The Patron Game with Heterogeneous Endowments: A Case against Inequality Aversion

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I am an experimental economist, presenting a lab experiment

Possible issues:

• jargon
• overlooking methodological “details”
• external validity of the results
The discussion is organized as follows:

1. Motivation and literature review
2. Theoretical framework
3. Experimental design
4. Results
5. Conclusion
Several experimental studies show that individuals tend to resist inequitable outcomes.

Inequality aversion has gained considerable attention as one of the most prominent models of other-regarding preferences aimed at explaining such departures from purely selfish behaviour.

The intuition is that subjects are willing to give up (part of) their monetary payoffs in order to decrease the degree of inequality within a group.

This concept has been formalized by several models. The most representative are:

- Fehr and Schmidt (1999)
Fehr and Schmidt (1999) apply their model of inequality aversion to rationalize the usual findings observed in many settings:

- **Ultimatum games** (Kahneman, et al., 1986b; Guth et al. 1982; Cameron, 1995; Hoffman, et al., 1996; Slonim and Roth, 1997)
- **Dictator games** (Forsythe, et al., 1994; Andreoni and Miller, 2002)
- **Gift exchange games** (Fehr et al., 1993; Berg et al., 1995; Fehr, Gachter and Kirchsteiger, 1997)
- **Bargaining and market games** (Roth et al., 1991; Guth et al., 1997).

Cox (2004), Cox, Friedman and Gjerstad (2007) and Falk and Fischbacher (2000) provide evidence that inequality aversion may enhance the effect of reciprocity and trust, shaping the behavior of respondents and trustors.
Fehr and Schmidt (1999) also rationalize by means of inequality aversion some findings of Public Good Games (PG), both in its standard version and with punishment.

Public Good experiments have also been used to test inequality aversion using a heterogeneous distribution of endowments. The evidence obtained is mixed: while some studies show that heterogeneity between players increases the contributions to the public good (Chan et al., 1996), others deliver the opposite (Anderson et al. 2003; Cardenas, 2002a,b; Ledyard, 1995; Isaac and Walker, 1988) or null results (Varughese and Ostrom, 2001).
More recently Bolton and Ockenfels (2006) and Fehr, Naef and Schmidt (2006) reaffirmed the importance of inequality aversion in explaining the behavior of donors, proposers, and trustor in response to some papers rather skeptical about the role of inequality aversion in explaining deviations from selfish behavior.

Is it possible, and in case how, to reconcile this large body of mixed evidence. Two possible directions:

1. Is the mixed evidence rationalizable thanks to some of the theoretical features of the games used to elicit inequality aversion preferences?

2. Do the heterogeneous results correlate with the empirical strategy used to test the inequality aversion hypothesis?
Theoretical point of view. Games differ along several dimensions:

1. **Different opportunity sets**: while the DG and UG are characterized by different types of choice (typically, the rich has more power in shaping the final outcomes), the actions are symmetric in the PG.

2. **Strategic considerations** are particularly relevant in public good games. In fact, a (repeated) PG allows to measure only the cumulative effect of any exogenous manipulation of the design.

3. **Efficiency concerns** play a more relevant role in PG and TG.

How does this correlate and possibly interact with inequality?
Empirical point of view. What is a correct test of inequality aversion?

Most of the experimental evidence displays results that are consistent with the inequality aversion hypothesis, but they do not constitute a clean test of the models. Other competing causes can rationalize the results.

Shaked (2006) criticizes models of inequality aversion because they lack a well-defined explanatory power. Relying on heterogeneous preferences at the individual level the models can account for virtually every aggregate outcome.

→ A direct test is needed
There are few directly tests.

1. Engelmann and Strobel (2004): results do not support a significant role played by IA as compared to that of other explanatory factors like efficiency concerns.

2. Buckley and Croson (2006) use a repeated Public Good with 2 “rich” players and 2 “poor” players. Rich subjects contribute slightly more in absolute level, but less in relative terms, in line with the altruism model while rejecting the prediction based on the inequality aversion hypothesis.

However, as Cooper and Kagel (2013) correctly argue, any attempt to have a single model fit the infinite variety of preferences present in the population is bound to lead to some questionable results. Forcing these models to their point predictions is probably too stringent a standard.
Motivation and Literature Review (8)

A proper test of the inequality aversion models should entail a design in which only the degree of inequality is exogenously manipulated. This would make the prediction of the models falsifiable while holding only at the aggregate level.

Along these lines: Korenok, Millner and Razzolini (2011), who manipulate the degree of heterogeneity of the endowments in a Dictator Game. They find that dictators pass more money when recipients are poorer, supporting the inequality aversion hypothesis. Caveats: within-subject design; role uncertainty.
Research Goals

We use the Patron Game (Filippin and Raimondi, 2013), a game that can be manipulated along both our directions of interest:

1. The degree of payoff heterogeneity. This provides a direct and clean test of the inequality aversion hypothesis, by taking a very general prediction, i.e. that the presence of inequality should affect the amount of contributions, and making it falsifiable at the aggregate level.

2. The strength of strategic interaction, in order to assess the role played by strategic interaction considerations when inequality matters.

We do so choosing a pure between-subject design
Summary of Results

Our results show that:

1. Unequal endowments do not alter the average contributions in the Patron Game
   → Clean evidence against the inequality aversion hypothesis.

2. Strategic interaction does not play a dramatic role as well, although an effect of the asymmetry in the opportunity set emerges, together with the tendency to free ride on the burden of contributing to the poor subjects
This model evaluates one’s payoff against each opponent, experiencing a disutility whenever payoffs differ. For this reason, people are willing to contribute some of their payoff in order to obtain more equitable outcomes.

The utility function is:

$$U_i(x) = x_i - \alpha_i \frac{1}{n-1} \sum_{j \neq i} \max \{x_j - x_i, 0\} - \beta_i \frac{1}{n-1} \sum_{j \neq i} \max \{x_i - x_j, 0\}$$

where:

- $i \in (1, ..., n)$ is a set of $n$ players
- $x = x_1, ..., x_n$ are monetary payoffs
- $\alpha_i; \beta_i \in (0, 1]$ are the weights of inequality
- $\alpha_i \geq \beta_i$ means that disadvantageous inequality is worse
Theoretical framework

2. Bolton and Ockenfels (2000) model of Inequality Aversion

Combines self-interest motivations with a concern for relative standing inside the group.

The utility function is \( u_i(x_i, \sigma_i) \)

where:

\( x_i \) = payoff of player \( i \)

\( \sigma_i \) = relative share of the total payoffs

\( \rightarrow \) the utility function is maximized when \( \sigma_i = 1 / n \), i.e. when one's own share is equal to the average share.

Difference between the two models:

- In Fehr and Schmidt a subject implicitly prefers that all subjects get the same.

- In Bolton and Ockenfels utility is maximized when getting the average payoff, regardless of inequality among the opponents.
In the standard PG each subject is assigned to a group of 4 players and decides, in each of 10 rounds, how to allocate his endowment $e_i = 100$ to:

- either a private investment with a 1:1 return (= saving),
- or a public fund in which all the contributions $c_i$ of the group are pooled, multiplied by 1.5, and finally divided in equal parts among the participants, regardless of how much each player contributed.

Each agent has then the following payoff function

$$P_i = 1 - 0.625c_i + 0.375\sum c_{-i}$$

The social optimum is full contribution $c_i = 100$, but the dominant strategies is to free ride: $P_i$ is maximized with $c_i = 0$ because gets back only a part (0.375) of each token contributed.
The name captures the role played by a single person called upon to use his wealth to advance a social goal.

• Subjects play in groups of 4 for 10 rounds;
• All subjects receive an endowment in every round (suppose for the moment \( e_i = 100 \) for everybody).
• Only 1 (randomly selected) subject decides how to allocate his endowment between an individual account with a 1:1 return Vs. a public fund that yields 1.5 times his contribution \( c_P \) and is then equally divided among the 4 subjects.

Patron’s payoff: \( P_P = 100 - 0.625 \ c_P \)
\( \Rightarrow c_P = 0 \) to maximize payoff
\( \Rightarrow \) In this case \( c_P = 100 \) does NOT generate a Pareto superior outcome because there is only one subject contributing
\( \Rightarrow \) positive contributions generate disadvantageous inequality
4. The Patron Game

The Patron Game removes:

• Conditional cooperation,
• Conditional altruism,
• Reciprocity,
• Other strategic interaction motives,
• Imitation,
• Possibility to reach a Pareto superior outcome.

It is isomorphic to a repeated Dictator Game with multiple recipients and an efficiency factor.
The Patron Game allows to manipulate the degree of strategic interaction between the limits given by

- one patron: it eliminates any consideration about the behavior of the opponents
- a number of patrons equal to $N$: it corresponds to the classic public good game.

The Patron Game also allows to control the degree of inequality by manipulating the initial endowments, jointly with or independently from the degree of strategic interaction.
The Patron Game can be fruitfully used:

1. to directly test the main prediction of inequality aversion models at the aggregate level
   → manipulation of the degree of inequality keeping constant the strategic interaction framework

2. to evaluate the role played by strategic interaction and by asymmetries in the set of conceivable actions in a framework in which inequality matters.
Let’s call $K$ the number of patrons, i.e. the number of players that can decide their contribution level, while the other $N - K$ subjects are characterized by a passive role.

We run the following treatments:

• Patron Game with heterogeneous endowments (the only active player has a higher endowment): $K1_{\text{Unequal}}$

• Patron Game with equal endowments: $K1_{\text{Equal}}$

• Patron Game with heterogeneous endowments and 2 active players (the rich ones): $K2_{\text{Unequal}}$

• Public Good Game with heterogeneous endowments: $K4_{\text{Unequal}}$
## Experimental design: sample

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Number of participants</th>
<th>Active players</th>
<th>Indep. Obs</th>
<th>Endowment</th>
<th>Choice set</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rich</td>
<td>poor</td>
</tr>
<tr>
<td>1 K1_Unequal</td>
<td>80</td>
<td>20</td>
<td>20</td>
<td>150</td>
<td>50</td>
</tr>
<tr>
<td>2 K1_Equal</td>
<td>80</td>
<td>20</td>
<td>20</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>3 K2_Unequal</td>
<td>48</td>
<td>24</td>
<td>12</td>
<td>150</td>
<td>50</td>
</tr>
<tr>
<td>4 K4_Unequal</td>
<td>52</td>
<td>52</td>
<td>13</td>
<td>150</td>
<td>50</td>
</tr>
</tbody>
</table>
1. Tests of Inequality aversion

Our first goal is to provide a direct test of the inequality aversion models at the aggregate level, by using the Patron game in which strategic interaction considerations are entirely removed by manipulating the heterogeneity of initial endowments.

Testable implication 1: if inequality aversion plays a role the average relative contributions in K1_Unequal should be significantly higher than those in K1_Equal.

Testable implication 2: If inequality aversion is the main driver of subjects’ behavior, contributions should be equal to zero in K1_Equal.
Result 1: By comparing the two Patron Games with and without inequality the evidence goes clearly against the inequality aversion hypothesis.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Indep. Obs.</th>
<th>Contributions (euro)</th>
<th>Mann Whitney</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>St. Dev</td>
</tr>
<tr>
<td>K1_Unequal</td>
<td>20</td>
<td>0.237</td>
<td>0.215</td>
</tr>
<tr>
<td>K1_Equal</td>
<td>20</td>
<td>0.220</td>
<td>0.179</td>
</tr>
</tbody>
</table>

In the K1_Unequal treatment ex post inequality is lower than ex ante (apparently consistent with inequality aversion in isolation…). However, the average contribution of the patrons does not increase with the introduction of asymmetric endowments.
Result 2: In K1_Equal contributions are significantly greater than zero, contributing to generate unfavorable inequality.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Indep. Obs</th>
<th>Contributions (euro)</th>
<th>Mann Whitney</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>St. Dev</td>
</tr>
<tr>
<td>K1_Unequal</td>
<td>20</td>
<td>0.237</td>
<td>0.215</td>
</tr>
<tr>
<td>K1_Equal</td>
<td>20</td>
<td>0.220</td>
<td>0.179</td>
</tr>
</tbody>
</table>
Additional evidence shows that the two treatments also display a very similar distribution of individual relative contributions:

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Contributions (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$c = 0$</td>
</tr>
<tr>
<td>K1_Unequal</td>
<td>5%</td>
</tr>
<tr>
<td>K1_Equal</td>
<td>10%</td>
</tr>
</tbody>
</table>
The time pattern is also quite similar.
A subject could contribute because he does not understand that the dominant strategy in the stage game is to free ride.

Dummy=1 for players reporting a self-reported bad understanding Positively correlates with contributions, strong and significant only in the first rounds of the game.

However

- the share of confused players in the different treatments is very low, ranging from 0 to 15% and being 5.8% on average;
- a Kruskal-Wallis test for equality of populations confirms that the size of confusion does not significantly differ across treatments;
- the effect of confusion does not affect considerably the results, which are robust to the exclusion of these players
2. Test of Strategic Interaction

The second goal of our paper is to test how strategic interaction may shape (or interact with) inequality aversion.

The surprising null effect of inequality admittedly renders such an exercise less interesting, as apparently there is nothing the strategic framework can interact with. Hence, we limit the exposition to the main results associated to the manipulation of the degree of strategic interaction.
We introduced strategic interaction among patrons to analyze whether the role played by inequality aversion is weakened when there is more than one patron. Having found that inequality aversion plays no role, we still check whether the possibility of free riding on the choice of the other patron weakens the incentive to contribute.

The point estimate of the average contribution is indeed lower although the difference is not statistically significant.
We than allow also the “poor” subjects to contribute. The aim is to test whether, keeping constant the degree of inequality, increasing strategic interaction by removing the asymmetry in the choice set affects the choice of the rich subjects.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Indep. Obs.</th>
<th>Contributions (euro)</th>
<th>Mann Whitney</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>St. Dev</td>
</tr>
<tr>
<td>K4_Unequal (rich only)</td>
<td>13</td>
<td>0.213</td>
<td>0.115</td>
</tr>
<tr>
<td>K2_Unequal</td>
<td>12</td>
<td>0.148</td>
<td>0.100</td>
</tr>
</tbody>
</table>

The average contribution in the K4_Unequal treatment higher than in the K2_Unequal (though not significantly so) and very similar to that in the K1_Unequal.
Conclusions

• Our results provide clean evidence against the inequality aversion hypothesis (in the lab!) as subjects’ behavior does not react to higher level of inequality.

• The results with equal endowments would even point toward inequality seeking.

• Strategic interaction does not play a significant role as well, although there could be minor effects.

• Interpretation: our results apply to the internal consistency of lab experiments that claims there is evidence supporting the inequality aversion hypothesis. Our findings are not strong enough to have external validity, i.e. we are not claiming that inequality aversion does not work in general.
Thank you!