Information Networks and their Role in Threshold Public Goods Games: An Experimental Study

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Information Networks and their Role in Threshold Public Goods Games: An Experimental Study

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INTRODUCTION

- Many public goods are provided in discrete quantities and require raising funds beyond a threshold.
- Social networks important – information exchange between social peers impacts donation behavior
- We use laboratory experiments to study role of social networks through which individuals share information on meeting public goods funding thresholds.

Primary Questions

- Does denser information networks influence fundraising success?
- Does impact of information networks depend on donor income levels?
- Does peer information impact individual decisions?

EXPERIMENTAL DESIGN & IMPLEMENTATION

Table 1: Experimental Treatments with 2x2 between-subjects design

<table>
<thead>
<tr>
<th>Endowment Level</th>
<th>Information Network</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW (30 tokens)</td>
<td>LOCAL</td>
</tr>
<tr>
<td>HIGH (50 tokens)</td>
<td>COMPLETE</td>
</tr>
</tbody>
</table>

Information Network Treatment Diagrams (Line segments indicate information neighborhoods)

- Data for 24 groups (6 groups per treatment)
- Subjects randomly assigned to groups of six (N=6) & Subject ID
- ID determined information neighborhoods (see diagram) and remained unchanged during experiment.
- Data collected at Indiana University in Spring 2015

RESULTS

GROUP CONTRIBUTION BEHAVIOUR

Figure 1: Group Contribution in tokens

- Tokens not donated yield private return \( p \)
- If \( m_i \geq T \) (a threshold level) public good is provided yielding payoff \( b \) to every \( i \)
- If \( m_i < T \) public good not provided and all tokens refunded
- Contributions beyond \( T \) receive no additional payoffs

Nash Equilibria of Game

- Social Optimum: Threshold met exactly
- Free-riding Equilibrium: No one contributes
- Inefficient Nash Equilibrium: Threshold not met and no individual can unilaterally contribute to meet \( T \)

Information Neighborhoods

- \( I_i \) is information relationship between individuals
- \( \sum I_i \) receives information on \( I \)'s contribution
- \( I \)'s information neighborhood is set of individuals linked to her: \( \sum I_i = \{ j : I_i = 1 \} \)
- Average “viewable contributions” therefore: \( \frac{1}{\sum I_i} \sum m_i \)

Figure 2: Group Efficiency

IMPACT OF NETWORK & ENDOWMENT ON MEETING THRESHOLD

Table 2: RE Logit Regression of Group Contributions

<table>
<thead>
<tr>
<th>Threshold</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW</td>
<td>( \frac{1}{2} )</td>
<td>( \frac{1}{2} )</td>
<td>( \frac{1}{2} )</td>
<td>( \frac{1}{2} )</td>
</tr>
<tr>
<td>HIGH</td>
<td>( \frac{1}{2} )</td>
<td>( \frac{1}{2} )</td>
<td>( \frac{1}{2} )</td>
<td>( \frac{1}{2} )</td>
</tr>
</tbody>
</table>

| Constant | \( 1.07^{**} \) | \( 1.08^{**} \) | \( 1.08^{**} \) | \( 1.08^{**} \) |
| LOCAL dummy | \( -1.27^{**} \) | \( -1.17^{**} \) | \( -0.97^{**} \) | \( -0.74^{**} \) |
| Last period distance to \( T \) | \( 0.18^{**} \) | \( 0.28^{**} \) | \( 0.28^{**} \) | \( 0.28^{**} \) |
| \( \Delta \) in Viewable Contributions | \( 0.41 \) | \( 0.83^{**} \) | \( 0.83^{**} \) | \( 0.83^{**} \) |
| Observations | 240 | 240 | 240 | 240 |

IMPACT OF INFO. NEIGHBORS ON \( \Delta \) IN INDIVIDUAL CONTRIBUTIONS

Table 3: RE Regression of \( \Delta \) in Ind. Contributions Given \( e \)

<table>
<thead>
<tr>
<th>Threshold</th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW</td>
<td>( \Delta ) in Viewable Contributions</td>
<td></td>
</tr>
<tr>
<td>HIGH</td>
<td>( \Delta ) in Viewable Contributions</td>
<td></td>
</tr>
<tr>
<td>( 1^{**} )</td>
<td>( 0.25 )</td>
<td>( 0.66^{**} )</td>
</tr>
</tbody>
</table>

| Independent Variable | (1) | (2) |
| LOCAL dummy | \( 0.56 \) | \( 0.76 \) |
| \( \Delta \) in Viewable Contributions | \( 0.41 \) | \( 0.83^{**} \) |
| \( \Delta \) in Viewable Contributions | \( 0.41 \) | \( 0.83^{**} \) |
| Observations | 576 | 576 |

SUMMARY OF RESULTS

- Impact of Networks and Income on Equilibrium Selection (Table 2)
  - HIGH groups likely to contribute beyond threshold.
  - More equitable distribution of contributions in COMPLETE treatments.
  - COMPLETE information reduces tendency of HIGH groups to over-contribute.

- Impact of Information Neighbors on Contributions (Table 3)
  - Individuals increase contributions when threshold not met in previous round.
  - Contributions in LOW groups unaffected by information of social peers.
  - In HIGH-COMPLETE groups, contributions increase when average viewable contributions decrease.

IMPLICATIONS AND FUTURE WORK

- Implications
  - Information about social peers influence threshold public goods funding campaigns success.
  - Information about more peers may lead to greater equitable contributions.
  - Richer donors are more affected by their peers when they have more information
  - Fund drives more efficient (with less wasteful contributions) if rich donor groups have more information
  - Individuals contributing smaller endowment shares more likely to top up contribution shortfalls.

- Future Work
  - In current decision models returned if threshold not met
  - I.e. no payoff risk to individuals
  - Peer information may impact outcomes differently with payoff risk
  - No uncertainty about delivery of public good benefits if threshold met

- New Treatments
  - No refund – Tokens lost if threshold not met.
  - Uncertainty about public good provision – Even if \( T \) is met, public good provided with probability < 1

Acknowledgements

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