Solving Conflicts over Common-pool Resources

through Stakeholder Delegation

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Resources and institutions

Resource scarcity is a worldwide critical issue:

- Lot of resource stocks facing the "tragedy of the commons" (Hardin, 1968): the conflict between individual and collective interests.

In the vein of the third way of governance (Ostrom, 1990), Blomquist et al. (2010) showed that:

- The management of natural resources at the "Lowest appropriate level" improve the effectiveness and the sustainability of resource management.
- Indirect policies (management delegation) improve the efficiency of the resource management.

The main idea: Involve the users by placing them at the center of a local institutional solution.

Resource-level management

Lot of arguments are in favor of a Resource-level management (*e.g.* Agrawal and Gibson, 2001; Brosius et al., 1998; Kemper et al., 2007; Ostrom et al., 1999; Petit et al., 2017):

- *e.g.* Knowledge of the resource and local conditions, Legitimacy of resource users, Subsidiarity, Stakeholders involvement, Presence and availability of local stakeholders, etc...

Our work takes place on the 6th principle of Ostrom: The availability of a Conflict Resolution mechanism for resource users at a local/available level (Blomquist et al., 2010; Ostrom, 1990).

- Delegate the conflict resolution mechanism to the stakeholders

Delegation in the literature

Delegation has been amply studied:

- Contract design (*e.g.* Laffont and Martimort, 1998; Bolton et al., 2005): *principal-agent's delegation.*
- Behavioral economics (*e.g.* Bartling and Fischbacher, 2011; Fehr et al., 2013): *Willingness or reluctance to delegate.*
- Political science (*e.g.* Epstein and O'Halloran, 1999; Marten, 2019): *Delegation of policy making or military forces.*
- Social psychology (*e.g.* Anderson, 2003; Steffel et al., 2016): *Decision avoidance by delegating.*

Can we use it for appropriation conflicts?

In the field

Management delegation has been observed as successful in case studies:

- With and without stakeholders involvement *in La Mancha aquifers, Spain (Esteban and Albiac, 2012)*
- Resilience of resource-level management to shocks *in Spain (Kahil et al., 2016)*
- Self-restrictions by users *in Pakistan, India, Egypt and Yemen (van Steenbergen, 2006)*
- Delegation of the creation of Water Users Associations (WUA) *in Minquin county, China (Aarnoudse et al., 2012)*
- WUA with conflicts resolution mechanism *in South Africa (Madigele, 2018)*

As shown in Madigele (2018), our mechanism can take place in decentralized institutions.

Research question

Can delegation of decision to a stakeholder solve appropriation conflicts in a Common-Pool resource social dilemma?

We study this question theoretically and experimentally.

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Approval mechanism

We study a situation in which users of the resource can be in conflict due to the appropriation decisions.

As a framework, we use the Approval Mechanism (AM, Masuda et al., 2014; Saijo et al., 2018; Yao et al., 2022).

It allows users to approve or disapprove decisions and in case of conflict, to manage it with an exogenous or endogenous rule.

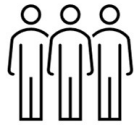
- Our rule: Delegate the collective appropriation decision to a stakeholder

Experimental design

- 126 subjects (mostly students) in 42 groups for 3 treatments recruited on Laboratory of Environmental Economics - Montpellier (LEE-M)
- Subjects were randomly assigned in partner matching in groups of 3 and played in between and within subjects
  S1. All groups are controls (not treated)
  S2. A random part of the groups are treated
- Parameters were calibrated on Yao et al. (2022)
- Side-tasks[1]: SVO, NLE, NEP, CRT, Understanding, Socio-demographic

[1] respectively Murphy and Ackermann (2014); Siegler and Opfer (2003) NLE ;Dunlap et al. (2000); Frederick (2005)

Experimental design



Unregulated (UR)

Stage 1

Extraction

Extractions: x_1, x_2, x_3

Player i's profit:

$$\pi_i(x_i, x_{-i}) = \frac{x_i}{X}(aX - bX^2) + p(w - x_i)$$

Example

Player 1: $x_1 = 4$
Player 2: $x_2 = 7$
Player 3: $x_3 = 8$

$\pi_1(4,7,8) = 134$
$\pi_2(4,7,8) = 159{,}5$
$\pi_3(4,7,8) = 168$

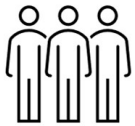
Experimental design

Unregulated (UR)

Stage 1

Extraction

Stage 1



Delegation Mechanism (DM)

Proposal

Example

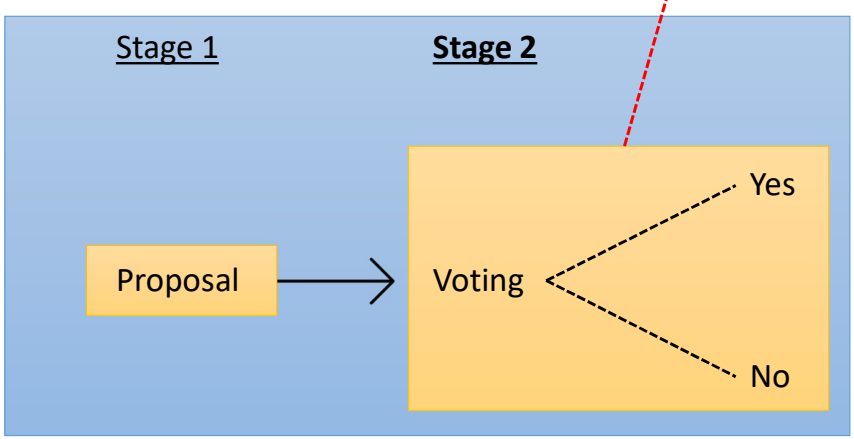
Player 1: $x_1 = 4$
Player 2: $x_2 = 7$
Player 3: $x_3 = 8$

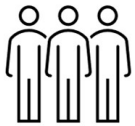
Experimental design

Stage 1

Extraction

Two treatments :
Majority or Unanimity





Delegation Mechanism (DM)

Example

Player 1: $x_1 = 4$
Player 2: $x_2 = 7$
Player 3: $x_3 = 8$

Expected profits:
$\pi_i(4,7,8)$

Only Player 1 votes No

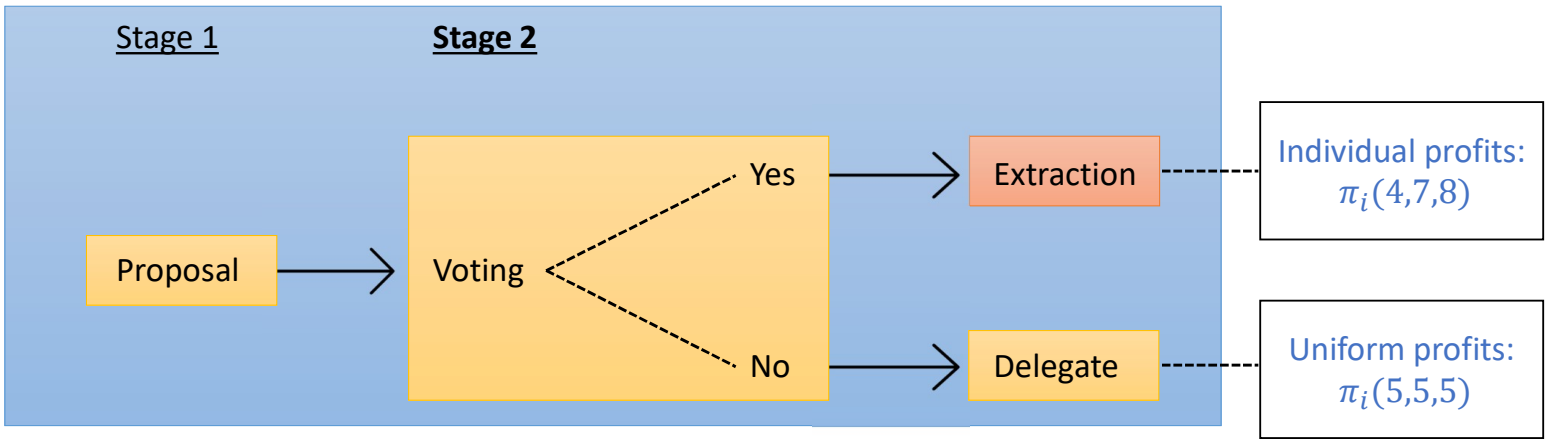
Experimental design

Unregulated (UR)

Stage 1

Extraction

Delegation Mechanism (DM)



Example

Player 1: $x_1 = 4$
Player 2: $x_2 = 7$
Player 3: $x_3 = 8$

Expected profits:
$\pi_i(4,7,8)$

Only Player 1 votes No

Player 3 is randomly designated as Delegate and chooses a unique extraction level:
$x_i \in \{4,5,6,7,8\}$

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Theoretical predictions Predictions

Unregulated CPR:

Stage 1. Players choose the Nash extraction $x_i^* = 6$

Delegation AM CPR:

Stage 2. A delegate chooses the optimal extraction $\hat{x} = 4$ or the closest available extraction if $\hat{x} \notin [\underline{x}, \bar{x}]$

Stage 1. By Backward Elimination of Weakly Dominated Strategies (BEWDS) we predict:

- Delegation under Unanimity approval implements the social optimum in BEWDS
- Delegation under Majority approval is Pareto-improving in BEWDS

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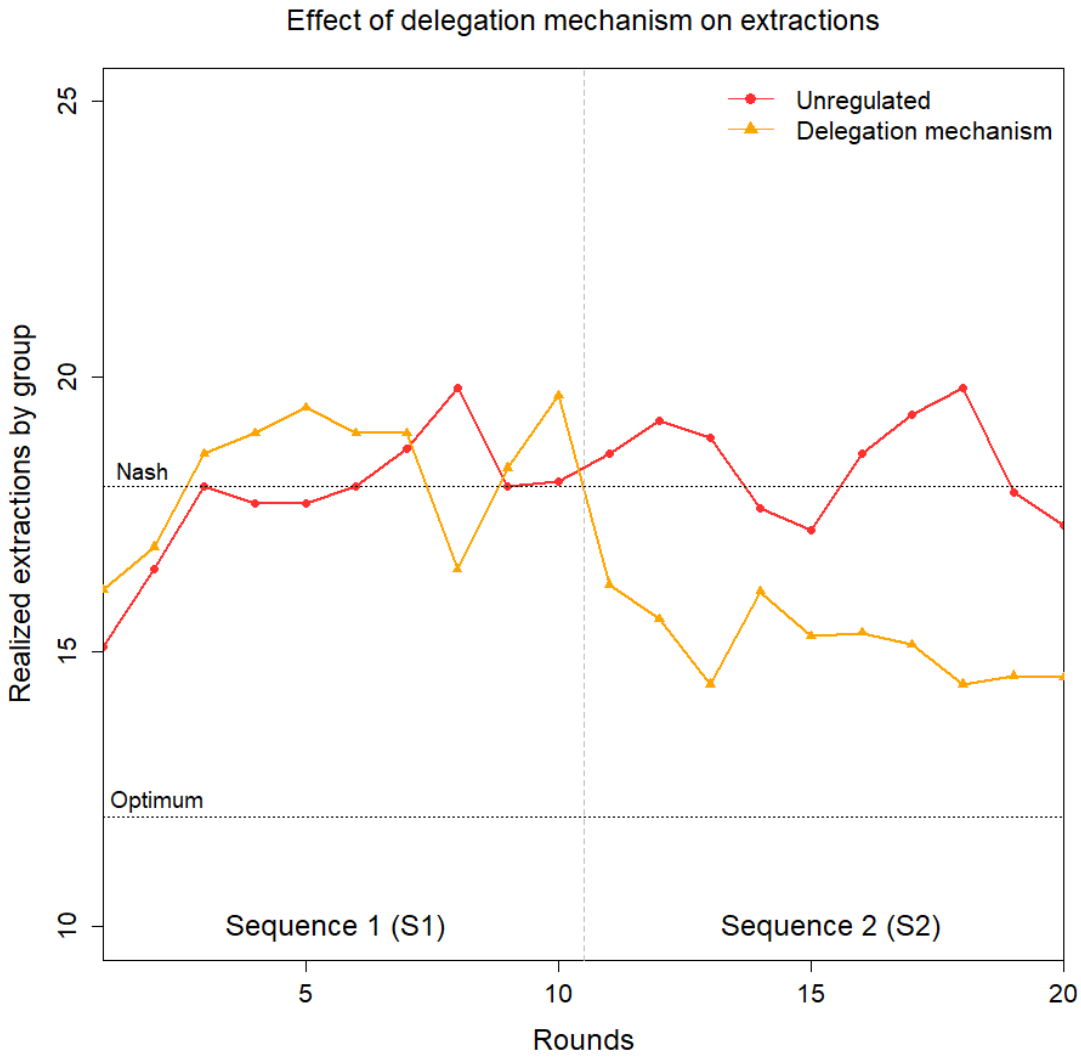
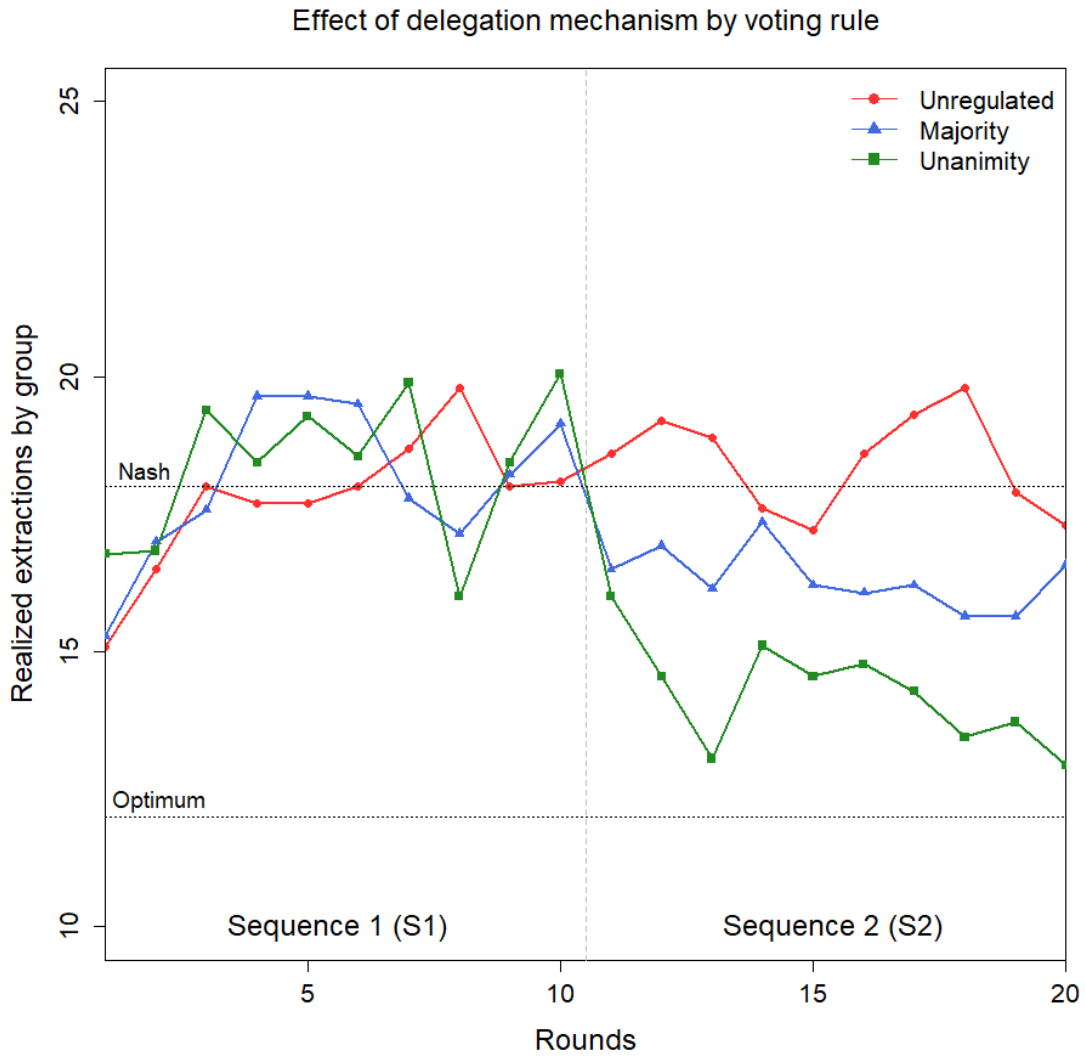
Average group extractions



Average group extractions



Average group extractions

Table 1: Difference-in-differences (DiD) regressions on extractions

	Overall	Majority	Unanimity
	(1)	(2)	(3)
Seq × *Delegate*	-3.771***	-2.444**	-4.802***
	(0.724)	(1.036)	(0.857)
Sequence and Round FE	Yes	Yes	Yes
Group FE	Yes	Yes	Yes
Observations	2520	1440	1680

Note : s.e. are clustered at the group level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

- The implementation of the Delegation AM reduces significantly the level of group extractions.
- The Delegation AM is more efficient under the Unanimity than under the Majority.

Proposals and decisions

		Majority		Unanimity	
		Mean	%	mean	%
Unregulated	Extracted	18.09		18.37	
With Delegation	Proposed	17.52		16.14	
	Approved	16.49	71.4%	14.43	27.2%
	Conflictual	20.02	28.6%	16.79	72.8%
	Delegate's choice	15.75		14.18	
	Extracted	16.33		14.24	

- The implementation of the mechanism reduces proposed extractions.
- The delegates' decisions reduce extractions slightly under the approved level.

Efficiency of delegates

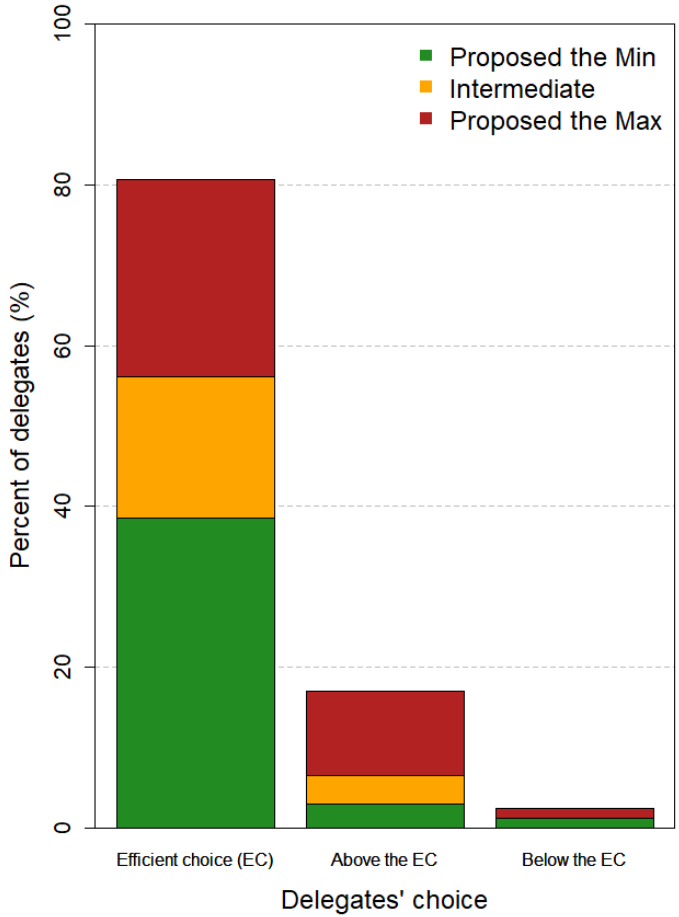
What do we consider as an efficient choice (EC)?

What we observe:

- Most of the delegates choose the efficient extraction (81%): 13.35 units
- A significant part (17%) chooses to over-extract: 21.21 units
- 2% under the EC

Why? We identified two profiles of inefficient delegates:

- Lack of understanding and low result at NLE
- No understanding faults and proposed the higher in Stage 1 (retaliation, punishement)



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Conclusion

1. Delegating the conflict resolution to a stakeholder strongly reduces over-exploitation.
2. Most delegates choose the efficient solution.
3. A significant part of the inefficient delegates' decisions can be explained by a lack of understanding.

Delegating the appropriation conflict resolution mechanism at the resource-level to stakeholders has positive effects on the resource management.

Then, promoting this kind of resource-level mechanism could be an effective indirect policy involving users in the management.

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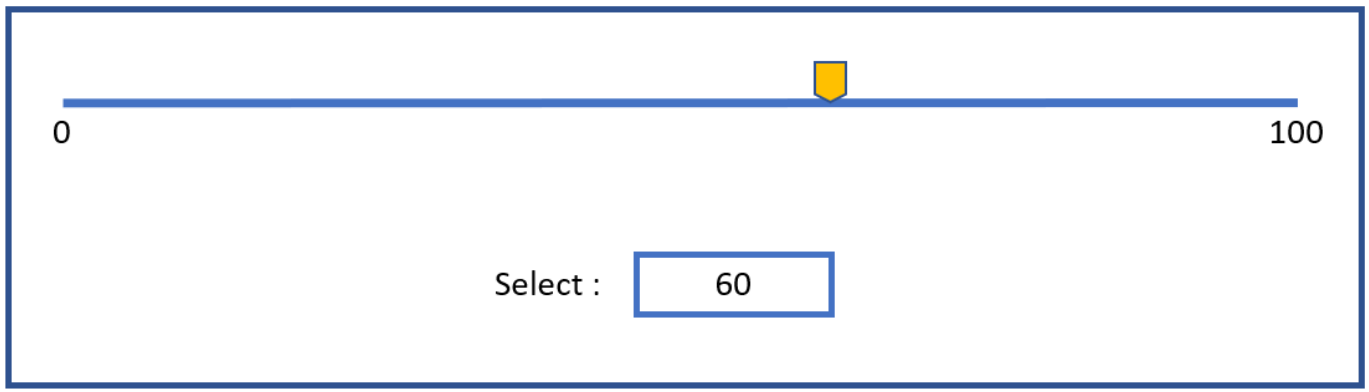
Appendix 1: Number Line Estimation test

Back

e.g. Siegler and Opfer (2003). The Development of Numerical Estimation. *Psychological Science*, 14(3), 237–250.



Appendix 2: Theoretical predictions

Back

Under the Delegation Approval Mechanism, we study the equilibrium by Backward induction as follows:

Stage 2. Considering that it exists at least one strict inequality in $x_1 \leq x_2 \leq x_3$, the delegate does the efficient choice if he can:

$$\pi_i(\hat{x}, \hat{x}, \hat{x}) \geq \pi_i(x_1, x_1, x_1) \geq \pi_i(x_2, x_2, x_2) \geq \pi_i(x_3, x_3, x_3) \qquad (1)$$

Stage 1. By BEWDS, consider for example that $x_1 < x_2 \leq x_3$ and $\forall x \in [\hat{x}, w]$:

- Under Unanimity: As player 1 rejects because $\pi_1(x_1, x_1, x_1) > \pi_1(x_1, x_2, x_3)$, every players choose $\hat{x}$
- Under Majority: Player 2 also rejects if $\pi_2(x_1, x_2, x_3) - \pi_2(x_1, x_1, x_1) < 0$. Players following BEWDS reject any subgame such that $X \geq \alpha$ and accept any subgame that satisfies $x_2 > x_1 \left[\left(\alpha - X^{min} \right) / \left(\alpha - X \right) \right]$ if $X < \alpha$.