

$v(\mathbf{0}) > c > v(\mathbf{0}) - \sum_{i=1}^{N} R_i^{\mathrm{O}}(v(e_i), e_i)$ where $\boldsymbol{h} = e_i$ is profile when only A_i holds out

NB: Toeholding ruled out by A3

Solution Concepts

Think of the Strategy

“First gets everything, Last gets nothing”

May not want to give everything to the first

May not be feasible to give nothing to the last

May not want to give nothing to the last, *even if it’s feasible*: it might hurt you

Now we formalize them

Principal's Problem

P chooses $\boldsymbol{R}$ to maximize value $J(\mathbf{0})$ at $\boldsymbol{h} = \mathbf{0}$

$$\max_{\boldsymbol{R}} \underbrace{v(\mathbf{0}) - \sum_{i=1}^{N} R_i(v(\mathbf{0}), \mathbf{0})}_{J(\mathbf{0}|\boldsymbol{R})}$$

such that

A_i incentive compatible to accept at $\mathbf{0}$

P unwilling to renegotiate upon deviation (only with L.C.)

Incentive Compatibility for Agents at $\boldsymbol{h}$

$\boldsymbol{R}$ is incentive compatible at $\boldsymbol{h}$ ($\boldsymbol{R} \in \mathcal{I}(\boldsymbol{h})$) if

$$u_i(h_i|\boldsymbol{h}_{-i}, \boldsymbol{R}) \geq u_i(h_i'|\boldsymbol{h}_{-i}, \boldsymbol{R}) \quad \forall\, h_i' \,\forall\, i \tag{IC}$$

NB: RHS under $\boldsymbol{R}$ as no renegotiation on-path

Incentive Compatibility for Agents at $\mathbf{0}$

$\boldsymbol{R}$ is incentive compatible at $\mathbf{0}$ ($\boldsymbol{R} \in \mathcal{I}(\mathbf{0})$) if

$$R_i(v(\mathbf{0}), \mathbf{0}) \geq R_i^{\mathrm{O}}\left(v(e_i) - \sum_{j \neq i} R_j(v(e_i), e_i), e_i\right) \tag{IC}$$

P could pay A_i a lot at $\mathbf{0}$ $\implies$ costly

dilute A_i's value at e_i ... by paying others a lot $\implies$ costly *off-path*

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What are feasible actions in renegotiation if agents deviate?

Credibility for Principal w. Limited Commitment

Exchange offer $\boldsymbol{R}$ is credible at $\boldsymbol{h}$ if (cf. Pearce 87, Farrel–Maskin 89, Ray 94)

$\boldsymbol{R}$ is IC at $\boldsymbol{h}$ for all agents

At deviation profile $\hat{\boldsymbol{h}}$, P unwilling to renegotiate to any offer $\tilde{\boldsymbol{R}}$ credible at $\hat{\boldsymbol{h}}$

when renegotiated payoff is discounted by $\delta \in [0, 1]$ (cf. DeMarzo–Fishman 07)

Formally

$$\mathcal{C}(\boldsymbol{h}) = \left\{ \boldsymbol{R} \in \mathcal{I}(h) : J(\hat{\boldsymbol{h}}|\boldsymbol{R}) \geq \delta J(\hat{\boldsymbol{h}}|\tilde{\boldsymbol{R}}) \quad \forall \tilde{\boldsymbol{R}} \in \mathcal{C}(\hat{\boldsymbol{h}}) \quad \forall \hat{\boldsymbol{h}} : ||\hat{\boldsymbol{h}} - \boldsymbol{h}|| = 1 \right\}$$

Thm1: $\mathcal{C}(\cdot)$ exists and is unique for any $\delta \in [0, 1]$ Existence

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Caveats in Definition

It seems as if if A_i holds out, P does not try to win him back in the off-path offer

- If P wins A_i back, he could have offered it in the first place
- Only the continuation eqm. where A_i holds out determines his outside option

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Same as Rubinstein: No belief updating

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Other Renegotiation Protocols

If P can renegotiate out of inefficiency

- Theoretically, agreement may never be achieved (Anderlini–Felli 01)
- Empirically, it might be illegal to bribe a holdout (17 CFR §240.14d-10)
- Relaxing this restores first best

If agents can hold P accountable, blocking renegotiation

- Relaxing this leads to the full-commitment case

Benchmarks: Full Commitment

Efficiency (First Best)

Efficiency achieved if everyone tenders $\boldsymbol{h} = \mathbf{0}$

Follows from A1 : $v(\boldsymbol{h})$ decreasing in $\boldsymbol{h}$

How Different Elements Add Up

Coordinated Agents: FB achieved by Coase Thm. (No holdout problems)

$\downarrow$ + collective action problem

Dispersed Agents: FB not achieved with cash (Classic holdout problems)

$\downarrow$ + flexible contractual space

Benchmarks

$\downarrow$ + limited commitment

Main Results

Full Commitment: Holdout Problems w. Cash

B0: There is no $\boldsymbol{R}$ non-contingent that implements $\boldsymbol{h} = \mathbf{0}$ (only result requiring A3)

Intuition: A_i benefits from the deal when others participate

Impact on deal not fully internalized and costly for P to compensate

Incentive to free-ride impedes value enhancement

Essential force underlines Grossman–Hart, Bulow–Rogoff, etc

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Impact on deal not fully internalized and costly for P to compensate

Incentive to free-ride impedes value enhancement

Essential force underlines Grossman–Hart, Bulow–Rogoff, etc

Full Commitment: One Solution to All

B1: No heterogeneity in the exchange offers

Proof with $v(\mathbf{1})$ normalized to 0:

P implements $\boldsymbol{h} = \mathbf{0}$ by offering small $R_i > 0$ only if all agents agree

$$u_i = \begin{cases} 0 & \text{if } h_i = 1 \\ R_i > 0 & \text{if } h_j = 0 \, \forall j \end{cases} \implies h_i = 0 \text{ weakly dominates } h_i = 1$$

Intuition: With unanimity, every agent pivotal, and thus no incentive to free ride

B2: Efficiency achieved: No role for policy intervention

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Limited Commitment Results

R0: Lack of Commitment Undermines Restructuring

R0: Unanimity Fails with Limited Commitment

Result: Unanimity doesn't implement $\boldsymbol{h} = \mathbf{0}$ when P has L.C.

Unanimity gives P nothing when agents deviate

P not willing to execute threat ex post, carrying out the deal

Anticipating this, everyone holds out

No value enhancement to start with

NB: Seeing off-eqm non-credible offers, per subgame perfection,

A_i correctly "believes" P will offer credible ones when he deviates

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Takeaways

T0: Holdout problems appear to be coordination failures (Sturzenegger–Zettelmeyer 07)

…but are essentially commitment problems

T1: Securities with higher priority are attractive to dilute

... and thus more vulnerable to dilution

T2: Ability to punish holdouts tomorrow

…limits ability to punish holdouts today

T3: When picking a fight among agents

…one man's protection is another man's punishment

R1: Optimal Contracts Depends on Holdout's Payoff Sensitivity

Limited Commitment: Principal's Problem

P chooses $\boldsymbol{R}$ to maximize value $J(\mathbf{0})$ at $\boldsymbol{h} = \mathbf{0}$

$$\max_{\boldsymbol{R}} J(\mathbf{0}|\boldsymbol{R})$$

subject to

$$\boldsymbol{R} \in \mathcal{I}(\mathbf{0}) \tag{IC}$$

$$\text{P unwilling to renegotiate upon deviation } (\boldsymbol{R} \in \mathcal{C}(\mathbf{0})) \tag{RP}$$

R1: Optimal Contracts $\Longleftarrow$ Holdout's Payoff Sensitivity

Result: No contracts dominate cash when punishment hurts P & renegotiation costless

Arbitrary initial securities: payoff sensitivity serves as sufficient stat

Dilution credible for debt holdout $\Longrightarrow$ Senior debt effective

Dilution not credible for equity holdout $\Longrightarrow$ Cash optimal

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R1 Proof: Senior Debt Credible in Debt Restructuring

Debt restructuring: Senior debt offering credible

Senior debt dilutes the claim of the holdout in default by

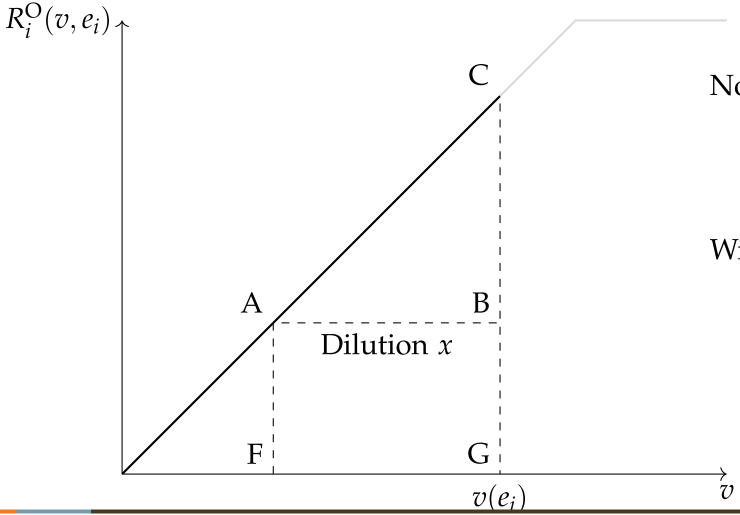
$$\frac{\partial R_i^{\mathrm{O}}(w, \boldsymbol{h})}{\partial w} = 1$$

And that of the principal by

$$\frac{\partial J(\boldsymbol{h}|\boldsymbol{R})}{\partial w} = 1 - \frac{\partial R_i^{\mathrm{O}}(w, \boldsymbol{h})}{\partial w} = 0$$

Diluting the holdout does not change the P's payoff $\Rightarrow$ (RP) met

Graphic Representation: Credible dilution w. Debt



No Dilution:

P gets nothing

A_i gets CG

With Dilution x:

P gets nothing

A_i gets $AF = CG - x$

R1 Proof: Offering Priority Not Credible in Takeovers

Takeovers: Offering priority not credible

Priority dilutes the equity stake of the holdout by

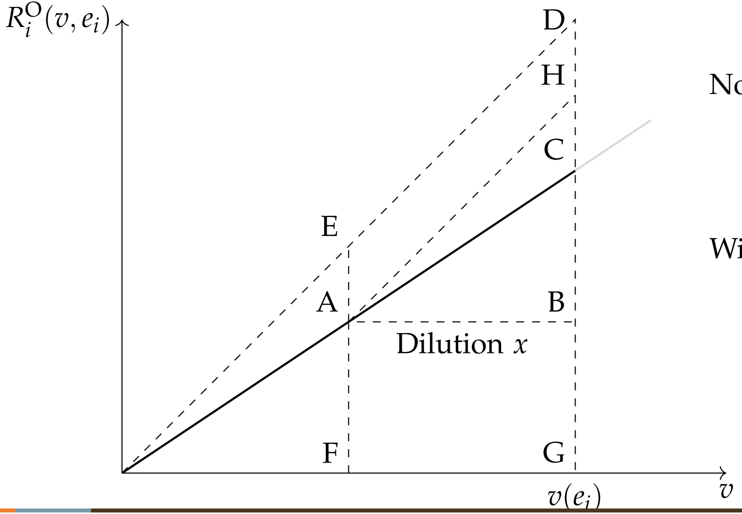
$$\frac{\partial R_i^{\mathrm{O}}(w, \boldsymbol{h})}{\partial w} = \alpha_i < 1$$

And that of the principal by

$$\frac{\partial J(\boldsymbol{h}|\boldsymbol{R})}{\partial w} = 1 - \frac{\partial R_i^{\mathrm{O}}(w, \boldsymbol{h})}{\partial w} = 1 - \alpha_i > 0$$

Diluting the holdout means diluting the principal ⇒ (RP) violated

Graphic Representation: Non-credible dilution w. Equity



No Dilution:

P gets CD

A_i gets CG

With Dilution x:

P gets $EA = DH < CD$

A_i gets $AF > CG - x$

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Debt "Optimality"

Debt contracts are

most sensitive in distress so that credible dilution facilitates restructuring

least sensitive in normal times so that no excessive dilution

R2: Higher Commitment Could Backfire

Problem Reduction

A contract $\boldsymbol{R}$ is a $(2^N + 1)$ dimensional object! Hard to characterize!

P's continuation payoff at $\boldsymbol{h}$ only depends eqm. punishment $x(\boldsymbol{h})$

Fully characterized by dynamics of

min punishment $\underline{x}(\boldsymbol{h})$ so that (IC) met

max punishment $\bar{x}(\boldsymbol{h})$ so that (RP) met

Commitment δ only affects P through credibility constraint (i.e., through $x(\boldsymbol{h})$)

NB: Interval structure guaranteed by A2

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Limited Commitment: Original Problem

How does δ (commitment) affect the principal's value $J(\mathbf{0})$

Recall that P's value at $\boldsymbol{h}$ is

$$\max_{\boldsymbol{R}} J(\boldsymbol{h}|\boldsymbol{R}) \equiv v(\boldsymbol{h}) - \left[\boldsymbol{h} \cdot \boldsymbol{R}^{\mathrm{O}} + (\mathbf{1} - \boldsymbol{h}) \cdot \boldsymbol{R}\right]$$

subject to IC

$$\boldsymbol{R} \in \mathcal{I}(h)$$

and RP

$$J(\boldsymbol{h} + e_i|\boldsymbol{R}) \geq \delta J(\boldsymbol{h} + e_i|\tilde{\boldsymbol{R}}) \qquad \forall \tilde{\boldsymbol{R}} \in \mathcal{C}(\boldsymbol{h} + e_i) \quad \text{for all} \quad i \in \xi(\boldsymbol{h}) := \{i : h_i = 0\}$$

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Limited Commitment: Reformulation with Punishment

The problem can be reformulated as choosing $x \in \mathbb{R}$ (punishment) to maximize

$$J(\boldsymbol{h}|x) := v(\boldsymbol{h}) - \left[x + \boldsymbol{h} \cdot R^{\mathrm{O}}\left(v(\boldsymbol{h}) - x, \boldsymbol{h}\right)\right] \qquad \text{(obj. reformulated)}$$

such that punishment x exceeds tendering agents' outside options

$$x \geq \underline{x}(\boldsymbol{h}) := \sum_{i \in \xi(\boldsymbol{h})} R_i^{\mathrm{O}}\left(v(\boldsymbol{h}+e_i) - \bar{x}(\boldsymbol{h}+e_i), \boldsymbol{h}+e_i\right) \qquad \text{(IC aggregated)}$$

but not exceeds max punishment in *dual* problem at $\boldsymbol{h} - e_i$ for any $i \notin \xi(\boldsymbol{h})$

$$J(\boldsymbol{h}|x) \geq \delta J(\boldsymbol{h}) \overset{\text{A2}}{\Longleftrightarrow} x \leq \bar{x}(\boldsymbol{h}) := \max\left\{x \in [0, v(\boldsymbol{h})] : J(\boldsymbol{h}|x) = \delta J(\boldsymbol{h})\right\}$$

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Limited Commitment: Equity Example

With equity, $\bar{x}(\boldsymbol{h}) = \underline{x}(\boldsymbol{h})$ (Recall R1)

Max punishment $\bar{x}$ satisfies recursion with initial condition $\bar{x}(\mathbf{1}) = 0$

$$\bar{x}(\boldsymbol{h}) = (1-\delta)v(\boldsymbol{h}) + \delta \sum_{i \in \xi(\boldsymbol{h})} \alpha_i (v(\boldsymbol{h} + e_i) - \bar{x}(\boldsymbol{h} + e_i))$$

Punishment = Loss due to discounting + Discounted payoff to tendering shares

Note: $\bar{x}$ has an oscillating structure

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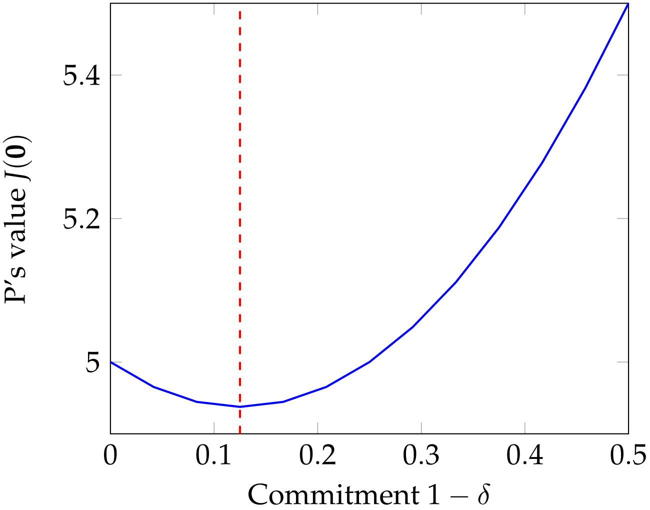
Dynamics of Punishment w. Equity: Intuition

Credible punishment has oscillating structure

At $\boldsymbol{h}$ if P can impose higher punishment upon deviation $\boldsymbol{h} + e_i$

$\implies$ P more willing to renegotiate at $\boldsymbol{h}$ $\implies$ Lower credible punishment at $\boldsymbol{h}$

R2: Higher Commitment Might Backfire: 3-agent case



Intuition

Consider path A_i, A_j deviate sequentially

$(+)$ Higher commitment makes punishment to A_i at e_i more credible

Lower on-path payment to A_i $\implies$ Higher value to P

$(-)$ Higher commitment also makes punishment to A_j at $e_i + e_j$ more credible

Lower payment to A_j at e_i $\implies$ Less credible punishment to A_i

$\implies$ Higher on path payment to A_i $\implies$ Lower value to P

Second $(-)$ effect dominates when commitment low as renegotiation more likely

Closed-Form Solution and Shapley Value

Let $\Sigma(\xi(h))$ be the set of all permutations on tendering agents $\xi(h)$

$$\bar{x}(\boldsymbol{h}) = (1-\delta)v(\boldsymbol{h}) + \sum_{k=1}^{|\xi(\boldsymbol{h})|} \frac{(-\delta)^{k+1}}{(|\xi(\boldsymbol{h})|-k)!} \sum_{\sigma \in \Sigma(\xi(\boldsymbol{h}))} \left(\prod_{s=1}^{k} \alpha_{\sigma(s)} \right) v \left(\boldsymbol{h} + \sum_{s=1}^{k} e_{\sigma(s)} \right)$$

Resembles Generalized Shapley Value (cf. Gul 89, Stole–Zwiebel 96, etc)

$$\psi_C(v) = \sum_{T \subset N \backslash C} \sum_{S \subset C} \frac{(N-|T|-|C|)!|T|!}{(N-|C|+1)!} (-1)^{|C|-|S|} v(S \cup T)$$

NB: P's lack of full bargaining power stems from her lack of full commitment

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…limits ability to punish holdouts today

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Extension: Property Rights Protection

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Baseline model assumes dilutability

- Sometimes investors protected by property rights (e.g., houses, collateral)
- Property rights undilutable by contracts (Ayotte–Bolton 11)

Serta Simmons created super-priority debt in uptier-transaction

- Existing secured creditors got diluted
- New York court confirmed legality in landmark ruling

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Question

Q3: Does weaker investor protection help restructuring?

Results with Property Rights Protection

Full Commitment Benchmark:

BM3: Weaker investor protection always help restructuring

Limited Commitment Extension:

R3: It sometimes hurts restructuring, depending on holdout's payoff sensitivity

Debt holdout: Large decrease in protection might help (regime switch)

General contracts: Small decrease might also help when asymmetric

Property Rights Protection

A$_i$'s utility has an additional *constant* term π_i for property value

$$u_i = h_i \left(R_i^O + \pi_i\right) + (1 - h_i)\, R_i$$

E.g., liquidation value of collateral

NB: State-contingent protection (e.g., CDS) not included (cf. Bolton–Oehmke 11)

BM3: Weaker Protection Helps Restructuring

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Lower π_i always leads to a higher value for P with full commitment

BM3: Higher Protection Hinders Restructuring: Proof

Only π_i needs to be compensated when dilution $\bar{x}(e_i)$ maxed out

$$R_i(v(\mathbf{0}), \mathbf{0}) \geq R^O(v(e_i) - \bar{x}(e_i), e_i) + \pi_i \qquad \text{(IC for A}_i\text{)}$$

Restructuring is easier when investors are less protected

R3: Weaker Protection Could Hinder Restructuring

R3: Weaker Protection Could Hinder Restructuring

Lower π_i could lead to a lower value for P with limited commitment

R3: Weaker Protection Hinders Restructuring: Proof

Suppose 2 creditors with $D_i = 1$ and $\pi_i \in (1/2, 3/2)$;

Asset value = 4 (resp. 2, 0) when 0 (resp. 1, 2) creditors hold out

Off equilibrium path, P needs to pay tendering agent A_j at least π_j

Holdout A_i gets paid in full if $\pi_j < 1$; 0 otherwise $\implies R_i^O = \mathbb{1}_{\pi_j < 1}$

R3: Weaker Protection Hinders Restructuring: Proof Sketch

Suppose $\pi_j \in (1, 3/2)$ drops to $\pi_j - \Delta\pi_j \in (1/2, 1)$

Payment to A_j goes down by $\Delta\pi_j$ through IC as renegotiation unaffected

$$R_j \geq \mathbb{1}_{\pi_i < 1} + \pi_j$$

Payment to A_i goes up by 1 through IC as credible punishment higher

$$R_i \geq \mathbb{1}_{\pi_j < 1} + \pi_i$$

Overall, restructuring is $1 - \Delta\pi_j$ more expensive when A_j less protected

R3: Weaker Protection Hinders Restructuring: Intuition

(+) Weaker protection decreases on-path compensation, facilitating restructuring

(−) Weaker protection decreases off-path compensation, hindering restructuring

P can no longer credibly pay holdouts less because tendering agents demand less

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Some Robustness Checks

Robustness: v also function of $\boldsymbol{R}$

Baseline: when v is not a function of $\boldsymbol{R}$

One dollar given to $\boldsymbol{R}$ holders

One dollar loss to $\boldsymbol{R}^{\mathrm{O}}$ holders

When v is a function of $\boldsymbol{R}$

One dollar given to $\boldsymbol{R}$ holders

More or less than one dollar loss to loss to $\boldsymbol{R}^{\mathrm{O}}$ holders

But relative distribution between P and A_i not affected by this modification

Robustness: Uncertainty and Risk-aversion

With risk-aversion

- P can punish holdouts by giving then less
- P can also punish holdouts by making their claims riskier

But P is also hurt if the change also makes her own claim riskier

- assuming same risk-bearing capacity

Empirical Relevance

Cross-sectional Patterns in Private Policies (R1)

Heterogenous tools used to address holdouts in different settings

- AMC restructured its $2.6B debt by offering secured for unsecured debt
- Elon Musk offered cash to buy Twitter for $43B

Explained by R1: Credible punishment determined by holdout's payoff sensitivity

- Equity has same priority with P and cannot be credibly punished

Evidence that Higher Commitment Can Help or Hurt (R2)

Conflicting evidence on effect of CACs (a device enhancing sovereign commitment)

- Some papers find CACs increase borrowing costs (Almeida 20)
- Others decrease (Chung-Papaioannou 21)

Reconciled by R2: Higher commitment can help or hurt

- Higher commitment to punish makes sovereign more likely to renegotiate

Policy Implications

Policy proposal: Replace debt with equity-like securities

Idea: Equity less valuable in distress, so easier to restructure

My paper casts doubt: Might be harder as punishing holdouts hurts sovereign (R1)

Policy proposal: Limit holdout recovery in court

Idea: Punishing holdouts more credible, so easier to restructure

My paper casts doubt: Might be harder as sovereign more likely to renegotiate (R2)

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Conclusion

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Holdout problems are essentially commitment problems

Credible punishment depends on holdout's payoff sensitivity

Commitment to punishing holdouts could backfire via renegotiation

Protecting investors could benefit principal, hurting investors

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Commitment to punishing holdouts could backfire via renegotiation

Protecting investors could benefit principal, hurting investors

Next Step

New concern in sovereign debt market

- Some lenders (e.g., China) might strike private deals with sovereign

How does lack of transparency affect restructuring and renegotiation?

- Difficult *interim informed principal problem*

Appendix

Credibility: Formal Definition

Incentive for Principal (δ-dominance)

$\boldsymbol{R}$ δ-dominates $\tilde{\boldsymbol{R}}$ ($\boldsymbol{R} \succeq_{\delta} \tilde{\boldsymbol{R}}$) at $\hat{\boldsymbol{h}} \Leftrightarrow J(\hat{\boldsymbol{h}}|\boldsymbol{R}) \geq \delta J(\hat{\boldsymbol{h}}|\tilde{\boldsymbol{R}})$, that is

$$\underbrace{v(\hat{\boldsymbol{h}}) - \sum_{i=1}^{N} u_i(\hat{h}_i|\hat{\boldsymbol{h}}_{-i}, \boldsymbol{R})}_{\text{P's payoff under } \boldsymbol{R} \text{ at } \hat{\boldsymbol{h}}} \geq \delta \underbrace{\left[v(\hat{\boldsymbol{h}}) - \sum_{i=1}^{N} u_i(\hat{h}_i|\hat{\boldsymbol{h}}_{-i}, \tilde{\boldsymbol{R}}) \right]}_{\text{P's payoff under } \tilde{\boldsymbol{R}} \text{ at } \hat{\boldsymbol{h}}}$$

NB: High δ proxy for low commitment (discount factor, prob. of renegotiation)

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NB: High δ proxy for low commitment (discount factor, prob. of renegotiation)

Incentive for Principal (δ-dominance)

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NB: High δ proxy for low commitment (discount factor, prob. of renegotiation)

Strong δ-Credibility

$\boldsymbol{R}$ is strongly δ-credible at $\boldsymbol{h}$ if

$\boldsymbol{R}$ is IC at $\boldsymbol{h}$ for agents

At deviation profile $\hat{\boldsymbol{h}}$, $\boldsymbol{R}$ δ-dominates all IC contracts at $\hat{\boldsymbol{h}}$

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Formally,

$$\mathcal{S}(\boldsymbol{h}) = \left\{ \boldsymbol{R} \in \mathcal{I}(h) : \boldsymbol{R} \succeq_\delta \tilde{\boldsymbol{R}} \quad \forall \tilde{\boldsymbol{R}} \in \mathcal{I}(\hat{\boldsymbol{h}}) \quad \forall \hat{\boldsymbol{h}} : ||\hat{\boldsymbol{h}} - \boldsymbol{h}|| = 1 \right\}$$

δ-Credibility

$\boldsymbol{R}$ is δ-credible at $\boldsymbol{h}$ if

$\boldsymbol{R}$ is IC at $\boldsymbol{h}$ for agents

At deviation profile $\hat{\boldsymbol{h}}$, $\boldsymbol{R}$ δ-dominates all δ-*credible* contracts

δ-Credibility

$\boldsymbol{R}$ is δ-credible at $\boldsymbol{h}$ if

$\boldsymbol{R}$ is IC at $\boldsymbol{h}$ for agents

At deviation profile $\hat{\boldsymbol{h}}$, $\boldsymbol{R}$ δ-dominates all δ-*credible* contracts

Formally,

$$\mathcal{C}(\boldsymbol{h}) = \left\{ \boldsymbol{R} \in \mathcal{I}(h) : \boldsymbol{R} \succeq_\delta \tilde{\boldsymbol{R}} \quad \forall \tilde{\boldsymbol{R}} \in \mathcal{C}(\hat{\boldsymbol{h}}) \quad \forall \hat{\boldsymbol{h}} : ||\hat{\boldsymbol{h}} - \boldsymbol{h}|| = 1 \right\}$$

Existence and Uniqueness

Thm 1: Set of δ-credible contracts exists and is unique

$\mathcal{C}(\cdot)$ exists and is unique for any $\delta \in [0, 1]$

Thm 1: $\mathcal{C}(\cdot)$ exists and is unique

At any $\boldsymbol{h} \neq \mathbf{0}, \mathbf{1}$

Persuading A_i to holdout is easy

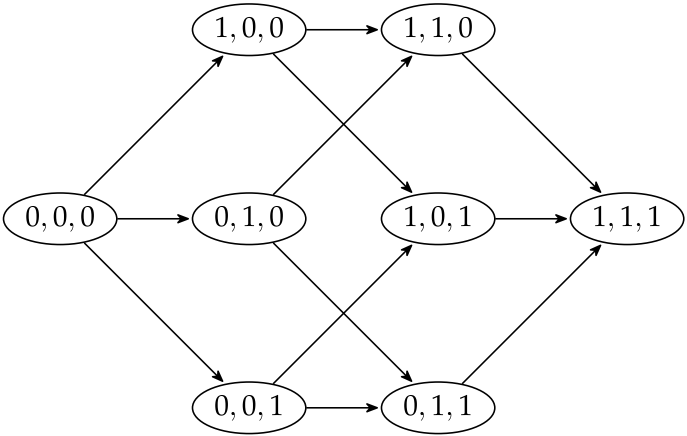
Just reduce tendering payoff to 0 $\implies$ Credibility has no bite

Persuading A_i to tender is difficult

$J(\boldsymbol{h} + e_i)$ limits the maximum possible punishment

Only credibility constraint at $\boldsymbol{h} + e_i$ for $i \in \xi(\boldsymbol{h})$ matters $\implies$ finite induction

Credibility dependence structure: 3-agent



Limited Commitmnet: Dual Problem

$$\max_x x$$

such that

$$x \geq \underline{x}(\boldsymbol{h})$$

and

$$J(\boldsymbol{h}|x) \geq \delta J(\boldsymbol{h})$$

Subproblem 1

For each $\boldsymbol{h}$, fix a number $J(\boldsymbol{h})$, solve for

$$\mathcal{C}(\boldsymbol{h}|J) = \left\{ R : \begin{array}{ll} u_i(h_i|h_{-i}, R) \geq u_i(h_i'|h_{-i}, R) \quad \forall h_i' \in H_i \; \forall \; i \in \mathcal{N} \quad \& \\ v(\hat{h}) - \sum_{i=1}^{N} u_i(\hat{h}_i|\hat{h}_{-i}, R) \geq \delta \, J(\hat{h}) \quad \forall \, \hat{\boldsymbol{h}} \in \mathcal{B}(\boldsymbol{h}) \end{array} \right\}$$

$\mathcal{C}(\cdot|J)$ well-defined given $J(\cdot)$

Subproblem 2

Given feasible contracts $\mathcal{C}(\boldsymbol{h})$, solve for

$$J(\boldsymbol{h}|\mathcal{C}) = \sup_{\boldsymbol{R} \in \mathcal{C}(\boldsymbol{h})} v(\boldsymbol{h}) - \sum_{i=1}^{N} u_i(h_i | h_{-i}, \boldsymbol{R})$$

$J(\boldsymbol{h}|\mathcal{C})$ attainable as $\mathcal{C}(\boldsymbol{h})$ closed for each $\boldsymbol{h}$

$\implies$ Solve for fixed point of $J(\boldsymbol{h}) = J(\boldsymbol{h}|\mathcal{C}(\boldsymbol{h}|J))$

Solve for $J(\boldsymbol{h}|\mathcal{C}(\boldsymbol{h}|J))$

Optimal contracts on

$$\mathcal{C}(\boldsymbol{h}|J) = \left\{ R : \begin{array}{ll} u_i(h_i|h_{-i},R) \geq u_i(h_i'|h_{-i},R) \quad \forall h_i' \in H_i \, \forall \, i \in \mathcal{N} & \& \\ v(\hat{h}) - \sum_{i=1}^{N} u_i(\hat{h}_i|\hat{h}_{-i},R) \geq \delta \, J(\hat{h}) \quad \forall \, \hat{\boldsymbol{h}} \in \mathcal{B}(\boldsymbol{h}) & \end{array} \right\}$$

binds IC to minimize payment on path

minimizes RHS of IC subject to credibility constraints

Asymmetry in IC

To solve for $J(\boldsymbol{h}|\mathcal{C}(\boldsymbol{h}|J))$

IC for holdout is easy: Simply set term in x to zero

$$x + \boldsymbol{h} \cdot \boldsymbol{R}^{\mathrm{O}}(v - x, \boldsymbol{h})$$

IC for tendering is difficult: Setting one of $\boldsymbol{R}^{\mathrm{O}}$ to zero might be costly

Require excessively large x and could hurt P

Argentina Sovereign Debt Crisis

Argentina struggled with holdouts due to low commitment

In 2005, Argentina in debt distress: exchange offer to deleverage

- Offers creditors 70% haircut

Argentina paid majority that accepted, defaulted on hold-out creditors

- Holdouts sued in NY court saying selective default violated pari passu clause

Decade-long legal battle led to ruling in favor of holdouts

- Court froze Argentina's US assets leading to renewed distress

Capital market access blocked for 15 yrs & loss amounts to $11.3B (Hébert–Schreger)

- Market responded making CACs standard (or mandatory) in sovereign bonds

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Weak Consistency

Axiom: Weak Consistency

WC (Adapted from Moulin 2000): R doesn't alter *allocation* of R^{O}

Let $x = \sum_{i=1}^{N}(1-h_i)\cdot R_i(v,\boldsymbol{h})$ be payoff to tendering shares, "dilution" of R^{O}

WC requires

$$\tilde{R^{\text{O}}}(v,\boldsymbol{h}) = R^{\text{O}}(v-x,h)$$

Implication: P cannot selectively dilute certain contracts Back

Problem Reduction

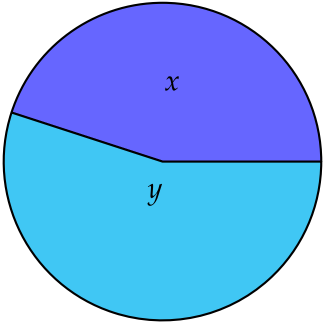
New contracts determine x allocated to R holders

$$\tilde{R}(x, h) = R(v, \boldsymbol{h})$$

Old contracts share the remaining $y = v - x$

$$R^{\mathrm{O}}(y, h) = \tilde{R^{\mathrm{O}}}(v, \boldsymbol{h})$$

WC reduces problem to design of R. $\tilde{R^{\mathrm{O}}}$ unnecessary Back



Classic Papers

Example 1: Takeover (Grossman–Hart 80)

Call $\xi(h) = \{i \in \mathcal{N} : h_i = 0\}$ the set of tendering agents

Value enhanced if majority tenders

$$v(h) = \mathbb{1}_{|\xi(h)| \geq 50\%}$$

Shareholder gets a share of asset value given dilution factor d

$$R_i^{\mathrm{O}}(v, \boldsymbol{h}) = \frac{v - d}{N}$$

Gets R_i if tendering

Back

Example 2: Bond Buyback Boondoggle (Bulow–Rogoff 88)

Asset value consists of random payoff and internal cash: $v(h)(\omega) = X(\omega) + W(h)$

Holdouts get paid in full or pledgeable value pro rata: $R_i^{O}(v, \boldsymbol{h}) = \min\left\{\frac{\theta v}{N-|\xi(h)|}, \frac{D}{N}\right\}$

Tendering creditor gets R_i

Holding out increases marginal value threshold

Back

Example 3: Debt Restructuring (Gertner–Scharfstein 91)

No-cash-shortage case: Asset value =random interim payoff+ project return

$$v(h)(\omega) = X(\omega) + Y - I$$

$$R_i^{\mathrm{O}}(v, \boldsymbol{h}) = \min\left\{\frac{\theta v}{N - |\xi(h)|}, \frac{D}{N}\right\}$$

Senior Debt

$$R_i(v, \boldsymbol{h}) = \min\left\{\frac{1}{|\xi(h)|}\left(v - \frac{N - |\xi(h)|}{N} qD\right), \frac{pD}{N}\right\}$$

Back

Existing Contracts

A_i's payoff is $h_i\, R_i^{\mathrm{O}}(v, \boldsymbol{h}, R) + (1 - h_i)\, R_i(v, \boldsymbol{h})$ where

v is value of asset

P's payoff is $v - \langle h, R^{\mathrm{O}}(v, \boldsymbol{h}, R)\rangle - \langle \mathbf{1} - h, R(v, \boldsymbol{h})\rangle$

Assumption: $\langle h, R^{\mathrm{O}}(\cdot, h, R)\rangle$ is 1-Lipschitz $\forall\, h, R$

Existing Contracts (Obsolete)

Existing contracts are potentially *inconsistent* $\implies$ Model payoff instead of contracts

Let R^{O} be system (E.g. bankruptcy) specifying payoff given holding structure $h = \{h_i\}_i$

- A_i's contract receives $R_i^{\mathrm{O}}(v, \boldsymbol{h})$ when
  - Asset value is v
  - A_i has h_i shares of his contract outstanding (initially $h_i = 1$)
- P receives $v - \langle h, R^{\mathrm{O}}(v, \boldsymbol{h}) \rangle$

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Exchange Offer

P offers new contracts R in exchange for old

A_i receives $(1 - h_i)\, R_i(v, \boldsymbol{h})$ from tendering $1 - h_i$

A_i receives $h_i\, \tilde{R^O}_i(v, \boldsymbol{h})$ from non-tendering shares

NB: $\tilde{R^O}$ differs from R^O due to contractual externality

NB: P cannot issue contracts to herself/outsider (cf. Mueller-Panunzi 04)

Simplifying notations

We write

$$R_i(h_i|h_{-i}) := R_i(v(h), h) \text{ for } h = (h_{-i}, h_i)$$

$$R_i^{\mathrm{O}}(h_i|h_{-i}, R) := R_i^{\mathrm{O}}\left(v(h) - \sum_{i=1}^{N}(1-h_i)R_i(v(h), h), h\right) \text{ for } h = (h_{-i}, h_i)$$

$$u_i(h_i|h_{-i}, R) := (1-h_i)\cdot R_i(h_i|h_{-i}) + h_i \cdot R_i^{\mathrm{O}} \cdot (h_i|h_{-i}, R)$$

Maximum Possible Punishment

Total payment to all agents off path at $\hat{h}$ without renegotiation

$$x(\hat{h}, R) + \hat{\boldsymbol{h}} \cdot \boldsymbol{R}^{\mathrm{O}}(v - x(\hat{h}, R), \hat{\boldsymbol{h}})$$

Credible only if total payment at $\hat{h}$ w/o reneg. $\leq$ payment at $\hat{h}$ w/ reneg.

$$x(\hat{h}, R) + \hat{\boldsymbol{h}} \cdot \boldsymbol{R}^{\mathrm{O}}(v - x(\hat{h}, R), \hat{\boldsymbol{h}}) \leq \min_{x}\{x + \hat{\boldsymbol{h}} \cdot \boldsymbol{R}^{\mathrm{O}}(v - x, \hat{\boldsymbol{h}})\}$$

One minimizer $x = 0$. Other minimize rs might exist depending on shape of $R_i^{\mathrm{O}}(\cdot, \hat{\boldsymbol{h}})$

Derivation of 3-agent example

Higher Commitment Hinders Restructuring: 3-agent

Assume asset value v_k when k agents hold out and $\alpha_i = 1/3$

No credible punishment when all hold out: $\bar{x}(\mathbf{1}) = 0$

Punishment only via discounting when 2 agents hold out: $\bar{x}(e_i + e_j) = (1 - \delta)v_2$

... also via off-path reneg. when 1 agent holds out: $\bar{x}(e_i) = (1 - \delta)v_1 + \frac{2}{3}\delta^2 v_2$

P's value quadratic in δ

$$J(\mathbf{0}) = v_0 - \delta v_1 + \frac{2}{3}\delta^2 v_2$$

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Intermediate Credibility

k-step δ-credible contracts

$\boldsymbol{R}$ is k-step δ-credible at $\boldsymbol{h}$ if

$\boldsymbol{R}$ is IC at $\boldsymbol{h}$ for agents

At deviation profile $\hat{\boldsymbol{h}}$, $\boldsymbol{R}$ δ-dominates all $(k-1)$-step δ-*credible* contracts

$$\mathcal{C}_k(\boldsymbol{h}) =$$

$$\left\{ R : \begin{array}{l} u_i(h_i | h_{-i}, R) \geq u_i(h_i' | h_{-i}, R) \quad \forall h_i' \in H_i \; \forall i \in \mathcal{N} \quad \& \\ v(\hat{h}) - \sum_{i=1}^{N} u_i(\hat{h}_i | \hat{h}_{-i}, R) \geq \delta \left[v(\hat{h}) - \sum_{i=1}^{N} u_i(\hat{h}_i | \hat{h}_{-i}, \tilde{R}) \right] \; \forall \tilde{R} \in \mathcal{C}_{k-1}(\hat{\boldsymbol{h}}) \; \forall \hat{\boldsymbol{h}} \in \mathcal{B}(\boldsymbol{h}) \end{array} \right\}$$

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Lemmata on k-step δ-credible contracts

Even (resp. odd) subsequences are decreasing (resp. increasing)

$$\mathcal{C}_{2k+2}(\boldsymbol{h}) \subset \mathcal{C}_{2k}(\boldsymbol{h}); \quad \mathcal{C}_{2k-1}(\boldsymbol{h}) \subset \mathcal{C}_{2k+1}(\boldsymbol{h})$$

δ-credible contracts are limiting case

$$\liminf_{k\to\infty} \mathcal{C}_k(\boldsymbol{h}) \subset \mathcal{C}(\boldsymbol{h}) \subset \limsup_{k\to\infty} \mathcal{C}_k(\boldsymbol{h})$$

Unanimity

How to incorporate unanimity?

Let A_1 be "Dead Weight Loss" who always tenders by setting

$$R_1^{O}(v, \boldsymbol{h}) = 0$$

Deal off $\iff$ Entire asset goes to A_1

$$R_1(v, \boldsymbol{h}) = v(\boldsymbol{h}) \quad \forall \boldsymbol{h} \neq \mathbf{0}$$

Example: Unanimity

Asset value 100 if anyone holds out, 200 if both tenders. Each has 50% equity.

P offers 51 if both tender; cancels deal otherwise.

A_1 \ A_2	Tender	Hold out
Tender	51, 51	50, 50
Hold out	50, 50	50, 50

Example

Example: Takeover with Cash

Firm Value $v = \$50 \times (2 + \#\text{tendering agents})$; A_1 and A_2 each 50% equity

P offers \$51 to acquire shares and costs \$1 to implement deal

$v = 100$	$v = 150$	$v = 200$
	A_2: 51	A_1: 51 A_2: 51
A_1: 50 A_2: 50	A_1: 75	
P: 0	P: $24 - 1 = 23$	P: $98 - 1 = 97$

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A_1: 50 A_2: 50	A_1: 75	
P: 0	P: $24 - 1 = 23$	P: $98 - 1 = 97$

Example: Takeover with More Cash

Firm Value $v = \$50 \times (2 + \#\text{tendering agents})$; A_1 and A_2 each 50% equity

P offers \$100 to acquire shares and costs \$1 to implement deal

$v = 100$

A_1: 100 A_2: 100

P: 0

$v = 200$

A_1: 100 A_2: 100

P: $0 - 1 = -1$

Example: Takeover with Moderate Cash

Firm Value $v = \$50 \times (2 + \#\text{tendering agents})$; A_1 and A_2 each 50% equity

P offers \$76 to acquire shares and costs \$1 to implement deal

$v = 100$	$v = 150$	$v = 200$
	A_2: 76	A_1: 76 A_2: 76
A_1: 50 A_2: 50	A_1: 75	
P: 0	P: $-1 - 1 = -2$	P: $48 - 1 = 47$

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A_1: 50 A_2: 50	A_1: 75	
P: 0	P: $-1 - 1 = -2$	P: $48 - 1 = 47$

Example: Takeover with Debt

Firm Value $v = \$50 \times (2 + \#\text{tendering agents})$; A_1 and A_2 each 50% equity

P offers debt $D = \$51$ to acquire shares and costs \$1 to implement deal

$v = 100$	$v = 150$	$v = 200$
(no tender)	A_2: 51	A_1: 51, A_2: 51
A_1: 100, A_2: 100	A_1: 49.5	
P: 0	P: $49.5 - 1 = 48.5$	P: $98 - 1 = 97$

Example: Takeover with Debt

P offers debt $D = \$67$ to acquire shares and costs \$1 to implement deal

$v = 100$	$v = 300$	$v = 400$
	A_2: 67	A_1: 102 A_2: 102
A_1: 50 A_2: 50	A_1: 66	
P: 0	P: $66 - 1 = 65$	P: $196 - 1 = 195$

Discarded Slides

Holdout Problems Are Pervasive

Land assembly, corporate takeovers, debt restructuring, ...

Problem is same in many settings but mechanisms addressing it different

- E.g., senior debt in corporate restructuring, cash bids in takeovers

Mechanism punishing holdouts solves problem but can't commit to punishment

- See Argentine restructuring: holdouts sued and got paid in full

Policies address holdout problem by targeting commitment to punish holdouts

- Some increase commitment, e.g. CACs, some decrease it, e.g. pari passu clauses

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Land assembly, corporate takeovers, debt restructuring, …

Problem is same in many settings but mechanisms addressing it different

- E.g., senior debt in corporate restructuring, cash bids in takeovers

Mechanism punishing holdouts solves problem but can't commit to punishment

- See Argentine restructuring: holdouts sued and got paid in full

Policies address holdout problem by targeting commitment to punish holdouts

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General characterization with l.c.

Define

$$\text{Delta} = \frac{\Delta \text{ Contract Payoff}}{\Delta \text{ Asset Value}}$$

If Delta < 1, contingent contracts cannot do better than non-contingent

General Contingent Contracts

Full value extraction achieved by diluting holdout off-path

NB: Implementation resembles consent payment, ruled legal by English high court

General Contingent Contracts: Proof

Pay every agent $R_i = \varepsilon \geq 0$ if all tenders and 0 if no one tenders

With partial tendering, divide the asset among tendering agents

$$R_i(v(\boldsymbol{h}), \boldsymbol{h}) = \begin{cases} 0 & \text{if } i \notin \xi(\boldsymbol{h}) \\ \frac{v(\boldsymbol{h})}{|\xi(\boldsymbol{h})|} & \text{if } i \in \xi(\boldsymbol{h}) \end{cases}$$

NB: Eqm unique when $\varepsilon > 0$

Example

Asset value 100 if anyone holds out, 200 if both tenders. Each has 50% equity.

P offers 1 if both tender; Senior debt of 100 if one tenders.

A_1 \ A_2	Tender	Hold out
Tender	$\underline{1}, \underline{1}$	$\underline{100}, 0$
Hold out	$0, \underline{100}$	$50, 50$

Intuition

A_i holds out only if outside option valuable

Outside option not valuable when others granted “priority”

P can pick a fight among agents by prioritizing tendering agents

Holdouts’ outside option diluted via contractual externality

Problem: Punishment credible only if P can commit

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Problem: Punishment credible only if P can commit

Intuition

When Delta < 1, reallocating value to tendering agents hurts P

Threat never credible

When Delta $= 1$, dilution cost entirely borne by holdouts, P indifferent

Threat credible