Decision Rights: Freedom, Power, and Interference

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Motivation

Why do we value decision rights?
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- for their **instrumental** value:
  - utility associated to achieving an outcome
  - standard assumption in economic models

- beyond the utility associated to achieving an outcome
- reluctance to delegate (Fehr & al. 2013, Bartling & al. 2014)
- reluctance to give up control (Owens & al. 2014)
Motivation

Why do we value decision rights?

- for their **instrumental** value:
  - utility associated to achieving an outcome
  - standard assumption in economic models

- for their **intrinsic** value:
  - beyond the utility associated to achieving an outcome
  - experimental evidence:
    - reluctance to delegate (Fehr & al. 2013, Bartling & al. 2014)
    - reluctance to give up control (Owens & al. 2014)
What we propose

Theoretical model

- decision rights allocation and choice
- individuals value decision rights instrumentally and intrinsically
  - they have procedural motivations
  - they care about the cause of the outcomes
  - freedom, power, and interference
- psychological game theory

Experimental design

- measure the effect of attitudes towards freedom, power, and interference
Procedural motivations

What is “the cause of an outcome”?
Procedural motivations

What is “the cause of an outcome”?

= an individual’s action

- freedom: My actions are the cause of my outcomes
- power: My actions are the cause of others’ outcomes
- interference: Others’ actions are the cause of my outcomes
Procedural motivations

What is “the cause of an outcome”?

≠ an individual’s action

the “freedom of choice” literature has shown that freedom must be defined in the context of a variation in a player’s preferences over the outcomes, i.e. type
Procedural motivations

What is “the cause of an outcome”?  

= an individual's type

- freedom: My type is the cause of my outcomes
- power: My type is the cause of others’ outcomes
- interference: Others’ types are the cause of my outcomes
Procedural motivations

Individuals have:

- preferences over outcomes (i.e. types)
  → decision rights are valued instrumentally

- preferences over freedom, power, and interference
  → decision rights are valued intrinsically
Theoretical framework

- model of decision right allocation and choice
- dynamic psychological game (Battigalli and Dufwenberg 2009)
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- dynamic psychological game (Battigalli and Dufwenberg 2009)

Key idea

players care about the cause of the outcomes
→
payoffs depend on beliefs about how the game is played
→
players may change behavior at an earlier stage in order to obtain higher freedom, higher power, or lower interference at a later stage
Theoretical framework

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→ players may change behavior at an earlier stage in order to obtain higher freedom, higher power, or lower interference at a later stage

Key feature 1

*Each player may be of different types.*

Why? Freedom, power, and interference require a variation in preferences over outcomes, which is modeled as uncertainty about types.
Theoretical framework

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- dynamic psychological game (Battigalli and Dufwenberg 2009)

Key idea

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payoffs depend on beliefs about how the game is played
→
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Key feature 2

*The causal influence of types on outcomes is measured by how far the conditional distribution of outcomes given types is from the unconditional distribution.*
Theoretical framework

- model of decision right allocation and choice
- dynamic psychological game (Battigalli and Dufwenberg 2009)

**Key idea**

- players care about the cause of the outcomes
  - payoffs depend on beliefs about how the game is played
  - players may change behavior at an earlier stage in order to obtain higher freedom, higher power, or lower interference at a later stage

**compared to Battigalli and Dufwenberg 2009**

- simplification: only 1st-order beliefs, instead of belief hierarchies
- extension: imperfect information and own-plan dependence
Theoretical framework

Simplified model and notation:
Theoretical framework

Simplified model and notation:

- Players $i = 1, 2$ and Nature $i = 0$
- Stages $n = 0, 1, ...$
- $a^n = (a^n_1, a^n_2)$ profile of actions chosen at stage $n$
- $h = (a^1, ..., a^N) = (a^n)_{n=1}^N$ history of length $N$
- $s_h$ local pure strategy at info set $h$
- $t_i \in T_i$ Player $i$’s type (determined by Nature at stage 0)
- $o_i \in O_i$ Player $i$’s material outcome at the end of the game
- $u_i(o \cap t)$ Player $i$’s utility function
- $\theta_{i, h, s_h}(o \cap t)$ Player $i$’s beliefs at info set $h$ that, after playing strategy $s_h$, type is $t$ and material outcome is $o$
- $V_i(\theta)$ Player $i$’s psychological payoff function
Theoretical framework

Example
Beliefs $\theta$

Player 1’s beliefs about the joint distribution of types and outcomes $\theta(o \cap t)$

**Freedom**: degree to which Player 1’s types cause his outcomes

$$F_1(\theta) = \sum_{t_1} \sum_{o_1} \theta(o_1 \cap t_1) \log \frac{\theta(o_1|t_1)}{\theta(o_1)}$$

**Power**: degree to which Player 1’s types cause Player 2’s outcomes

$$P_1(\theta) = \sum_{t_1} \sum_{o_2} \theta(o_2 \cap t_1) \log \frac{\theta(o_2|t_1)}{\theta(o_2)}$$

**Interference**: degree to which Player 2’s types cause Player 1’s outcomes

$$I_1(\theta) = \sum_{t_2} \sum_{o_1} \theta(o_1 \cap t_2) \log \frac{\theta(o_1|t_2)}{\theta(o_1)}$$
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**Non-Interference:** negative degree to which Player 2’s types cause Player 1’s outcomes

$$NI_1(\theta) = -I_1(\theta) = -\sum_{t_2} \sum_{o_1} \theta(o_1 \cap t_2) \log \frac{\theta(o_1 | t_2)}{\theta(o_1)}$$
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**Expected Utility**:

$$EU_1(\theta) = \sum_{t_1} \sum_{o_1} \theta(o_1 \cap t_1) u_1(o_1 \cap t_1)$$
Theoretical framework
Psychological Sequential Equilibrium

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Psychological Sequential Equilibrium

= Sequential Equilibrium if $V_1(\theta) = EU_1(\theta)$
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Psychological Sequential Equilibrium

$\neq$ Sequential Equilibrium if $V_1(\theta) = \alpha F_1(\theta) + EU_1(\theta)$
Theoretical framework
Psychological Sequential Equilibrium

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Psychological Sequential Equilibrium

$\neq$ Sequential Equilibrium if $V_1(\theta) = \beta NI_1(\theta) + EU_1(\theta)$
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Psychological Sequential Equilibrium

$\neq$ Sequential Equilibrium if $V_1(\theta) = \gamma P_1(\theta) + EU_1(\theta)$
Experiment
Implementing the theory in the lab

Players 1 and 2 play a game that varies the freedom, power, and non-interference associated with the decision right. The experiment estimates how Player 1’s preferences affect his valuation of the decision right, as revealed by his bid. This helps to analyze overbidding (i.e., bidding above what is prescribed by risk aversion alone).
Experiment
Implementing the theory in the lab

Players 1 and 2 play a game
Players 1 and 2 play a game
- allocation of the decision right

exercise of the decision right
- types are not known
- Player 1 bids for the decision right if bids succeeds, Player 1 has the decision right, o/w Player 2 has it
- types are known
- player with the decision right makes a final choice
- payoff consequences for both players
- vary the freedom, power, and non-interference associated with the decision right
- estimate how Player 1’s preferences affect his valuation of the decision right, as revealed by his bid
- analyze overbidding (i.e. bidding above what is prescribed by risk aversion alone)
Players 1 and 2 play a game

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- allocation of the decision right \([\text{types are not known}]\)
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- vary the freedom, power, and non-interference associated with the decision right
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- allocation of the decision right [types are not known]
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**risk aversion**

bid ↑ \(\implies\) payoff uncertainty ↓
Players 1 and 2 play a game

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**Risk Aversion**

- bid ↑ → payoff uncertainty ↓

**Preferences for Freedom/Power/Non-interference**

- bid ↑ → probability of having the decision right ↑
Players 1 and 2 play a game

- allocation of the decision right \([types \ not \ known]\)
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### Risk Aversion

\[
\text{bid} \uparrow \implies \text{payoff uncertainty} \downarrow
\]

### Preferences for Freedom/Power/Non-interference

\[
\text{bid} \uparrow \implies \text{probability of having the decision right} \uparrow
\]

- analyze overbidding (i.e. bidding above what is prescribed by risk aversion alone)
two players, 1 and 2

two boxes, L and R

each box contains two cards, A and B

each card has two sides, 1 and 2

each side can be Green or Red: color represents payoff ($\pi^{Green} \geq \pi^{Red}$)

color of side $i$ is payoff-relevant for Player $i$
Two stages

1 bidding stage

- Player 1 bids for the decision right in the choice stage

2 choice stage

- either Player 1 chooses from Box L or Player 2 chooses from Box R

If Box L is opened, Player 1 must choose between Card A and Card B.

If Box R is opened, Player 2 must choose between Card A and Card B.

In either boxes, whether Card A or Card B is selected has payoff consequences for both Player 1 and Player 2. The payoff consequences are described on Slide 8.

A priori, before either Box L or Box R is opened, Player 1 and Player 2 have the same information about Card A and Card B in either boxes.

After a specific box is opened, Player 1 and Player 2 receive additional (but different) information about Card A and Card B in that box.
**Experiment Information:** example

**Bidding stage: types are not known**

- **Box L**
  - Card A: Side 1 15 pt, Side 2 15 pt (case 1: probability 1/4)
  - Card B: Side 1 85 pt, Side 2 85 pt (case 2: probability 1/4)
  - Card A: Side 1 85 pt, Side 2 85 pt (case 3: probability 1/4)
  - Card B: Side 1 15 pt, Side 2 15 pt (case 4: probability 1/4)

- **Box R**
  - Card A: Side 1 15 pt, Side 2 15 pt (case 1: probability 1/4)
  - Card B: Side 1 85 pt, Side 2 85 pt (case 2: probability 1/4)
  - Card A: Side 1 85 pt, Side 2 85 pt (case 3: probability 1/4)
  - Card B: Side 1 15 pt, Side 2 15 pt (case 4: probability 1/4)

- **Notes:**
  - Players know the payoffs associated with ‘Green’ and ‘Red’, for each box and for each player.
  - Players do not know which card is preferred, for either box or by either player.
**Experiment Information:** example

**Bidding stage: types are not known**

- *Box L*
  - Player 1 prefers B
  - Card A: Side 1 15 pt, Side 2 85 pt
  - Card B: Side 1 15 pt, Side 2 85 pt
  - Case 1: probability 1/4
  - Case 2: probability 1/4
  - Case 3: probability 1/4
  - Case 4: probability 1/4

- *Box R*
  - Player 1 prefers A
  - Card A: Side 1 15 pt, Side 2 85 pt
  - Card B: Side 1 15 pt, Side 2 85 pt
  - Case 1: probability 1/4
  - Case 2: probability 1/4

- Players know the payoffs associated with ‘Green’ and ‘Red’, for each box and for each player.
- Player do not know which card is preferred, for either box or by either player.
Experiment

Information: example

**Bidding stage: types are not known**

- Players know the payoffs associated with ‘Green’ and ‘Red’, for each box and for each player.
- Players do not know which card is preferred, for either box or by either player.
**Experiment Information:** example

**Choice stage:** *types are known*

- **Box L**
  - Card A: Side 1 15 pt, Side 2 85 pt
  - Card B: Side 1 85 pt, Side 2 15 pt
  - Case 1: probability 1/4
  - Case 2: probability 1/4

- **Box R**
  - Card A: Side 1 15 pt, Side 2 85 pt
  - Card B: Side 1 85 pt, Side 2 15 pt
  - Case 1: probability 1/4
  - Case 2: probability 1/4

- **Player 1** has the decision right and he selects a card from Box L
- **Player 1** *knows* that he prefers Card B
- **Player 1** *does not know* which card Player 2 prefers
Experiment
Rounds and treatments
Experiment
Rounds and treatments

20 rounds
Experiment
Rounds and treatments

20 rounds

- stake size $\pi^{Green} - \pi^{Red}$ and payoff level $\frac{\pi^{Green} + \pi^{Red}}{2}$ vary across players and boxes
20 rounds

- stake size $\pi_{\text{Green}} - \pi_{\text{Red}}$ and payoff level $\frac{\pi_{\text{Green}} + \pi_{\text{Red}}}{2}$ vary across players and boxes
- in 10 rounds the decision right gives Player 1:

<table>
<thead>
<tr>
<th>freedom</th>
<th>non-interference</th>
<th>power</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\pi_{1}^{\text{Green},L} &gt; \pi_{1}^{\text{Red},L}$</td>
<td>$\pi_{1}^{\text{Green},R} &gt; \pi_{1}^{\text{Red},R}$</td>
<td>$\pi_{2}^{\text{Green},L} &gt; \pi_{2}^{\text{Red},L}$</td>
</tr>
<tr>
<td>he affects his outcome</td>
<td>he prevents Player 2 from affecting his outcome</td>
<td>he affects Player 2's outcome</td>
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20 rounds

- stake size $\pi^{\text{Green}} - \pi^{\text{Red}}$ and payoff level $\frac{\pi^{\text{Green}} + \pi^{\text{Red}}}{2}$ vary across players and boxes
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<tr>
<td>$\pi^{\text{Green},L}_1 &gt; \pi^{\text{Red},L}_1$</td>
<td>$\pi^{\text{Green},R}_1 &gt; \pi^{\text{Red},R}_1$</td>
<td>$\pi^{\text{Green},L}_2 = \pi^{\text{Red},L}_2$</td>
</tr>
</tbody>
</table>

- he affects
- he prevents Player 2 from affecting his outcome
- he affects, does not affect Player 2's outcome
Experiment

Rounds and treatments

20 rounds

- stake size $\pi_{\text{Green}} - \pi_{\text{Red}}$ and payoff level $\frac{\pi_{\text{Green}} + \pi_{\text{Red}}}{2}$ vary across players and boxes
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3 treatments

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Endowments</th>
<th>Rounds</th>
<th>freedom</th>
<th>non-interference</th>
<th>decision right gives Player 1</th>
<th>power</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>100,100</td>
<td>20</td>
<td>yes</td>
<td>yes</td>
<td>yes (10 rounds)</td>
<td>no (10 rounds)</td>
</tr>
<tr>
<td>T2</td>
<td>100,0</td>
<td>20</td>
<td>yes</td>
<td>yes</td>
<td>yes (10 rounds)</td>
<td>no (10 rounds)</td>
</tr>
<tr>
<td>T3</td>
<td>100,0</td>
<td>20</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>no</td>
</tr>
</tbody>
</table>
If Player 1 has the decision right:
Player 1’s Payoff = $w_1 + \text{Value of Side 1 of Selected Card} - r$
Player 2’s Payoff = $w_2 + \text{Value of Side 2 of Selected Card}$

If Player 2 has the decision right:
Player 1’s Payoff = $w_1 + \text{Value of Side 1 of Selected Card}$
Player 2’s Payoff = $w_2 + \text{Value of Side 2 of Selected Card}$

$w_i = \text{endowment of Player } i$
$r = \text{BDM randomly drawn price}$
244 participants (8 sessions: 3 T1, 3 T2, 2 T3)

Each session:

1. Card game (random assignment, fixed matching, quiz + trial + 20 rounds)
2. Lottery-choice questionnaire (Multiple Price List)
3. Locus of Control questionnaire
4. Feedback
   - Part 1: 1 round is randomly selected and paid out
   - Part 2: 1 chosen lottery is randomly selected, played out and paid out
   - Part 3: no remuneration
Theoretical predictions

Ruling out procedural motivations:

- choice stage:
  - Player with the decision right chooses his preferred card

- bidding stage:
  - Player 1 maximizes his valuation, which depends only on expected utility
  - optimal bid $y^*$ in Sequential Equilibrium:

\[
\Delta EU = u(w_1 + \pi^\text{Green}_1 - y^*) - \frac{u(w_1 + \pi^\text{Green}_1) + u(w_1 + \pi^\text{Red}_1)}{2} = 0
\]
Allowing for procedural motivations:

- choice stage: unchanged

- bidding stage:
  - Player 1 maximizes his valuation, which depends not only on Expected Utility, but also on Freedom, Non-Interference, or Power
  - optimal bid $y^*$ in Psychological Sequential Equilibrium:
    \[
    \Delta EU + \ldots = 0
    \]
Theoretical predictions

Allowing for procedural motivations:

- choice stage: unchanged

- bidding stage:
  - Player 1 maximizes his valuation, which depends not only on Expected Utility, but also on Freedom, Non-Interference, or Power
  - optimal bid $y^*$ in Psychological Sequential Equilibrium:
    \[ \Delta EU + \alpha \Delta F = 0 \]
Theoretical predictions

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- choice stage: unchanged

- bidding stage:
  - Player 1 maximizes his valuation, which depends not only on Expected Utility, but also on Freedom, Non-Interference, or Power
  - optimal bid $y^*$ in Psychological Sequential Equilibrium:

\[ \Delta EU + \beta \Delta NI = 0 \]
Allowing for procedural motivations:

- choice stage: unchanged

- bidding stage:
  - Player 1 maximizes his valuation, which depends not only on Expected Utility, but also on Freedom, Non-Interference, or Power
  - optimal bid $y^*$ in Psychological Sequential Equilibrium:

$$\Delta EU + \gamma \Delta P = 0$$
Empirical strategy

\[ \Delta EU_{nt} = 0 \] Expected Utility maximization

\[ \Delta EU_{nt} = -\alpha_n \Delta F_{nt} \] Psychological Payoff max. under pref. for Freedom

\[ \Delta EU_{nt} = -\beta_n \Delta NI_{nt} \] Psychological Payoff max. under pref. for Non-Interference

\[ \Delta EU_{nt} = -\gamma_n \Delta P_{nt} \] Psychological Payoff max. under pref. for Power

1st specification: constant

<table>
<thead>
<tr>
<th>Treatment</th>
<th>( \Delta F^c )</th>
<th>( \Delta NI^c )</th>
<th>( \Delta P^c )</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 and T2</td>
<td>1</td>
<td>1</td>
<td>1 ([\pi_2^{\text{Green}} &gt; \pi_2^{\text{Red}}])</td>
</tr>
</tbody>
</table>

\[ \text{T3} \quad 0 \quad 1 \quad 0 \]

2nd specification: proportional to payoff difference

<table>
<thead>
<tr>
<th>Treatment</th>
<th>( \Delta F^d )</th>
<th>( \Delta NI^d )</th>
<th>( \Delta P^d )</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 and T2</td>
<td>( \pi_1^{\text{Green}} - \pi_1^{\text{Red}} )</td>
<td>( \pi_1^{\text{Green}} - \pi_1^{\text{Red}} )</td>
<td>( \pi_2^{\text{Green}} - \pi_2^{\text{Red}} )</td>
</tr>
</tbody>
</table>

\[ \text{T3} \quad 0 \quad \pi_1^{\text{Green}} - \pi_1^{\text{Red}} \quad 0 \]
Which model best explains the behavior of most participants? Psychological Payoff maximization driven by pref. for Non-Interference.

Is the overbidding driven by pref. for Non-Interference economically sizable? Yes, it is appr. 20% of the stake size.

Benchmark assuming CRRA utility, robustness check assuming CARA utility.
Which fraction of participants is best explained by which model?

- Treatments 1&2: 39% EU, 56% Freedom or Non-Interference, 5% Power
- Treatment 3: 23% EU, 77% Non-Interference

<table>
<thead>
<tr>
<th></th>
<th>Treatments 1 and 2</th>
<th>Treatment 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Expected utility max. (excl. procedural preferences)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\hat{\rho}_{MPL}$</td>
<td>$\Delta EU = 0$</td>
<td>5.9</td>
</tr>
<tr>
<td>$\hat{\rho}_{bid}$</td>
<td>$\Delta EU = 0$</td>
<td>25</td>
</tr>
<tr>
<td>$0$</td>
<td>$\Delta EU = 0$</td>
<td>8.3</td>
</tr>
<tr>
<td><strong>Psychological payoff max. (incl. procedural preferences)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freedom or Non-Interference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\hat{\rho}_{MPL}$</td>
<td>$\Delta EU = -\alpha \Delta F^c$ or $-\beta \Delta NI^c$</td>
<td>27.4</td>
</tr>
<tr>
<td>$\Delta EU = -\alpha \Delta F^d$ or $-\beta \Delta NI^d$</td>
<td>28.6</td>
<td></td>
</tr>
<tr>
<td>Non-Interference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\hat{\rho}_{MPL}$</td>
<td>$\Delta EU = -\beta \Delta NI^c$</td>
<td>54.5</td>
</tr>
<tr>
<td>$\Delta EU = -\beta \Delta NI^d$</td>
<td>22.7</td>
<td></td>
</tr>
<tr>
<td>Power</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\hat{\rho}_{MPL}$</td>
<td>$\Delta EU = -\gamma \Delta P^d$</td>
<td>4.8</td>
</tr>
</tbody>
</table>

Nonlinear least squares, CRRA utility function, model selection according to Bayesian Information Criterion.
Is preference for Non-Interference driving behavior? Let's inspect its monetary measure.

**Overbidding**

bid predicted by ‘Psychological Payoff max. driven by pref. for Non-Interference’ 

\[
\text{minus}
\]

bid predicted by ‘Expected Utility max.’
overbidding in Treatments 1&2 (involving Non-Interference and Freedom) and in Treatment 3 (involving only Non-Interference) are not statistically different. Since treatment assignment is random, behavior in Treatments 1&2 is driven by preference for Non-Interference as in Treatment 3.

<table>
<thead>
<tr>
<th>specification for Non-Interference used to define:</th>
<th>regressors</th>
<th>obs</th>
</tr>
</thead>
<tbody>
<tr>
<td>overbidding</td>
<td>subsample</td>
<td>dummy for Treatment 3</td>
</tr>
<tr>
<td>$\Delta NI^c$</td>
<td>$\Delta NI^c$</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(5.61)</td>
</tr>
<tr>
<td>$\Delta NI^d$</td>
<td>$\Delta NI^d$</td>
<td>-4.69</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4.84)</td>
</tr>
<tr>
<td>$\Delta NI^c$</td>
<td>$\Delta NI^c$ or $\Delta NI^d$</td>
<td>-0.30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4.37)</td>
</tr>
<tr>
<td>$\Delta NI^d$</td>
<td>$\Delta NI^c$ or $\Delta NI^d$</td>
<td>-1.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3.63)</td>
</tr>
</tbody>
</table>

Dependent variable: overbidding. Subsample: subjects best explained by ‘Psychological Payoff max. driven by pref. for Non-Interference’. Linear regression with s.e. given in parentheses. *, **, *** indicate 5%, 1%, 0.1% levels. Round 5, when $\pi^\text{high}_1 = 75$ and $\pi^\text{low}_1 = 25$. 

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Overbidding driven by pref. of Non-Interference is appr. 20% of the stake size.

<table>
<thead>
<tr>
<th>round</th>
<th>stake size</th>
<th>mean</th>
<th>% of stake</th>
<th>sd</th>
<th>mean</th>
<th>% of stake</th>
<th>sd</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>70</td>
<td>10.80</td>
<td>15</td>
<td>16.97</td>
<td>13.47</td>
<td>19</td>
<td>21.81</td>
</tr>
<tr>
<td>2</td>
<td>50</td>
<td>10.84</td>
<td>22</td>
<td>17.11</td>
<td>9.81</td>
<td>20</td>
<td>15.86</td>
</tr>
<tr>
<td>3</td>
<td>30</td>
<td>11.38</td>
<td>38</td>
<td>16.16</td>
<td>6.03</td>
<td>20</td>
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</tr>
<tr>
<td>4</td>
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<td>10.75</td>
<td>15</td>
<td>15.61</td>
<td>13.95</td>
<td>20</td>
<td>20.14</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
<td>10.70</td>
<td>21</td>
<td>15.91</td>
<td>10.03</td>
<td>20</td>
<td>14.73</td>
</tr>
<tr>
<td>6</td>
<td>30</td>
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<td>20</td>
<td>8.99</td>
</tr>
<tr>
<td>7</td>
<td>70</td>
<td>10.57</td>
<td>15</td>
<td>14.64</td>
<td>14.36</td>
<td>21</td>
<td>19.28</td>
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<tr>
<td>8</td>
<td>50</td>
<td>10.57</td>
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<td>14.85</td>
<td>10.29</td>
<td>21</td>
<td>13.92</td>
</tr>
<tr>
<td>9</td>
<td>30</td>
<td>10.73</td>
<td>36</td>
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<td>24.96</td>
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<tr>
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<td>100</td>
<td>10.65</td>
<td>11</td>
<td>14.83</td>
<td>17.97</td>
<td>18</td>
<td>24.96</td>
</tr>
<tr>
<td>all</td>
<td>50</td>
<td>10.76</td>
<td>22</td>
<td>15.63</td>
<td>10.82</td>
<td>20</td>
<td>16.75</td>
</tr>
</tbody>
</table>
Conclusion

We proposed a theoretical framework and an experimental design to represent and measure procedural motivations in the valuation of decision rights: Freedom, Power, and Interference. The experimental findings: aversion to interference can explain evidence previously attributed to: betrayal aversion (Bohnet and Zeckhauser 2004), preference for decision rights (Fehr et al. 2013, Bartling et al. 2014), preference for payoff autonomy (Owens et al. 2014), and aversion to a counterpart's intentions (Butler and Miller 2016). Our framework and findings help interpret and unify previous research.
Conclusion

We proposed a theoretical framework and an experimental design to represent and measure procedural motivations in the valuation of decision rights: Freedom, Power, and Interference

- experimental findings: *aversion to interference*
Conclusion

We proposed a theoretical framework and an experimental design to represent and measure procedural motivations in the valuation of decision rights: Freedom, Power, and Interference.

- experimental findings: *aversion to interference*

Our framework and findings help interpret and unify previous research. Aversion to interference can explain evidence previously attributed to:

- *betrayal aversion* (Bohnet and Zeckhauser 2004)
- *preference for decision rights* (Fehr et al. 2013, Bartling et al. 2014)
- *preference for payoff autonomy* (Owens et al. 2014)
- *aversion to a counterpart’s intentions* (Butler and Miller 2016)
Thank you
Extra slides
Example

Manager Mary chooses between Supplier A and Supplier B. Does Mary have freedom of choice? No.
Example

Mary (Manager) chooses between Supplier A and Supplier B. One supplier offers a better contract than the other. Which supplier offers the best contract is determined by Nature at stage 0. When Mary chooses at stage 1, she knows which supplier offers the best contract. Depending on the case, Mary chooses a different supplier and obtains a different outcome.

Does Mary have freedom of choice? Yes.

Stage 0
Nature
Supplier A offers best contract
Supplier B offers best contract

Stage 1
Mary (Manager)
Supplier A
Supplier B
80
20
20
80
Example

Stage -1

Mary (Manager)

decide decision right

keep decision right

Stage 0

Nature

Supplier A offers best contract
Supplier B offers best contract
Supplier A offers best contract
Supplier B offers best contract

Stage 1

Eva (Employee)

Supplier A
Supplier A
Supplier A
Supplier B

80
80
80
80

20
20
20
20

20
20
20
20

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Example

Stage -1

Mary
(Manager)

delegate
decision right

keep
decision right

Stage 0

Nature

Supplier A
offers best contract

Supplier B
offers best contract

Supplier A
offers best contract

Supplier B
offers best contract

Stage 1

Eva
(Employee)

Supplier A
80
80

Supplier B
20
20

Eva
(Employee)

Supplier A
20
20

Supplier B
80
80

Mary
(Manager)

Supplier A
80
80

Supplier B
20
20

Mary
(Manager)

Supplier A
80
80

Supplier B
20
20

Nature

Supplier A
20
20

Supplier B
80
80

Nature

Supplier A
20
20

Supplier B
80
80
Example

Stage -1

Mary (Manager)

delegate decision right

keep decision right

Stage 0

Nature

Supplier A offers best contract

Supplier B offers best contract

Stage 1

Eva (Employee)

Supplier A

Supplier B

80

Eva (Employee)

Supplier A

Supplier B

Nature

Supplier A offers best contract

Supplier B offers best contract

Mary (Manager)

Supplier A

Supplier B

80 + freedom

+ power

+ no-interference

Nature

Supplier A

Supplier B

Supplier A

Supplier B

Supplier A

Supplier B
Theoretical framework
Related literature

- diversity (Nehring & Puppe 2009)
- power indices (Penrose 1946, Shapley & Shubik 1954, Banzhaf 1965, Diskin & Koppel 2010)
- positive and negative liberty (Berlin 1958)
Theoretical framework

Freedom, Non-Interference, and Power

\[ F_1(\theta) = \sum_{t_1} \sum_{o_1} g(o_1, t_1) \theta(o_1 \cap t_1) \log \frac{\theta(o_1 | t_1)}{\theta(o_1)} \]

\[ NL_1(\theta) = -\sum_{t_2} \sum_{o_1} g(o_1, t_2) \theta(o_1 \cap t_2) \log \frac{\theta(o_1 | t_2)}{\theta(o_1)} \]

\[ P_1(\theta) = \sum_{t_1} \sum_{o_2} g(o_2, t_1) \theta(o_2 \cap t_1) \log \frac{\theta(o_2 | t_1)}{\theta(o_2)} \]

- Logarithmic terms capture the probabilistic causal influence of types on outcomes.
- \( g(o, t) \) captures the qualitative effect of that dependence.
  - A strong dependence may matter little if the alternative outcomes are qualitatively very similar, e.g., if they generate similar payoffs.
Empirical strategy

\[ F_1(\theta) = \sum_{t_1} \sum_{o_1} g(o_1, t_1) \theta(o_1 \cap t_1) \log \frac{\theta(o_1|t_1)}{\theta(o_1)} \]

\[ NI_1(\theta) = -\sum_{t_2} \sum_{o_1} g(o_1, t_2) \theta(o_1 \cap t_2) \log \frac{\theta(o_1|t_2)}{\theta(o_1)} \]

\[ P_1(\theta) = \sum_{t_1} \sum_{o_2} g(o_2, t_1) \theta(o_2 \cap t_1) \log \frac{\theta(o_2|t_1)}{\theta(o_2)} \]

1st specification: constant

\[ g(o_i, t) = 1 \]

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Freedom $F_1(\theta)$</th>
<th>Non-Interference $NI_1(\theta)$</th>
<th>Power $P_1(\theta)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 and T2</td>
<td>$\frac{y}{100}$</td>
<td>$-\frac{100-y}{100}$</td>
<td>$\frac{y}{100} 1[\pi_2^{Green} &gt; \pi_2^{Red}]$</td>
</tr>
<tr>
<td>T3</td>
<td>0</td>
<td>$-\frac{100-y}{100}$</td>
<td>0</td>
</tr>
</tbody>
</table>
Empirical strategy

\[ F_1(\theta) = \sum_{t_1} \sum_{o_1} g(o_1, t_1) \theta(o_1 \cap t_1) \log \frac{\theta(o_1|t_1)}{\theta(o_1)} \]

\[ NI_1(\theta) = -\sum_{t_2} \sum_{o_1} g(o_1, t_2) \theta(o_1 \cap t_2) \log \frac{\theta(o_1|t_2)}{\theta(o_1)} \]

\[ P_1(\theta) = \sum_{t_1} \sum_{o_2} g(o_2, t_1) \theta(o_2 \cap t_1) \log \frac{\theta(o_2|t_1)}{\theta(o_2)} \]

2nd specification: proportional to payoff difference

\[ g(o_i, t) = \pi_i^{\text{Green}} - \pi_i^{\text{Red}} \]

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Freedom</th>
<th>Non-Interference</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 and T2</td>
<td>$\frac{y}{100}(\pi_1^{\text{Green}} - \pi_1^{\text{Red}})$</td>
<td>$-\frac{100-y}{100}(\pi_1^{\text{Green}} - \pi_1^{\text{Red}})$</td>
<td>$\frac{y}{100}(\pi_2^{\text{Green}} - \pi_2^{\text{Red}})$</td>
</tr>
<tr>
<td>T3</td>
<td>0</td>
<td>$-\frac{100-y}{100}(\pi_1^{\text{Green}} - \pi_1^{\text{Red}})$</td>
<td>0</td>
</tr>
</tbody>
</table>

Intuition: Logarithmic terms capture the probabilistic causal influence of types on outcomes and \( g(o, t) \) captures the \textit{qualitative effect} of that dependence. A strong dependence may matter little if the alternative outcomes are qualitatively very similar, e.g. if they generate similar payoffs.
Experiment
Bidding Stage

- Becker-DeGroot-Marschak (BDM) method
- like a 2nd price auction against a random draw
- Player 1 bids integer $y \in \{0, 100\}$
- random draw of an integer $r \in \{1, 100\}$
- $y \geq r$: Player 1 pays $r$ and gets decision right
- $y < r$: Player 1 pays 0 and Player 2 gets decision right
## Benchmark Treatment (T1). Rounds *without* Power.

<table>
<thead>
<tr>
<th></th>
<th>Box L</th>
<th>Box R</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\pi_1 \text{Green},L$ / $\pi_1 \text{Red},L$</td>
<td>$\pi_2 \text{Green},L$ / $\pi_2 \text{Red},L$</td>
<td>$\pi_1 \text{Green},R$ / $\pi_1 \text{Red},R$</td>
</tr>
<tr>
<td>100/30</td>
<td>70/70</td>
<td>100/30</td>
</tr>
<tr>
<td>90/40</td>
<td>70/70</td>
<td>90/40</td>
</tr>
<tr>
<td>80/50</td>
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<tr>
<td>50/20</td>
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<td>50/20</td>
</tr>
<tr>
<td>100/0</td>
<td>70/70</td>
<td>100/0</td>
</tr>
</tbody>
</table>

- $\pi_1 \text{Green},L = \pi_1 \text{Green},R = \pi_1 \text{Green}$ and $\pi_1 \text{Red},L = \pi_1 \text{Red},R = \pi_1 \text{Red}$
- stake size: $\pi_i \text{Green} - \pi_i \text{Red} \in \{30, 50, 70\}$
- payoff level: $\frac{\pi_i \text{Green} + \pi_i \text{Red}}{2} \in \{35, 50, 65\}$
Benchmark Treatment (T1). Rounds with Power.

<table>
<thead>
<tr>
<th>Box L</th>
<th>Box R</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\pi_1^{\text{Green},L}$ / $\pi_1^{\text{Red},L}$</td>
<td>$\pi_1^{\text{Green},R}$ / $\pi_1^{\text{Red},R}$</td>
</tr>
<tr>
<td>75/25</td>
<td>85/15</td>
</tr>
<tr>
<td>75/25</td>
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<td>75/25</td>
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<td>75/25</td>
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<tr>
<td>60/10</td>
<td>75/25</td>
</tr>
<tr>
<td>100/0</td>
<td>100/0</td>
</tr>
</tbody>
</table>

- $\pi_1^{\text{Green},L} = \pi_1^{\text{Green},R} = \pi_1^{\text{Red},L} = \pi_1^{\text{Red},R}$
- fix Player $i$’s payoffs at $\pi_i^{\text{Green}} = 75$, $\pi_i^{\text{Red}} = 25$ (stake size 50, payoff level 50)
- vary Player $j$’s stake size \{30, 70\} or payoff level \{35, 65\}
If Box L is opened, Player 1 must choose between Card A and Card B. If Box R is opened, Player 2 must choose between Card A and Card B. In either boxes, whether Card A or Card B is selected has payoff consequences for both Player 1 and Player 2. The payoff consequences are described on Slide 8.

A priori, before either Box L or Box R is opened, Player 1 and Player 2 have the same information about Card A and Card B in either boxes. After a specific box is opened, Player 1 and Player 2 receive additional (but different) information about Card A and Card B in that box.
Experiment
Treatment 1 and 2: example

Case 1: probability 1/4
Case 2: probability 1/4
Case 3: probability 1/4
Case 4: probability 1/4
Experiment
Treatment 1 and 2: example

case 1: probability 1/4

Box R
Experiment
Treatment 3

<table>
<thead>
<tr>
<th>Box L</th>
<th>Box R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Card C</td>
<td>Card A</td>
</tr>
<tr>
<td>Side 1</td>
<td>Side 1</td>
</tr>
<tr>
<td>Side 2</td>
<td>Side 2</td>
</tr>
<tr>
<td>Card B</td>
<td>Card B</td>
</tr>
<tr>
<td>Side 1</td>
<td>Side 1</td>
</tr>
<tr>
<td>Side 2</td>
<td>Side 2</td>
</tr>
</tbody>
</table>
Experiment
Treatment 3: example

Box L

Card C
Side 1
85 pt
Side 2
85 pt
case 1: probability 1/2

Card C
Side 1
85 pt
Side 2
15 pt
case 2: probability 1/2

case 1:

probability 1/2

Case 2:

probability 1/2
Experiment
Treatment 3: example

Case 1: probability 1/4
Case 2: probability 1/4
Case 3: probability 1/4
Case 4: probability 1/4

Box R
### Experiment

#### Treatment 3: Rounds

<table>
<thead>
<tr>
<th>Box L</th>
<th>Box R</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\pi_1^{Green,L}$</td>
<td>$\pi_1^{Red,L}$</td>
</tr>
<tr>
<td>100</td>
<td>70/70</td>
</tr>
<tr>
<td>90</td>
<td>70/70</td>
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<tr>
<td>80</td>
<td>70/70</td>
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<tr>
<td>85</td>
<td>70/70</td>
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<tr>
<td>75</td>
<td>70/70</td>
</tr>
<tr>
<td>65</td>
<td>70/70</td>
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<td>70</td>
<td>70/70</td>
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<tr>
<td>60</td>
<td>70/70</td>
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<tr>
<td>50</td>
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<tr>
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<td>85/15</td>
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<td>75/25</td>
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<td>75/25</td>
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<tr>
<td>75</td>
<td>75/25</td>
</tr>
<tr>
<td>60</td>
<td>75/25</td>
</tr>
<tr>
<td>100</td>
<td>100/0</td>
</tr>
</tbody>
</table>
Experiment
Procedures: Part 2, Lottery-choice Questionnaire

<table>
<thead>
<tr>
<th>Option A</th>
<th>Option B</th>
<th>your choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>85 with $\frac{1}{2}$ probability; 15 with $\frac{1}{2}$ probability</td>
<td>A □ B □</td>
</tr>
<tr>
<td>35</td>
<td>85 with $\frac{1}{2}$ probability; 15 with $\frac{1}{2}$ probability</td>
<td>A □ B □</td>
</tr>
<tr>
<td>40</td>
<td>85 with $\frac{1}{2}$ probability; 15 with $\frac{1}{2}$ probability</td>
<td>A □ B □</td>
</tr>
<tr>
<td>45</td>
<td>85 with $\frac{1}{2}$ probability; 15 with $\frac{1}{2}$ probability</td>
<td>A □ B □</td>
</tr>
<tr>
<td>50</td>
<td>85 with $\frac{1}{2}$ probability; 15 with $\frac{1}{2}$ probability</td>
<td>A □ B □</td>
</tr>
<tr>
<td>55</td>
<td>85 with $\frac{1}{2}$ probability; 15 with $\frac{1}{2}$ probability</td>
<td>A □ B □</td>
</tr>
<tr>
<td>60</td>
<td>85 with $\frac{1}{2}$ probability; 15 with $\frac{1}{2}$ probability</td>
<td>A □ B □</td>
</tr>
<tr>
<td>65</td>
<td>85 with $\frac{1}{2}$ probability; 15 with $\frac{1}{2}$ probability</td>
<td>A □ B □</td>
</tr>
<tr>
<td>70</td>
<td>85 with $\frac{1}{2}$ probability; 15 with $\frac{1}{2}$ probability</td>
<td>A □ B □</td>
</tr>
<tr>
<td>75</td>
<td>85 with $\frac{1}{2}$ probability; 15 with $\frac{1}{2}$ probability</td>
<td>A □ B □</td>
</tr>
<tr>
<td>80</td>
<td>85 with $\frac{1}{2}$ probability; 15 with $\frac{1}{2}$ probability</td>
<td>A □ B □</td>
</tr>
</tbody>
</table>

The first set of questions in the lottery-choice questionnaire. The values (85,15) are replaced by (75,25) in the second set and by (65,35) in the third set.
Experiment
Procedures: Part 3, Locus of Control Questionnaire

1. (I) Whether or not I get to be a leader depends mostly on my ability.
2. (C) To a great extent my life is controlled by accidental happenings.
3. (P) I feel like what happens in my life is mostly determined by powerful people.
4. (I) Whether or not I get into a car accident depends mostly on how good a driver I am.
5. (I) When I make plans, I am almost certain to make them work.
6. (C) Of ten there is no chance of protecting my personal interests form bad luck happenings.
7. (C) When I get what I want, it is usually because I’m lucky.
8. (P) Although I might have good ability, I will not be given leadership responsibility without appealing to those positions of power.
9. (I) How many friends I have depends on how nice a person I am.
10. (C) I have often found that what is going to happen will happen.
11. (P) My life is chiefly controlled by powerful others.
12. (C) Whether or not I get into a car accident is mostly a matter of luck.
13. (P) People like myself have very little chance of protecting our personal interests when they conflict with those of strong pressure groups.
14. (C) It’s not always wise for me to plan too far ahead because many things turn out to be a matter of good or bad fortune.
15. (P) Getting what I want requires pleasing those people above me.
16. (C) Whether or not I get to be a leader depends on whether I’m lucky enough to be in the right place at the right time.
17. (P) If important people were to decide they didn’t like me, I probably wouldn’t make many friends.
18. (I) I can pretty much determine what will happen in my life.
19. (I) I am usually able to protect my personal interests.
20. (P) Whether or not I get into a car accident depends mostly on the other driver.
21. (I) When I get what I want, it’s usually because I worked hard for it.
22. (P) In order to have my plans work, I make sure that they fit in with the desires of people who have power over me.
23. (I) My life is determined by my own actions.
24. (C) It’s chiefly a matter of fate whether or not I have a few friends or many friends.

I = Internal Scale, P = Powerful Others Scale, C = Chance Scale

Neri and Rommeswinkel
Decision Rights: Freedom, Power, and Interference
Descriptive Results
Bidding Behavior

- bids don’t differ significantly in rounds with and without Power
- in Treatments 1 and 2 bids are not significantly different
- in Treatment 2 (when decision right gives Non-Interference and Freedom) bids are significantly lower than in Treatment 3 (when decision right gives only Non-Interference)
## Descriptive Results

### Bidding Behavior

<table>
<thead>
<tr>
<th>round</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>all</th>
<th>T1 vs T2</th>
<th>T2 vs T3</th>
<th>T1 vs T3</th>
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<tr>
<td>1</td>
<td>35</td>
<td>44</td>
<td>57</td>
<td>44</td>
<td>z = -2.492 (0.0127)</td>
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<td></td>
</tr>
<tr>
<td>2</td>
<td>45</td>
<td>46</td>
<td>51</td>
<td>47</td>
<td>z = -2.357 (0.0184)</td>
<td>z = -1.709 (0.0874)</td>
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<td>36</td>
<td>27</td>
<td>32</td>
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<td>z = -2.884 (0.0039)</td>
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<td>43</td>
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<td>42</td>
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<td>z = -3.000 (0.0027)</td>
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<tr>
<td>7</td>
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<td>44</td>
<td>64</td>
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<td>z = -2.198 (0.0280)</td>
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<tr>
<td>8</td>
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<td>28</td>
<td>48</td>
<td>34</td>
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<td>z = -2.893 (0.0038)</td>
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<tr>
<td>9</td>
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<td>31</td>
<td>37</td>
<td>29</td>
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<td>z = -2.043 (0.0411)</td>
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<td>10</td>
<td>47</td>
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<td>57</td>
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<td>z = -2.916 (0.0035)</td>
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<td>52</td>
<td>43</td>
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<td>z = -1.941 (0.0523)</td>
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</tr>
<tr>
<td>12</td>
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<td>28</td>
<td>50</td>
<td>35</td>
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<td>z = -2.430 (0.0151)</td>
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<tr>
<td>13</td>
<td>36</td>
<td>37</td>
<td>51</td>
<td>40</td>
<td>z = -2.586 (0.0097)</td>
<td>z = -2.916 (0.0035)</td>
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<td>z = -1.941 (0.0523)</td>
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<td>15</td>
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<td>50</td>
<td>36</td>
<td>z = -2.586 (0.0097)</td>
<td>z = -2.916 (0.0035)</td>
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<td>16</td>
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<td>z = -1.706 (0.0880)</td>
<td>z = -1.941 (0.0523)</td>
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<td>17</td>
<td>26</td>
<td>33</td>
<td>43</td>
<td>33</td>
<td>z = -1.706 (0.0880)</td>
<td>z = -1.941 (0.0523)</td>
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</tr>
<tr>
<td>18</td>
<td>40</td>
<td>46</td>
<td>59</td>
<td>47</td>
<td>z = -1.860 (0.0628)</td>
<td>z = -2.614 (0.0089)</td>
<td></td>
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<td>19</td>
<td>24</td>
<td>35</td>
<td>43</td>
<td>32</td>
<td>z = -1.860 (0.0628)</td>
<td>z = -2.614 (0.0089)</td>
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<td>68</td>
<td>67</td>
<td>z = -1.860 (0.0628)</td>
<td>z = -2.614 (0.0089)</td>
<td></td>
</tr>
<tr>
<td>all</td>
<td>37</td>
<td>40</td>
<td>50</td>
<td>42</td>
<td>z = -1.860 (0.0628)</td>
<td>z = -2.614 (0.0089)</td>
<td></td>
</tr>
</tbody>
</table>
Hypothesis of expected-utility-maximizing behavior is rejected

- compare CE in lottery-choice (Part 2) to CE implied in bidding (Part 1)

\[ \Delta CE = \pi^\text{Green}_1 - y - CE_{\text{lottery}} \left( \frac{1}{2}, \pi^\text{high}_1, \frac{1}{2}, \pi^\text{Red}_1 \right) \]

- if \( \Delta CE < 0 \), more risk aversion in bidding

- due to imprecise measurement \( \Delta CE \sim U \left( 0, \sqrt{\frac{25}{12}} \right) \),
  instead mean = \(-14.11\) and sd = 25.41
In more than 98 percent of the observations, the decision right is exercised by selecting the card that gives the decision-maker his highest payoff.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Player 1</th>
<th>Player 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>has decision</td>
<td>chooses preferred card</td>
</tr>
<tr>
<td>1</td>
<td>0.41</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>0.4</td>
<td>0.99</td>
</tr>
<tr>
<td>3</td>
<td>0.55</td>
<td>1</td>
</tr>
<tr>
<td>all</td>
<td>0.44</td>
<td>1</td>
</tr>
</tbody>
</table>
Aversion to strategic uncertainty instead of aversion to interference?

- Player 1 perceives strategic uncertainty if he believes that Player 2 will not necessarily choose the option in his best interest
- This alternative mechanism is not supported by data
  - In 98% of obs., participants choose the option in their best interest
  - It would require either a very strong aversion or very far-off beliefs
May lack of evidence of preference for Power depend on the design?

- Player 1 learns his own preferences, but not Player 2's preferences
- PROS: no confounds with social preferences
- CONS: Player 1 may not find the exercise of power valuable
Results
Inequality Aversion (Fehr and Schmidt 1999)

\[ b^* - \frac{\pi_{\text{Green}} - \pi_{\text{Red}}}{2} = \lambda V^{\text{dis}} + \mu V^{\text{adv}} \]

\( V^{\text{dis}} \) = difference in disadvantageous inequality between Box L and Box R

\( V^{\text{adv}} \) = difference in advantageous inequality between Box L and Box R

\[ V^{\text{dis}} = \max \left( 0, \frac{\pi_{\text{Green}} + \pi_{\text{Red}}}{2} + w - \pi_{\text{Green}} - w_1 + b \right) - \max \left( 0, \pi_{\text{Green}} + w - \frac{\pi_{\text{Green}} + \pi_{\text{Red}}}{2} - w_1 \right) \]

\[ V^{\text{adv}} = \max \left( 0, \pi_{\text{Green}} + w - b - \frac{\pi_{\text{Green}} + \pi_{\text{Red}}}{2} - w_2 \right) - \max \left( 0, \frac{\pi_{\text{Green}} + \pi_{\text{Red}}}{2} + w - \pi_{\text{Green}} - w_2 \right) \]

\[ b = b^*(\lambda, \mu) + \beta + \epsilon \]

NLS estimates: \( \hat{\lambda} = 0.013 \) \( \hat{\mu} = -0.089 \) \( \hat{\beta} = 12.44^{***} \)

aversion to interference is still the main driver

possible reasons

- in complex tasks individuals focus on their own payoffs
- game is not framed as a game with a moral obligation to share